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Cengage Technology Editions are being launched to support educators and learners in making a smooth transition from print to digital learning and instruction.

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Introducing to Engineering

An Introduction to Mechanical Engineering

Third Edition
Jonathan Wickert, Iowa State University
Kemper Lewis, University at Buffalo - SUNY


Also Available in SI Units

An Introduction to Mechanical Engineering introduces students to the ever-emerging field of mechanical engineering, giving an appreciation for how engineers design the hardware that builds and improves societies all around the world. Intended for students in their first or second year of a typical college or university program in mechanical engineering or a closely related field, the text balances the treatments of technical problem-solving skills, design, engineering analysis, and modern technology.

New to This Edition
- 50% more homework problems.
- New section on written and graphical communications.
- New introduction to Newton’s Laws of Motion.
- New design applications are developed in each chapter through the homework problems, case studies, and/or example problems, allowing students to learn how their engineering science knowledge gets transformed into engineered systems using design principles.
- Many new and updated “Focus On” features, highlighting emerging trends and technologies in mechanical engineering, expose students to modern and recent global technologies, products, and events, and how engineers impact them.
- Increased emphasis on the development of innovative solutions to technical challenges that address global, social, environmental, and economic issues.
- Includes many new global, environmental, and social applications including: the NAE Grand Challenges; the Deepwater Oil Spill; clean energy vehicles; sustainable cities; advanced materials; global energy consumption; sports technology; design, policy, and innovation; and renewable energy.
- New Cengage Learning Global Engineering CourseMate brings course concepts to life with interactive learning, study, and exam preparation tools that support the printed textbook. Watch student comprehension soar as your class works with the printed textbook and the textbook-specific website. Global Engineering CourseMate goes beyond the book to deliver what you need!

Key Features
- Addresses the questions “who are mechanical engineers” and “what do they do?”
- Explores innovative design experiences, problem-solving skills, basic engineering analysis, and case studies.
- Emphasizes design projects, and exposes students to computer-aided engineering, principles of engineering science, and mechanical engineering hardware.
- Includes a number of vignettes and case studies to demonstrate the realism of the material.
- “Focus on …” boxes in each chapter are used to highlight interesting topics and other emerging concepts in mechanical engineering, broadening the textbook’s coverage without detracting from its flow.
- Presents engineering as a visual and graphical activity by placing particular emphasis on the quality and breadth of the nearly three hundred photographs and illustrations. The text leverages realism to motivate students through interesting examples that offer a glimpse of what they will be able to study in later courses and, subsequently, practice in their own careers.

Ancillaries
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual
Global Engineering CourseMate
Global Engineering CourseMate – SI Version

Cengage Learning’s Engineering CourseMate brings course concepts to life with interactive learning, study, and exam preparation tools that support the printed textbook. Visit www.cengage.com/centermate for more details.

Also Available
An Introduction to Mechanical Engineering
First Edition, Korean Version
An Introduction to Mechanical Engineering

Contents
1. The Mechanical Engineering Profession
   What is Engineering? / Who Are Mechanical Engineers? / Career Paths / Typical Program of Study
2. Mechanical Design
   Design Process / Manufacturing Processes / Case Study in Conceptual Design: Mousetrap-Powered Vehicles / Case Study in Urban Power Infrastructures / Case Study in Computer-Aided Design: Noninvasive Medical Imaging
3. Technical Problem-Solving and Communication Skills

4. Forces in Structures and Machines
   Forces in Rectangular and Polar Forms / Resultant of Several Forces / Moment of a Force / Equilibrium of Forces and Moments / Design Application: Rolling-Element Bearings
5. Materials and Stresses
   Tension and Compression / Material Response / Shear / Engineering Materials / Factor of Safety
6. Fluids Engineering
   Properties of Fluids / Pressure and Buoyancy Force / Laminar and Turbulent Fluid Flows / Fluid Flow in Pipes / Drag Force / Lift Force
7. Thermal and Energy Systems
8. Motion and Power Transmission
   Rotational Motion / Design Application: Gears / Speed, Torque, and Power in Gearsets / Simple and Compound Geartrains / Design Application: Belt and Chain Drives / Planetary Geartrains

A. Greek Alphabet
B. Trigonometry Review
of specialization. An explanation of good study habits and what it takes to succeed is included, as well as an introduction to design and problem solving, communication, and ethics. Once this foundation is established, the book moves on to the basic physical concepts and laws that students will encounter regularly. The framework of this text teaches students that engineers apply physical and chemical laws and principles, as well as mathematics, to design, test, and supervise the production of millions of parts, products, and services that people use every day. By gaining problem solving skills and an understanding of fundamental principles, students are on their way to becoming analytical, detail-oriented, and creative engineers.

New to This Edition
- A section on Learning Engineering
- Fundamental Concepts and Design
- Variables from Fundamental Dimensions has been added to emphasize the idea that in order to become successful engineers, students must first completely grasp certain fundamentals and design variables followed by the knowledge of how these variables are calculated, approximated, measured, or used in engineering analysis and design.
- Additional sections have been added in Chapter 10, Force and Force-Related Parameters, in order to more fully explain important concepts in mechanics conceptually.
- A section on Lighting Systems has been added to introduce the basic terminology and concepts.
- A section on Energy Sources, Generation, and Consumption has been added to introduce conventional and renewable energy sources, generation, and consumption patterns and their current importance during this period in our history where the world’s growing demand for energy is among one of the most difficult challenges that we face and that they will face as future engineers.
- A section on Linear Interpolation has been added to emphasize the significance of linear interpolation in engineering analysis.
- Now includes a section on Excel Financial Functions.
- Three new Professional Profiles from Environmental, Civil, and Mechanical Engineering disciplines have been added.
- Additional Ethics Case Studies as well as Engineering Marvels Case Studies appear in the text.
- Over 200 additional problems!

Key Features
- Organized into 6 parts with 20 chapters; each chapter begins by stating its objectives and concludes by summarizing what the reader should have gained from studying that chapter.
- Sufficient material is provided to allow instructors to have the flexibility to choose specific topics to meet his or her needs.
- Information collection and proper utilization of that information are encouraged in this book by asking students to do a number of assignments that require information gathering by using the Internet as well as employing traditional methods.
- A full set of free PowerPoint slides created by the author offer lecture content for instructors. Another set of slides also provides images from the text. Complimentary test bank for instructors is also available for download from the companion web site as well as a Visual Basic tutorial.

Ancillaries
- Instructor’s Solution Manual
- SI Version Instructor’s Solutions Manual

Also Available
- Engineering Fundamentals: An Introduction to Engineering

Contents
Part One: Engineering – An Exciting Profession
1. Introduction to the Engineering Profession
2. Preparing for an Engineering Career
3. Introduction to Engineering Design
4. Engineering Communication
5. Engineering Ethics

Part Two: Engineering Fundamentals – Concepts Every Engineer Should Know
6. Fundamental Dimensions and Units
7. Length and Length-Related Parameters
8. Time and Time-Related Parameters
9. Mass and Mass-Related Parameters
10. Force and Force-Related Parameters
11. Temperature and Temperature-Related Parameters
12. Electric Current and Related Parameters
13. Energy and Power

Part Three: Computational Engineering Tools – Using Available Software to Solve Engineering Problems
14. Electronic Spreadsheets
15. MATLAB®

Part Four: Engineering Graphical Communication – Conveying Information to Other Engineers, Machinists, Technicians, and Managers
16. Engineering Drawings and Symbols

Part Five: Engineering Material Selection – An Important Design Decision
17. Engineering Materials

Part Six: Mathematics, Statistics, and Engineering Economics – Why Are They Important?
18. Mathematics in Engineering
19. Probability and Statistics in Engineering
20. Engineering Economics

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MindTap and other online activities to all major Learning Management Systems.

**Ancillaries**

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2. Parts of Speech
   - Nouns
   - Verbs
   - Adjectives
   - Adverbs
   - Numbers
   - Pronouns
   - Prepositions
   - Conjunctions
   - Interjections
   - Subject-Verb Agreement
   - Antecedent Agreement
   - Parallel Construction
   - Sentence Structures
   - The Subject in a Sentence
   - The Predicate
   - Elements of Sentence Parts and Sentence Structure
   - Prepositions
   - Conjunctions
   - Interjections
   - Pronouns
   - Verbs
   - Adjectives
   - Adverbs
   - Numerical Expressions
   - Word Processing in Microsoft Word
   - Finding Information and Citing Sources
   - Writing
   - Revising Reports and Reviewing Grammar
   - Engineering Toolbox and Visual Elements
   - PART III. OTHER TYPES OF PROFESSIONAL WRITING
   - Professional Correspondence
   - Proposals, Collaborative Writing, and Progress Reports
   - Specifications, Contracts, and Intellectual Property
   - Overview Reports
   - PART IV. ORAL PRESENTATIONS AND POSTER PREPARATION
   - Oral Presentations and Running Meetings
   - Poster Presentations
   - Appendix 1: Word Processing in Microsoft Word 2010
   - Appendix 2: Making Graphs in Microsoft Excel 2010 and Excel for Mac 2011
   - Appendix 3: Preparing Oral Presentations with Microsoft PowerPoint 2010

**Engineering Communication: A Practical Guide to Workplace Communications for Engineers**
First Edition
David Ingre, Kwantlen University College


Intended for an introductory Communications course for engineering students, this book also serves as a workplace guide for practicing engineers. Predicated on the successful dynamic analysis model CMAPP (context, message, audience, purpose, and product), this practical guide provides students with a variety of communication strategies, along with help in creating the types of proposals, reports, memos, letters, etc., most appropriate for the workplace. Interrelated case studies and exercises help to develop the critical thinking and planning skills essential for engineering students, and the importance of both ethical and cultural considerations in the development of effective communications is stressed throughout the book.

**Key Features**
- This text focuses on the most important elements of contemporary communications likely to be used by engineers.
- An exploration of the growing distinctions between technical communications and more traditional forms of writing, such as narratives and essays, is emphasized.
- Students will be given the opportunity to deal with the importance of both ethics and cultural considerations in the development of effective communication.
- Case studies are presented throughout the text which allows the student to examine the application of the CMAPP approach in the real world and study and analyze common weaknesses.
- Exercises are based on material covered in the chapter and give opportunities to apply the material to the case study organizations as well as with people in the real-world marketplace.

**Contents**
1. Building a Foundation
   - The Relevance of Engineering Communication / Characteristics of Engineering Communication / Ethics / Applications / Cultural Impact / The Issue of Gender / Correct Language
2. The CMAPP Analysis
   - Transactional Communication Models / The CMAPP Communication Model
3. Complementary Attributes of the CMAPP Model
   - Abbreviations and Acronyms / Complimentary CMAPP Attributes
4. Research and Reference Works
   - Research / Documenting Sources / Style Guides / Language Use Tools
5. From Data to Information
   - Data Versus Information / The Information-Evaluation Distinction
6. Visual Elements in Written and Oral Communication
   - Document Visuals / Visuals in Documents and Presentations / Charts and Tables / Clip Art and Other Web Visuals
   - Standardization and Originality / Conveying Good News / Conveying Bad News / Neutral News
8. Communication Strategies (2): Mechanism Description, Process Description, and Instructions
   - Persuasive Strategies / Targeting the Intellect / Targeting the Emotions / Choosing a Strategy
10. Common Products (1): Letters, Memos, Faxes, and E-mail
    - Letters / Memos / Faxes / Email
11. Common Products (2): Reports, Summaries, and Abstracts
    - Definitions and Distinctions / Reports Overview / Informal Reports / Categories / Formal Reports
12. Common Products (3): Proposals
    - Classification of Proposals / CMAPP Implication / Informal and Formal Proposals / General Considerations
13. Effective Presentations
    - The CMAPP Approach to Presentations / Audience Analysis / Purpose / Conquering Stage Fright / The Development Process / Types of Delivery / Elements of the Presentation / Visuals and Visual Aids / After the Presentation
14. Seeking Employment
    - Gambling / The Employment Application Package / Preparation / Cover Letters / Resumes / Interviews
15. The Importance of Language Use
    - Overview / Parts of Speech / Nouns / Pronouns / Verbs / Adjectives / Adverbs / Prepositions / Conjunctions / Interjections / Sentence Parts and Sentence Structure / The Subject in a Sentence / The Predicate in a Sentence / Compound Predicate / Objects and Subject Compliments / Clauses, Phrases, and Fragments / Sentence Structures / Subject-Verb Agreement / Pronoun-Antecedent Agreement / Third Person Pronoun Agreement / Parallel Construction / Punctuation / The Period / The Question Mark / The Exclamation Point / The Comma / The Semicolon / The Colon / The Dash / The Hyphen / Quotation Marks / Parenthesis / The Apostrophe / Abbreviations / Capitalization / Number Expression
A Writer’s Handbook for Engineers

First Edition
David A. McMurray, Austin Community College
Joanne Buckley, McMaster University


Grounded in authentic workplace scenarios, the step-by-step approach of A Writer’s Handbook for Engineers prepares students for real-world communication and workplace problem-solving. The examples included in this handbook show that the field of engineering possesses a wonderful, fascinating array of things to write about by covering numerous types of common writing projects that are likely to be encountered in a career as an engineering student and as a practicing engineer. This resource is useful for students at all levels, and even for practicing engineers as a reference tool, as it emphasizes refined communication skills for presentations and on the job, everyday correspondence.

Key Features
• A wide range of writing projects and writing project development tools are presented as well as examples from several engineering fields and disciplines.
• Support for document-development efforts is given with a useful variety of tools such as headings, lists, tables, special notices, graphics, charts, hypertext, and web pages to effectively plan, develop, format, and finalize engineering writing projects.
• Annotated student examples appear extensively throughout explaining why certain writing decisions were made or highlighting salient points.
• A section on how to use the handbook is presented to allow readers to get the most out of the extensive material provided.
• Procedures for performing software tasks with specific types of software are integrated throughout.
• URLs for applicable websites are integrated throughout the book, providing students with additional resources.

Contents
1. The Writing Process
   Planning / Drafting the Engineering Document / Selecting and Using the Writing Structures / Reviewing and Revising / Proofreading the Final Manuscript
2. Professional Document Design
   Essential Document Format / Fonts, Margins, Line Spacing, Alignment / Headings / Lists / Highlighting / Notices / Tables / Graphs and Charts / Illustrations / Equations / Web Pages and Web Sites
3. Basic Grammar
   Parts of Speech / Parts of Sentences / Phrases and Clauses / Sentence Types
4. Grammatical Sentences
   Subject-Verb Agreement / Other Problems with Verbs / Problems with Pronouns / Adverbs and Adjectives / Sentence Fragments / Comma Splices and Fused Sentences
5. Punctuation
   Commas / Common Problems with the Commas / Semicolons / Colons / Apostrophes / Quotation Marks / Other Marks
6. Sentence Structure and Style
   Problems with Modifiers / Shifts / Mixed Constructions / Coordination and Subordination / Parallelism / Needed Words / Sentence Variety
7. Usage
   Glossary of Usage / Wordiness / Diction and Audience / Precision in Language / The Dictionary and Thesaurus
8. ESL
   Articles / Verbs / More ESL Advice
9. Mechanics and Spelling
   Spelling / Hyphens / Capitalization / Abbreviations / Numbers / Italics / Underlining
10. Research Process
11. Engineering Documents
    Basic Engineering Reports / Instructions and User Guides / Policies and Procedures / Recommendation, Evaluation, and Feasibility Reports / Literature Reviews and Background Reports / Primary Research Reports / Proposals / Progress Reports / Specifications / Handbooks
12. Documentation
    IEEE Style of Documentation / CBE Style of Documentation / APA Style of Documentation / MLA Style of Documentation / List of Style Manuals
13. Professional Communications and Resumes

MATLAB® Programming with Applications for Engineers

First Edition
Stephen J. Chapman, BAE Systems- Australia


MATLAB® Programming with Applications for Engineers seeks to simultaneously teach MATLAB® as a technical programming language while introducing the student to many of the practical functions that make solving problems in MATLAB® so much easier than in other languages. The book provides a complete introduction to the fundamentals of good procedural programming. It aids students in developing good design habits that will serve them well in any other language that he or she may pick up later. Programming topics and examples are used as a jumping off point for exploring the rich set of highly optimized application functions that are built directly into MATLAB®.

Key Features
• Teaches good programming skills and habits that transfer to any other procedural programming language.
• A heavy emphasis is placed on using the built-in MATLAB® functions for engineering applications and solving real world type problems.
• “Good Programming Practice” features emphasize good design practices. Examples of good programming practices include the use of proper program headers and data dictionaries in all programs, good commenting, proper program structure, etc.
• “Programming Pitfalls” are also emphasized. This feature highlights the most common errors that beginners make and how to avoid them.
• Uses a five-step program design process employed regularly throughout the text.
• Includes a significant section on 3D plots with an extensive example explaining the importance and operation of the difficult meshgrid function.
• Students learn how to use handle graphics to create simple interactive plots and animations.
• Includes a chapter totally devoted to MATLAB® applications commonly used by engineering students.
1. Introduction to MATLAB®
   The Advantages of MATLAB® / Disadvantages of MATLAB® / The MATLAB® Environment / Using MATLAB® as a Calculator

2. MATLAB® Basics

3. Two-Dimensional Plots
   Additional Plotting Features for Two-Dimensional Plots / Polar Plots / Annotating and Saving Plots / Additional Types of Two-Dimensional Plots / Using the plot function with Two-Dimensional Arrays

4. Branching Statements and Program Design
   Introduction to Top-Down Design Techniques / Use of Pseudocode / Relational and Logic Operators / Branches / More on Debugging MATLAB® Programs / MATLAB® Applications: Roots of Polynomials

5. Loops and Vectorization
   The while Loop / The for Loop / Looping Arrays and Vectorization / The MATLAB® Profiler / Additional Examples / The textread Function / MATLAB® Applications: Statistical Functions / MATLAB® Applications: Curve Fitting and Interpolation

6. Basic User-Defined Functions
   Introduction to MATLAB® Functions / Variable Passing in MATLAB®: The Pass-By-Value Scheme / Optional Arguments / Sharing Data Using Global Memory / Preserving Data Between Calls to a Function / MATLAB® Applications: Sorting Functions / MATLAB® Applications: Random Number Functions

7. Advanced Features of User-Defined Functions
   Function Functions / Subfunctions and Private Functions / Function Handles / Anonymous Functions / recursive Functions / Plotting Functions / Histograms

8. Complex Numbers and 3D Plots
   Complex Data / Multidimensional Arrays / Three-Dimensional Plots

9. Cell Arrays, Structures, and Importing Data
   Cell Arrays / Structure Arrays / Importing Data into MATLAB®

10. Handle Graphics and Animation
    Handle Graphics / Position and Units / Printer Positions / Default and Factory Properties / Graphics Object Properties / Animations and Movies

11. MATLAB® Applications

Appendix A: ASCII Character Set
Appendix B: Additional MATLAB® Input/Output Functions
Appendix C: Working with Character Strings
Appendix D: Answers to Quizzes
Essentials of MATLAB® Programming

Second Edition
Stephen J. Chapman, BAE Systems - Australia


Stephen Chapman’s Essentials of MATLAB® Programming is a successful freshman-level text that is useable in a wide range of courses. This brief text serves two purposes: (1) teaching how to program using MATLAB® as a technical programming language, and (2) teaching students the basics of computer programming. Using top-down design methodology, the text encourages students to think about the proper design of a program before coding. Problem-solving skills as well as the ability to locate desired functions within MATLAB® are also presented making this text a useful reference tool.

Key Features
- Emphasis on Top-Down Methodology – encourages the student to think about the proper design of a program before beginning to code.
- Presents the use of functions to logically decompose tasks into sub-tasks, for use in data hiding, as well as the common mistakes made while using functions and how to avoid them.
- Teaches the proper use of MATLAB®’s built-in tools for easier programming and debugging.
- Includes “Good Programming Practice” and “Programming Pitfalls” boxes that highlight each practice or pitfall.
- All MATLAB® source code is available for download via the companion website.

8. Input/Output Functions
The textread Function / More About the Load and Save Commands / An Introduction to MATLAB® File Processing / File Opening and Closing / Binary I/O Functions / Formatted I/O Functions / Comparing Formatted and Binary I/O Functions / File Positioning and Status Functions

9. Handle Graphics

10. Graphical User Interfaces
How a Graphical User Interface Works / Creating and Displaying a Graphical User Interface / Object Properties / Grapser Interface Components / Additional Containers: Panels and Button Groups / Dialog Boxes / Menus / Tips for Creating Efficient GUIs

11. The MATLAB® Compiler
Setting up the MATLAB® Compiler / Setting Up Computers that Run Compiled Applications / Using the MATLAB® Compiler

A. ASCII Character Set

B. Answers to Quizzes

Table of Contents
1. Introduction to MATLAB®
2. MATLAB® Basics
3. Branching Statements and Program Design
4. Loops
5. User-Defined Functions
6. Additional Data Types and Plot Types
7. Cell Arrays, Structures, and Handle Graphics

Appendices
A. ASCII Character Set
B. MATLAB® Input / Output Functions
C. Answers to Quizzes

Engineering Design

COMSOL® for Engineers
M. Tabatabaian, PhD, British Columbia Institute of Technology
600 pages. Casebound. 7 x 9. ©2014.

COMSOL® for Engineers is designed for engineers from the fields of mechanical, electrical, and civil disciplines, this book introduces multiphysics modeling techniques and examples accompanied by practical applications using COMSOL 4.x.

Key Features
- Includes a companion DVD with files of models, images, code
- Uses progressive approach in terms of examples and models

Contents
Key Features
• Coverage has been thoroughly reviewed
• New to This Edition
• Class-tested design problems.
• Marketing, while facilitating hands-on learning
• Steps of the design process, including articulating
• That will help them solve engineering problems.
• Application. With explicit guidance, students learn
• Studies, labs, and group projects to show their
• This book is dedicated to the essential

New to This Edition
• Coverage has been thoroughly reviewed and revised to present a clear, linear
demonstration of the engineering design process, as well as the fundamentals and
considerations which must be associated with Professional Engineering Design.
• Illustrations, such as graphs and charts, have been up-dated for clarity of presentation.
• In addition to an entire chapter full of sample design projects, labs and case studies have
been integrated into the body of the chapters in order to reinforce the chapter concepts
through the use of hands-on exercises and/or real-world examples.

Contents
1. Introduction
   Definition of Engineering Design / Importance and Challenges of Engineering Design / Introduction to Systematic Design / Design Process / Professionalism and Ethics / Lab 1: Ethics
2. Essential Transferable Skills
   Working in Teams / Lab 2: Ice-Breaking – Forming Teams / Lab 3: Team Dynamics / Scheduling / Lab 4: Project Management (Microsoft Project) / Research Skills / Technical Writing and Presentation / Presentation Style / Lab 5: Presentation Style
3. Identifying Needs and Gathering Information (Market Analysis)
   Problem Definition: Need Statement / Gathering Information: Clarifying the Need / How to Conduct a Market Analysis / Relevant Information Resources / Web Tools / Case Study: Automatic Aluminum Can Crusher
4. Customer Requirements
   Identifying Customer Requirements / Prioritizing Customer Requirements / Case Study: Automatic Aluminum Can Crusher – Requirements / Organizing Customer Requirements – Objective Tree / Case Study: Automatic Aluminum Can Crusher – Objective Tree
5. Establishing Functional Structure
6. Specifications
7. Developing Concepts
   Developing Working Structures / Steps to Develop Concepts from Functions / Brainstorming / Creativity / Developing Concepts – Samples
8. Concepts Evaluation
9. Embodiment Design
   Product Drawings / Prototype / Design for “X” / Safety Considerations / Human Factors / Lab 7: Ergonomics
10. Detailed Design
11. Sample Design Projects
    Design Project Rules / Aluminum Crusher / Coin Sorting Contest / Model (Toy) Solar Car / Workshop Training Kit / Shopping Carts / Mechanical Vents / All Terrain Vehicle / Pocket-sized Umbrella / Model of Therapeutic Wheelchair / Disposable Blood Pump / Newspaper Vending Machine / Peace Corps Group Project
level lectures (over twenty five lectures 30-40 minutes in length) by the author.

- The Projects consists of a part, assembly, or drawing that incorporates the Lesson’s new material and uses and expands on previously introduced material from other Lessons.
- Author’s website includes valuable learning tools available for download such as Projects, Lessons, Tutorials, Creo™ Files, Quick Reference Cards, and Creo™ related articles and information.
- All Lessons have 3D PDF’s for display of 3D parts.
- Lesson 13-18 are downloadable PDF’s with integrated 3D/PDF Models.
- Lessons 19-22 are downloadable video lectures which guide students through new assemblies and drawings

Contents

Introduction
Parametric Design / Fundamentals / Part Design / Establishing Features / Datum Features / Parent Child Relationships / Capturing Design Intent / Assemblies / Drawings / Using the Text / Text Organizations

Lesson 1. Creo™ Overview Parametric 2.0
Creating the Pin Part / Creating the Plate Part / Creating the Assembly / Creating Drawings

Lesson 2. Creo™ Parametric 2.0
Creo’s Interface / Catalog Parts / File Functions / Help / View and Display Functions / View Tools / Using Mouse Buttons to Manipulate the Model / System Display Settings / Information Tools / The Model Tree / Working on the Model / About the Dashboard / Productivity Enhancements / Customizing the User Interface (UI)

Lesson 3. Direct Modeling
Modeling / Extrude Tool / Round Tool / Shell Tool / Draft Tool / Chamfer Tool / Hole Tool / Extrude Tool (Cut) / Mirror Sketch / Revolve Tool / Cross Sections / Revolve Tool (Cut) / Blend Tool / Enhanced Realism / Sweep Tool

Lesson 4. Extrusions
The Design Process / Material Files / Sketch Tool / Environment / Sketching / Dimensioning / Constraint Rules / Modifying Dimensions / Mirror Tool

Lesson 5. Datum, Layers, and Sections
Navigator / Layer Tree / Colors / Appearance Manager / Datum Plane Tool / Layers / Geometric Tolerances / Suppressing and Resuming Features using Layers / View Manager / Cross Sections / Relations / Info / Feature List

Lesson 6. Revolved Features
Chamfers / Threads / Standard Holes / Navigation Window / Folder Browser / Manipulating Folders / Working Directory / Options / Revolve Tool / Sketcher Preferences / Modify Dimensions / Set Datums / Model Tree / Feature Information / Sketcher Palette / Holes / Annotations / Note Properties / Dimension Properties / Materials / Model Information / Cosmetic Threads / Using the Model Player / Printing and Plotting

Lesson 7. Feature Operations
Ribs / Relations / Parameter Symbols / Operators and Functions / Arithmetic Operators / Assignment Operators / Mathematical Functions / Failures / Resolve Feature / Failed Features / Family Tables / Copy / Paste Special / Rib Tool / Measuring Geometry / Flexing the Model / Standard Holes / Relations / Family Tables / Creo/MANUFACTURING™

Lesson 8. Assemblies
Assembly Constraints / Placing Components / Bottom-up Design / Pro/Library / Catalog Parts / Layer Tree / Add a Component to the Assembly / Regenerating Models / Copy and Paste Components / Bill of Materials / Assembly Sections / Top-Down Design / Creating Components in the Assembly Mode / Reference Viewer / Pattern / Analysis / Interference / Bill of Materials / Edit Definition

Lesson 9. Exploded Assemblies and View Manager
Exploded Assemblies / Creating Exploded Views / Component Display / Types of Representations / URLs and Model Notes / Views: Perspective, Saved, and Exploded / Saved Views / Default Exploded Views / View Manager / Explode View / View Style / Model Tree

Lesson 10. Introduction to Drawings
Formats, Title Blocks, and Views / Specifying the Format Size / System Formats / Drawing User Interface / Drawing Tree / Drawing Templates / Template View / Views / Sheet Setup / Insert General View / Default Orientation / Attach Tab / Model Annotations / View Movement / Move Views / Delete Views / Model Annotations / Default Template / Cleanup Dimensions / Section Views / Drawing View Properties / Template / Template View / Make Note

Lesson 11. Part Drawings
Sheet Setup / Drawing Options / Drawing Options File / Drawing Views / Projection Views Auxiliary Views / Grl Datums / Section Views / Annotate Tab / Axes / Cleanup Dimensions / Reference Dimensions / Layout Tab / Drawing Views / Scale / View Properties / Text Style / Drawing Options / Section Options / Font / Geometric Tolerances / Pictorial Drawing Views / System Formats / Title Block Notes

Lesson 12. Assembly Drawings
Format Options / Format Notes / Tables / Table Tab / Repeat Region / Note Properties / Text Style / Report Symbols / Adding Parts List (BOM) Data / Parameters / PTC Material Name / Assembly Drawings / Assembly Format / Drawing Options / Assembly Sections / Erase Datums / Annotate / Crosshatching / Bill of Materials / Replace Component / BOM Balloons / Drawing Scale / Balloons / Exploded Assembly Drawings / Combined Stave / Exploded Views Down loadable Lessons:

Lesson 13. Patterns
Fill Pattern / Dimensional Pattern / Directional Pattern / Component Pattern / 3D Model Space / Pro/Library

Lesson 14. Blends
Blend Sections / Blend Options / Parallel Blends / Blend Tool / Sketch Options / Polar Grid / Axial Pattern / Shell Tool / Analysis Measure / Section / Enhanced Realism / Scenes / Drawing and Model Annotation

Lesson 15. Sweeps
Sweep Forms / Sweep Options / Sweep Tool / Trajectory / Sweep Section / Polar Grid / Enhanced Realism / Rendering Scene / Spot Lights / Drawings and Model Annotations

Lesson 16. Helical Sweeps and Annotations
Helical Sweeps / Annotations / Helical Compression / Spring / Helical Sweep Tool / Notes/Annotations / URL Links / Springs / Annotation Features / Digital Product Definition Data Practices ASME Y14.41 / Driving Dimensions / Annotation Orientation / Geometric Tolerance / Annotation Feature / Surface Finish / Active Annotation Orientation

Lesson 17. Shell, Reorder, and Insert Mode
Creating Shells / Reordering Features / Inserting Features / Draft Tool / Pattern / Pattern Table / Reorder / Insert Mode / Mode / Model Setup / Scenes / Color Editor / Lights / Spot Light / Distance Light / Sky Light 3D PDF / Adobe Reader for PDF U3D / Perspective View on PDF / Drawing Views / Model Annotations / Drawing Tree / ECO

Lesson 18. Drafts, Suppress, and Text Extrusions
Drafts / Suppressing and Resuming Features / Text Extrusions / Draft Tool / Shell Tool (non-default thickness) / Group / Mirror / Surface Round / Section / Suppress / Extrude Tool (Text) / Resume / Model CHECK Geometry Check / Render Setup / Spotlight / Scenes / Color Editor / Moving Lights / Focus / Distance Light / Rendering Rooms / Drawing Views

Video Lecture Lessons:

Lesson 19. Gear Assembly
Lesson 20. Valve Assembly
Lesson 21. Pulley Assembly
Lesson 22. Coupling Assembly

Creo™ Parametric
Louis Gary Lamit, DeAnza College

Pro/ENGINEER® Wildfire™ 5.0
Louis Gary Lamit, DeAnza College

Pro/ENGINEER® Wildfire™ 4.0
Louis Gary Lamit, DeAnza College
Engineering Ethics

Hold Paramount: The Engineer’s Responsibility to Society

Second Edition
P. Aarne Vesilind, Bucknell University
Alastair S. Gunn, University of Waikato


This essential text provides students with practical insight into the engineering code of ethics and how a practicing engineer is obligated to act in a responsible manner. To illustrate the complexities involved with acting in an ethical fashion, the authors have created characters that encounter a number of situations that test the engineering code of ethics. The dialogue between these characters highlights different perspectives of realistic situations that students will face as practicing engineers. As they proceed through the book, students see how the code can help in decision making, as well as the implications of various decisions. The philosophical theory that supports the ethical positions encountered is presented as boxed material following each section.

New to This Edition
• New content on climate change, obligations to future generations, and sustainability.
• The addition of a discussion of the Precautionary Principle.
• New discussions on integrity and honesty.
• Updated case studies and references.

Key Features
• Co-written by an ethicist and a practicing engineer to provide a well-rounded perspective.
• Organized around different sections of the engineering code of ethics.
• Includes material on the development of the code of ethics and its evolution.
• End-of-chapter questions challenge students to think about ethics and how they would address ethically-charged situations.
• Includes material on cultural issues and their impact.

Contents
1. Doing the Right Thing
   Morals, Obligations to Strangers / Ethics
2. Faithful Agents
   Technical Expertise and Ethical Obligations
3. Enhance Human Welfare
   Moral Responsibility of Engineers
4. Hold Paramount
5. Safety of the Public
   The Moral Status of Animals / Ethical and Legal Obligations / Ethical Dilemmas I / Calculation the Value of Life / Fix Up Your Organization Ethically / Whistleblowing I / Whistleblowing II / Disaster in Kansas City / Ethics and Engineering Education / Options / Ethically Right for Me? I / Acceptable Risk / Trusting the Experts / Deception I / Confidentiality / Loyalty to the Firm
6. Professional Development
   Tenure in Engineering Schools / Famous Engineers in History / The Reputation Game in Engineering Education / Networking
7. Solicit or Accept Gratuities
   Deception II / Corporate Gift Policies
8. Self-Laudatory Language
   Advertising
9. Contributions in Order to Secure Work
   Competitive Bidding / Bribery and Law / When in Rome / Ethical Dilemmas II / Human Rights I
10. Professional Development of Others
    The Existential Pleasures of Engineering I / The Existential Pleasures of Engineering II / Engineering and Armaments / Reverence for Life / The Ethics of Asking and the Ethics of Giving / Maintaining the Quality of Engineering Education / Affirmative Action
11. Overseas Work
    Human Rights II / Politicians and Their Reputations
12. Uphold the Honor and Dignity
    Manners / Workplace Harassment
13. Without the Knowledge of Their Employers
    Conflict of Interest I / Employee Loyalty
14. Avoid Conflicts of Interest
    Conflict of Interest II / A Paradox / Why Be a Good Engineer?
15. Objective and Truthful Manner
    Professional Respect / Engineers and the Media
alternating current flow and a solution of Kepler’s problem.

- Material on Probability and Statistics has been moved online to a free Companion Site.
- Additional new material including: application of vector integral theorems to the development of Maxwell’s equations, Orthogonal curvilinear coordinates and vector operations in these coordinates, use of the Laplace transform to solve partial differential equations involving wave and diffusion phenomena, a complex integral formula for the inverse Laplace transform of a function, LU factorization of matrices into products of lower and upper triangular matrices with an application to the efficient solution of systems of linear equations, Heaviside’s formula for the computation of the inverse Laplace transform of a function.

**Key Features**
- The book is divided into 6 parts for ease of use.
- Includes a Guide to Notation in the inside front cover showing the symbols and notation used throughout the text paired with the section in which it is defined or used.
- Presents the correct development of concepts such as Fourier series and integrals, conformal mappings, and special functions, at the beginning of the text followed by applications and models of important phenomena, such as wave and heat propagation and filtering of signals.
- Includes numerous fully–solved example problems as well as review problems following each section of the text.

**Ancillaries**

Cengage Learning’s Engineering CourseMate brings course concepts to life with interactive learning, study, and exam preparation tools that support the printed textbook. Visit www.cengage.com/coursemate for more details.

**Also Available - Best Buy Bundles**


**Contents**

**PART I – Ordinary Differential Equations**
- **1. First-Order Differential Equations**
  Terminology and Separable Equations / Linear Equations. Exact Equations. Homogeneous, Bernoulli and Riccati Equations / Additional Applications / Existence and Uniqueness Questions
- **2. Linear Second-Order Equations**
  The Linear Second-Order Equations / The Constant Coefficient Case / The Nonhomogeneous Equation / Spring Motion / Euler’s Differential Equation
- **3. The Laplace Transform**
  Definition and Notation / Solution of Initial Value Problems / Shifting and the Heaviside Function / Convolution / Impulses and the Delta Function / Solution of Systems / Polynomial Coefficients
- **4. Series Solutions**
  Power Series Solutions / Frobenius Solutions
- **5. Approximation of Solutions**
  Direction Fields / Euler’s Method / Taylor and Modified Euler Methods

**PART II – Vectors, Linear Algebra, and Systems of Linear Differential Equations**
- **6. Vectors and Vector Spaces**
  Vectors in the Plane and 3-Space / The Dot Product / The Cross Product / The Vector Space Rn / Orthogonalization / Orthogonal Complements and Projections / The Function Space C[a,b]
- **7. Matrices and Linear Systems**
  Matrices / Elementary Row Operations / Reduced Row Echelon Form / Row and Column Spaces / Homogeneous Systems / Nonhomogeneous Systems / Matrix Inverses / Least Squares Vectors and Data Fitting / LU Factorization / Linear Transformations
- **8. Determinants**
  Definition of the Determinant / Evaluation of Determinants I / Evaluation of Determinants II / A Determinant Formula for A / Cramer’s Rule / The Matrix Tree Theorem
- **9. Eigenvalues, Diagonalization, and Special Matrices**
  Eigenvalues and Eigenvectors / Diagonalization / Some Special Types of Matrices
- **10. Systems of Linear Differential Equations**
  Linear Systems / Solution of X=AX / Solution of X=AX+G / Exponential Matrix Solutions / Applications and Illustrations of Techniques / Phase Portraits

**PART III – Vector Analysis**
- **11. Vector Differential Calculus**
  Vector Functions of One Variable / Velocity and Curvature / Vector Fields and Streamlines / The Gradient Field / Divergence and Curl
- **12. Vector Integral Calculus**
  Line Integrals / Green’s Theorem / An Extension of Green’s Theorem / Independence of Path and Potential Theory / Surface Integrals / Applications of Surface Integrals / Lifting Green’s Theorem to R3 / The Divergence Theorem of Gauss / Stokes’s Theorem / Curvilinear Coordinates

**PART IV – Fourier Analysis, Special Functions, and Eigenfunction Expansions**
- **13. Fourier Series**
  Why Fourier Series? / The Fourier Series of a Function / Sine and Cosine Series / Integration and Differentiation of Fourier Series / Phase Angle Form / Complex Fourier Series / Filtering of Signals
- **14. The Fourier Integral and Transforms**
  The Fourier Integral / Fourier Cosine and Sine Integrals / The Fourier Transform / Fourier Cosine and Sine Transforms / The Discrete Fourier Transform / Sampled Fourier Series / DFT Approximation of the Fourier Transform
- **15. Special Functions and Eigenfunction Expansions**
  Eigenfunction Expansions / Legendre Polynomials / Bessel Functions

**PART V – Partial Differential Equations**
- **16. The Wave Equation**
  Derivation of the Wave Equation / Wave Motion on an Interval / Wave Motion in an Infinite Medium / Wave Motion in a Semi-Infinite Medium / Laplace Transform Techniques / Characteristics and d’Alembert’s Solution / Vibrations in a Circular Membrane I / Vibrations in a Circular Membrane II / Vibrations in a Rectangular Membrane
- **17. The Heat Equation**
  Initial and Boundary Conditions / The Heat Equation on (0, L] / Solutions in an Infinite Medium / Laplace Transform Techniques / Heat Conduction in an Infinite Cylinder / Heat Conduction in a Rectangular Plate
- **18. The Potential Equation**
  Laplace’s Equation / Dirichlet Problem for a Rectangle / Dirichlet Problem for a Disk / Poisson’s Integral Formula / Dirichlet Problem for Unbounded Regions / A Dirichlet Problem for a Cube / Steady-State Equation for a Sphere / The Neumann Problem

**PART VI – Complex Functions**
- **19. Complex Numbers and Functions**
  Geometry and Arithmetic of Complex Numbers / Complex Functions / The Exponential and Trigonometric Functions / The Complex Logarithm / Powers
- **20. Complex Integration**
  The Integral of a Complex Function / Cauchy’s Theorem / Consequences of Cauchy’s Theorem
- **21. Series Representations of Functions**
  Power Series / The Laurent Expansion
- **22. Singularities and the Residue Theorem**
  Singularities / The Residue Theorem / Evaluation of Real Integrals / Residues and the Inverse Laplace Transform
- **23. Conformal Mappings and Applications**
  Conformal Mappings / Construction of Conformal Mappings / Conformal Mappings and Solutions of Dirichlet Problems / Models of Plane Fluid Flow

Appendix: A Maple™ Primer Answers to Selected Problems
Elements of Advanced Engineering Mathematics

First Edition
Peter V. O’Neil, University of Alabama- Birmingham

This book is intended to provide students with an efficient introduction and accessibility to ordinary and partial differential equations, linear algebra, vector analysis, Fourier analysis, special functions, and eigenfunction expansions, for their use as tools of inquiry and analysis in modeling and problem solving. It should also serve as preparation for further reading where this suits individual needs and interests. Many types of computations, such as construction of direction fields, or the manipulation Bessel functions and Legendre polynomials in writing eigenfunction expansions, require the use of software packages. A short Maple™ primer is included as Appendix B. This is designed to enable the student to quickly master the use of Maple™ for such computations. Other software packages can also be used.

Key Features
• This new text incorporates Maple™ by Maplesoft® - a world leader in mathematical and analytical software.
• Rigorous engineering mathematics topics are now made accessible with the emphasis of visuals, numerous examples, and interesting mathematical models.
• Provides students with an efficient introduction to the required math necessary for engineering, as well as the tools for inquiry and analysis used in modeling and problem solving.
• A separate Student’s Solutions Manual is available.

Ancillaries

Also Available - Best Buy Bundles

Contents

**Part I: Ordinary Differential Equations**
1. **First-Order Differential Equations**
   Terminology and Separable Equations / Linear Equations / Exact Equations / Additional Applications / Existence and Uniqueness Questions / Direction Fields / Numerical Approximation of Solutions
2. **Linear Second-Order Equations**
   Theory of the Linear Second-Order Equation / The Constant Coefficient Homogeneous Equation / Solutions of the Nonhomogeneous Equation / Spring Motion
3. **The Laplace Transform**
   Definition and Notation / Solution of Initial Value Problems / Shifting and the Heaviside Function / Convolution / Impulses and the Dirac Delta Function / Appendix on Partial Fractions Decompositions
4. **Series Solutions**
   Power Series Solutions / Frobenius Solutions

**Part II: Vectors, Linear Algebra, and Systems of Linear Differential Equations**
5. **Algebra and Geometry of Vectors**
   Vectors in the Plane and 3-Space / The Dot Product / The Cross Product / The Vector Space R^n
6. **Matrices and Systems of Linear Equations**
   Matrices / Linear Homogeneous Systems / Nonhomogeneous Systems of Linear Equations / Matrix Inverses
7. **Determinants**
   Definition of the Determinant / Evaluation of Determinants I / Evaluation of Determinants II / A Determinant Formula for A^−1 / Cramer’s Rule
8. **Eigenvalues and Diagonalization**
   Eigenvalues and Eigenvectors / Diagonalization / Some Special Matrices
9. **Systems of Linear Differential Equations**
   Systems of Linear Differential Equations / Solution of X'=AX for Constant A / Solution of X'=AX+G

**Part III: Vector Analysis**
10. **Vector Differential Calculus**
    Vector Functions of One Variable / Velocity and Curvature / Vector Fields and Streamlines / The Gradient Field / Divergence and Curl
11. **Vector Integral Calculus**
    Line Integrals / Green’s Theorem / An Extension of Green’s Theorem / Potential Theory / Surface Integrals / Applications of Surface Integrals / The Divergence Theorem of Gauss / Stokes’ Theorem

**Part IV: Fourier Analysis and Eigenfunction Expansions**
12. **Fourier Series**
    The Fourier Series of a Function / Sine and Cosine Series / Derivatives and Integrals of Fourier Series / Complex Fourier Series
13. **The Fourier Integral and Transforms**
    The Fourier Integral / Fourier Cosine and Sine Integrals / The Fourier Transform / Fourier Cosine and Sine Transforms
14. **Eigenfunction Expansions**
    General Eigenfunction Expansions / Fourier-Legendre Expansions / Fourier-Bessel Expansions

**Part V: Partial Differential Equations**
15. **The Wave Equation**
   Derivation of the Equation / Wave Motion on an Interval / Wave Motion in an Infinite Medium / Wave Motion in a Semi-Infinite Medium / d’Alembert’s Solution / Vibrations in a Circular Membrane / Vibrations in a Rectangular Membrane
16. **The Heat Equation**
   Initial and Boundary Conditions / The Heat Equation on [0, L] / Solutions in an Infinite Medium / Heat Conduction in an Infinite Cylinder / Heat Conduction in a Rectangular Plate
17. **The Potential Equation**
   Laplace’s Equation / Dirichlet Problem for a Rectangle / Dirichlet Problem for a Disk / Poisson’s Integral Formula / Dirichlet Problem for Unbounded Regions / A Dirichlet Problem for a Cube / Steady-State Heat Equation for a Sphere

APPENDIX A: Guide to Notation
APPENDIX B: A Maple™ Primer

Answers to Selected Problems Index

Advanced Engineering Mathematics with MATLAB®

Second Edition
Thomas L. Harman, University of Houston- Clear Lake
James B. Dabney, Rice University
Norman John Richert, University of Houston- Clear Lake

Advanced Engineering Mathematics with MATLAB® is written for engineers and engineering students who are interested in applying MATLAB® to solve practical engineering problems. The book emphasizes mathematical principles, not computations, with MATLAB® employed as a tool for analysis that shows how engineering problems are defined and solved. The book features complete MATLAB® integration throughout, abundant examples which show real, practical applications, and end-of-chapter problems which reinforce techniques.

Key Features
• Uses MATLAB® as a computing tool for analysis and understanding of mathematical theory.
• Stresses practical engineering applications and implements solutions with MATLAB®’s computational power.
• MATLAB® m-files for all examples and for selected Reinforcement Exercises are provided via a companion website.
• The Solutions Manual contains answers to the Reinforcement Exercises in Chapters 2 through 15 that do not require the use of MATLAB®. Also includes a CD-ROM containing the m-files for all examples in the book and solutions to Reinforcement Exercises that do require the use of MATLAB®.
• Carefully structured pedagogy–previews provide motivation for each chapter’s material, numerous examples amplify points.
made in the text, while Reinforcement and Exploration problems summarize the material and provide practice on applying solution techniques.
• Each chapter includes an annotated bibliography along with answers to selected problems.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Introduction
2. Numbers and Vectors
3. Matrices
4. Eigenvalues and Eigenvectors
5. Linear Differential Equations
6. Advanced Differential Equations
7. Approximation of Functions
8. Fourier Analysis
9. Laplace Transforms
10. Discrete Systems
11. The Discrete Fourier Transform and the FFT
12. Advanced Calculus
13. Vector Differential Operators
14. Vector Integral Calculus
15. Partial Differential Equations
Index of MATLAB® Commands

Linear Algebra
Yuma Ju, Tsinghua University
Jinde Hu, Tsinghua University
Cuiqin Lin, Tsinghua University
Wenxun Xing, Tsinghua University
Feiyan Wang, Tsinghua University


Comprehensive in scope yet clear in writing, Linear Algebra is suitable as a text or as a reference for students not majoring in mathematics. This text is perfect for the first year engineering student who may require extra material to boost their linear algebra skills. The esteemed team of authors have collaborated their broad base of mathematical knowledge to present a well rounded approach in all chapters. As well as providing application problems, a brief introduction to inner product space, Hermite quadratic functions, and Jordan canonical matrix is presented in the appendix.

Key Features
- This book is also suitable for students not majoring in mathematics but using linear algebra as a tool to solve problems in their various majors.
- Some key theorems, which are hard to prove, are tackled with simplified and brief proofs. For example, the relationship among the highest order of non-singular sub-matrix, the ranks of the columns and rows of a matrix implies that the ranks of the columns and rows are the same.
- All exercises are divided into three levels: basic, hard, and complementary. They can be used electively for students at different levels. Several application-based problems are presented in Chapter 7, which can be used as a supplement to make students aware of the wide application of linear algebra.

Contents
1. Determinants
2. Matrices
3. Systems of Linear Equations
4. Vector Spaces and Linear Transformation
5. Eigenvalues and Eigenvectors, Diagonalization of Matrix
6. Quadratic Forms
7. Applications

Applied Numerical Methods for Engineers Using MATLAB® and C
Robert J. Schilling, Clarkson University
Sandra L. Harris, Clarkson University


This book provides a comprehensive discussion of numerical computing techniques with an emphasis on practical applications in the fields of civil, chemical, electrical, and mechanical engineering. It features two software libraries that implement the algorithms developed in the text—a MATLAB® toolbox, and an ANSI C library. This book is intended for undergraduate students.

Key Features
- Comprehensive coverage of topics, including chapters on optimization (Chapter 6) and digital signal processing (Chapter 10).
- Two complete software libraries with source code and built-in documentation that implement the algorithms developed in the text. A GUI-driven MATLAB® toolbox and a comprehensive ANSI C library are provided on an accompanying CD-ROM bound into the text.
- 38 detailed case studies apply techniques to problems in civil, mechanical, chemical and electrical engineering, with solutions in both MATLAB® and C.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Numerical Computation
2. Linear Algebraic Systems
3. Eigenvalues and Eigenvectors
4. Curve Fitting
5. Root Finding
6. Optimization
7. Differentiation and Integration
8. Ordinary Differential Equations
9. Partial Differential Equations
10. Digital Signal Processing
References and Further Reading
Appendices
1. NLIB Using MATLAB®
2. NLIB Using C
3. Vectors and Matrices
4. Answers to Selected Problems

Mathematical Methods in Chemical & Environmental Engineering
Second Edition
Ajay K. Ray, National University of Singapore
Santosh K. Gupta, IIT- Kanpur


This comprehensive book covers a broad selection of mathematical topics that are essential for a modern chemical/environmental engineer. It features a blend of analytical and numerical techniques for solving problems in diverse areas, such as, heat and mass transfer, thermodynamics, fluid mechanics, reaction engineering, transport phenomena, and process systems engineering. This second edition text emphasizes problem-solving, and deals extensively with methods for solving systems of linear and non-linear algebraic equations, systems of linear and non-linear ordinary, and partial differential equations.

Key Features
- Discusses several important advanced topics (bifurcation theory, Gear’s algorithm, stability
and error propagation of algorithms, etc.) in an easy-to-understand style.
• It also discusses various analytical methods, as well as numerical techniques.
• Contains examples with solutions as well as unsolved problems which require the use of computers.

Contents
1. Introduction
2. Elements of Calculus: A Review
3. Determinants, Matrices and Systems of Linear Algebraic Equations I
4. Systems of Linear Algebraic Equations II
5. Systems of Linear Algebraic Equations III
6. Linear Independence and Ortho-normality of Vectors and Functions
7. Linear Regression
8. Numerical Integration and Differentiation
9. Non-Linear Algebraic Equations
10. Elements of Catastrophe and Singularity Theories
11. Eigenvalues and Eigenvectors
12. Numerical Computation of the Eigenvalues and Eigenvectors Matrices
15. Numerical Solutions Methods for Initial Value Problems
17. Introduction to Partial Differential Equations

Probability, Statistics, and Random Processes for Engineers
Richard H. Williams, University of New Mexico (Emeritus)

This book focuses on teaching probabilistic and statistical methods to upper-division electrical and computer engineering (ECEE) students. It is the result of over 20 years of teaching this course in the rapidly changing environment of ECEE education. In addition to being readable and focused for ECEE students, the book is a teachable book for ECEE instructors with a variety of technical backgrounds. The first part of the book, Chapters 1-3, contains fundamental probability material. The second part, Chapters 4-7, presents applications and extensions based upon the first three chapters. The four application chapters may be studied in any order, as they do not depend on each other in any essential way.

Key Features
• Includes a wealth of applications for electrical and computer engineering (ECEE) students.
• Introduces functions with random features, such as noise or sinusoids with random phase, in Chapter 4. The coverage is restricted to "wide-sense stationary" random processes, a class of functions which are very useful in modern practice and also supply a starting point for more complicated applications.
• Illustrates the application of probability to the reliability of devices and software in Chapter 7. The chapter focuses on failure rates (hazard functions), a description that engineers look to for guidance in a variety of cases involving system reliability.
• Contains computer simulations written in pseudocode as well as applications in MATLAB®. Computer exercises appear at the end of each chapter.
• Features helpful appendices such as a summary of probability models discussed throughout the book. Readers may refer to the appendix rather than leaf through the various parts of the book searching for features of a probability model.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Probability
Why Probability? / General Outline of this Chapter / Probability Calculations
2. Single Random Variables
Introduction / General Outline of this Chapter / Probability Models / Expectations / Characteristic Functions / Functions of Single Random Variables / Conditioned Random Variables
3. Multiple Random Variables
Introduction / General Outline of this Chapter / Bivariate Cumulative and Density Functions / Bivariate Expectations / Bivariate Transformations / Gaussian Bivariate Random Variables / Sums of Two Independent Random Variables / Sums of IID Random Variables / Conditional Joint Probabilities / Selected Topics
4. Random Processes
Introduction / An Ensemble / Probability Density Functions / Independence / Expectations / Stationarity / Correlation Functions / Ergodic Random Processes / Power Spectral Densities / Linear Systems / Noise / Matched Filters / Least Mean-square Filters
5. Statistical Inferences and Confidence
Introduction / The Maximum Likelihood Technique / Estimation of Mean and Variance / Summary / Exercises / Computer Exercises
6. Random Countable Events
Introduction / Poisson Random Variables / Erlang Random Variables / Queuing
7. Reliability
Introduction / Reliability / Failure Rates / System Reliability / The Weibull Model / Accelerated Life Testing

Appendices
Legal Aspects of Architecture, Engineering, and the Construction Process

Ninth Edition
Justin Sweet, University of California-Berkeley
Marc M. Schneier, Editor, Construction Litigation Reporter

The primary focus of this text is to provide a bridge for students between the academic world and the real world. This bridge is built through an understanding of what is law, how law is created, how law affects almost every activity of human conduct, and how legal institutions operate. Intended mainly for architectural and engineering students, but increasingly for those in business schools and law schools, this text features a clear, concise, and jargon-free presentation. It probes beneath the surface of legal rules and uncovers why these rules developed as they did, outlines arguments for and against these rules, and examines how they work in practice. Updated with the most recent developments in the legal aspects of architectural, engineering, and the construction processes, this text is also a valuable reference for practitioners and has been cited in over twenty-five court decisions.

New to This Edition
• Chapters are now grouped into parts according to major themes to ease facilitator students' understanding of book organization.
• Each chapter now starts with an overview section to amplify understanding of the chapter's purpose.
• Much of the material has been reorganized, streamlined, and/or updated.
• New topics include the employer-employee relationship, the dual employer doctrine, and independent contractors.
• Expanded discussion of acceptance by communication, E-sign, and regulation of contracts entered into by homeowners.
• Updated discussion of tort history and greatly expanded discussion of the independent contractor rule and the economic loss doctrine.
• Includes two new topics within the Environmental Law discussion: the Clean Water Act and the Clean Air Act.

Key Features
• Provides the legal backdrop against which engineers and architects must perform professional services.
• Describes the alternatives for performing design professional services and methods of formalizing the agreed upon services.
• Concentrates on new provisions in the standard documents published by the AIA and EJCDC (included in the Appendices).
• Many illustrations of how the legal rules operate are provided through summaries of actual cases and the reproduction of some cases.
• Compensation issues are addressed, whether for design professionals (highlighting the distinction between basic and additional services), or for construction companies, including unlicensed contractors.
• Understandable text that highlights recurring issues, such as extras, allocation of responsibility during construction among the major actors, resolution of disputes, and termination.
• Familiarizes students with industry practices, dispute avoidance practices, and alternative dispute resolution.
• Addresses alternative project delivery methods: construction management, design/build, lean project delivery, project alliance, program management, project alliance, and building information modeling.
• The book covers the "stigma" effect of defective construction, green or sustainability design and construction, "new home warranty" and the "right to cure" laws.
• Includes instructions for non–legal students and non-lawyers on how to properly cite case decisions.

Ancillaries

Contents
1. Sources of Law: Varied and Dynamic
2. The American Judicial System: A Forum for Dispute Resolution
3. Forms of Business Association: Organizing to Accomplish Objectives
4. Agency and Employment
5. Contracts: From Formation to Breach
6. Tort: Legal Relations not Arising from Contract
7. Restrictions on Ownership: Land Use Controls and Environmental Law

Part B: The Main Actors: The Prime Contractor and Design Professional
8. Introduction to the Construction Process: Focus on the Prime Contractor and Regulatory Framework
9. Licensing of the Design Professional and Contractor
10. The Design Professional – Client Relationship
11. Design Professional Liability
12. Defenses to Claims of Design Professional Liability

Part C: Project Delivery Methods
14. Project Organization, Pricing, and Delivery Methods
15. Public Contracts

Part D: Performance Disputes: From Design to Termination
16. Performance Disputes Overview: Claims and Defenses to Liability for the Owner and Prime Contractor
17. Construction Contracts and Rules of Contract Interpretation
18. Changes: Complex Construction Centerpiece
19. Payment: Money Flow as Lifeline, and the Complexity of Project Completion
20. Subsurface Problems: Predictable Uncertainty
21. Time: A Different but Important Dimension
22. Owner–Contractor Disputes: Damages and Settlements
23. The Subcontracting Process: An "Achilles Heel"
24. Terminating a Construction Contract: Sometimes Necessary but Always Costly

Part E: Risk Management and Dispute Resolution
25. Shifting Losses and Risk Management: Contribution, Indemnity and Insurance
26. Surety Bonds: Backstopping Contractors
27. Claims, Arbitration, and Other Alternative Dispute Resolution Methods

Appendices

Construction Law for Design Professionals, Construction Managers and Contractors

First Edition
Justin Sweet, John H. Boalt Professor of Law Emeritus, University of California, Berkeley
Marc M. Schneier, Editor, Construction Litigator
Blake Wentz, Milwaukee School of Engineering


Construction Law for Design Professionals, Construction Managers and Contractors is aimed primarily at architecture, professional engineering and construction management students. The material is adapted from Legal Aspects of Architecture, Engineering and the Construction
Process—an icon of construction law teaching since 1970. Given the authors’ long and deep understanding of the intersection between the law and the construction industry, professors and students can trust that this text is unparalleled. The addition of Blake Wentz, Associate Professor and Director of the Construction Management Program at the Milwaukee School of Engineering, to the author team emphasizes the book’s commitment to delivering the highest level of field-related content.

Key Features
- The text focuses on the legal issues of particular interest to engineering, architecture and construction management students.
- Contains discussions aimed more squarely at Design and Construction industry participants.
- Focuses on construction management, together with two other major project participants: the owner and prime contractor.
- Up-to-date content. The text incorporates the latest versions of the AIA, CMAA and EJCDC standard form documents, the legal documents students are likely to encounter when they start work.
- Material is presented in a straightforward and easy-to-learn manner.
- Virtually every chapter begins with a Scenario: a description of a hypothetical project. That Scenario is referred back to throughout the chapter to provide concrete illustrations of the concepts discussed. The students are shown how abstract legal principles are applied in a specific, factual setting. The instructor may easily modify the Scenario to fit the teaching needs of the particular class.
- Each chapter ends with review questions for students to use for self-testing.
- Includes a complete chapter and three appendices devoted to ethics.
- Additional appendices containing legal documents are available on the book’s website for students and instructors.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Ancillaries
Instructor’s Solution Manual
MindTap

Contents
PART A: A LEGAL FRAMEWORK OF THE DESIGN AND CONSTRUCTION PROCESS
1. American Legal System
2. Forms of Business Association and Employment
3. Contracts: From Formation to Breach
4. Remedies for Contract Breach: Focus on Construction Disputes
5. Torts: Legal Relations Not Arising from
6. Regulation of Land and the Construction Process
PART B: THE MAIN ACTORS: THE OWNER, PRIME CONTRACTOR AND DESIGN PROFESSIONAL
7. The Project Participants: Focus on the Owner, Prime Contractor and Construction Manager
8. Licensing of the Design Professional, Contractor and Construction Manager
9. The Design Professional-Client Relationship
10. Professional Design Services: The Sensitive Client Issues and Copyright
11. Design Professional Liability
12. Defenses to Claims of Design Professional Liability
13. Ethics
PART C: PROJECT DELIVERY METHODS
14. Project Organization, Pricing, and Delivery Methods
15. Public Contracts
PART D: PERFORMANCE DISPUTES
16. Performance Disputes Overview: Claims and Defenses to Liability for the Owner and Prime Contractor
17. Contractor Payment and Project Completion
18. Changes: Complex Construction Centerpiece
19. Subsurface Problems: Predictable Uncertainty
20. Time: Project Scheduling and Delay Claims
22. Terminating a Construction Contract: Sometimes Necessary but Always Costly
PART E: RISK MANAGEMENT AND DISPUTE RESOLUTION
23. Apportioning or Shifting Losses: Contribution and Indemnity
24. Insurance
25. Surety Bonds: Backstopping Contractors
26. Claims and Disputes: Emphasis on Arbitration
Appendix A: Standard Form of Agreement Between Owner and Contractor (AIA Document A101-2007)
Appendix B: General Conditions of the Contract for Construction (AIA Document A201-2007)
Appendix C: General Conditions of the Construction Contract, (EJCDC Document C-700 (2007))
Appendix D: Standard Form of Agreement Between Owner and Architect with Standard Form of Architect’s Services (AIA Document B101-2007)
Appendix E: 2012 Code of Ethics & Professional Conduct (AIA)
Appendix F: Code of Ethics for Engineers (NSPE 2007)

Available Online:
Appendix H: Standard Form of Agreement Between Contractor and Subcontractor (AIA Document A401-2007)
Appendix I: Performance and Payment Bonds (AIA Document A312-2010)
Appendix J: Standard Form of Agreement Between Owner and Engineer for Professional Services (EJCDC Document E-500 2008)
Appendix K: Suggested Form of Agreement Between Owner and Contractor for Construction Contract (EJCDC Document C-520 2007)
Appendix L: Standard Form of Agreement Between Owner and Construction Manager – Construction Manager as Owner’s Agent (CMAA Document A-1 2013)

Appendix M: Standard Form of Agreement Between Owner and Construction Manager (Construction Manager At-Risk) (CMAA Document CMAR-1 2013)

Appendix N: General Conditions of the Contract for Construction – Construction Manager as Advisor (AIA Document A232-2009)
Appendix O: Standard Form of Agreement Between Owner and Construction Manager as Constructor where the basis of payment is the Cost of Work Plus a Fee with a Guaranteed Maximum Price (AIA Document A133-2009)
Appendix P: Frank Lloyd Wright and the Johnson Building: A Case Study

Environmental Engineering
C. VanGuilder
300 pages. Casebound. 7 x 9. ©2014.

Designed for business managers, environmental health and safety (EHS) personnel, and environmental engineers, this book can be used as a textbook or an industrial guidance reference on conducting environmental audits across all industries. It explains the audit process, from planning, to the actual audit, to the evaluation of results and necessary corrections. The primary emphasis is on condensing the numerous volumes of environmental laws, rules, and regulations into a brief and understandable series of questions. These audits also contain checklists for source reduction, waste minimization, reuse, and recycling before waste disposal. The audits will also encompass water, air, solid waste, remediation, chemical and petroleum bulk storage, and many health and safety requirements.

Key Features
- Includes a CD containing the USEPA multimedia checklists across all programs
- Condenses numerous volumes of environmental laws, rules, and regulations into an understandable series of questions
- Provides a supplement on how to deal with environmental regulatory inspectors

Contents
This text presents a balanced treatment of environmental engineering by combining engineering concepts with the importance of environmental ethics. This third edition highlights sustainable development and emphasizes the need for engineers to become even more environmentally responsible during this time of increasing awareness of environmental concerns. The authors challenge students with problems that require not only a technical solution, but also a thorough consideration of its ethical ramifications. The text also provides comprehensive exposure to all types of environmental problems, including ecosystem dynamics, wastewater treatment, and air pollution control.

New to This Edition
- Addition of “Focus on...” boxes to highlight historical, ethical, and sustainable dimensions of environmental engineering.
- Includes a new section on sustainability and cradle-to-cradle design.
- New chapter on Green Engineering (Chapter 17).
- Expanded coverage of oxygen demand.
- Presents the latest regulatory standards.
- More photos and illustrations.

Key Features
- Incorporates ethical decision making into the discussions and problem sets.
- Uses material balances to unify the coverage of all types of environmental problems, including ecosystem dynamics, wastewater treatment, and air pollution control.
- Introduces in Chapter 2 the various tools engineers use in making decisions, including technology, benefit/cost, risk, and ethics.
- Begins the applications coverage with the quest for clean water. Students learn when water is “clean enough” and how to measure water quality characteristics.
- Covers all the major “pollution areas.”
- Emphasizes the concepts of pollution prevention and life cycle analysis in the chapter on the collection and disposal of municipal solid waste.
- Provides case studies that center on technical as well as ethical problems, offering ideal opportunities for instructors to relate their own experiences.

Ancillaries
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Contents
Part One - Environmental Engineering
1. Identifying and Solving Environmental Problems
   - What is Environmental Engineering / The Holy Cross College Hepatitis Outbreak / The Donora Episode / Jersey City Chromium / The Discovery of Biological Wastewater Treatment / The Garbage Barge / Sustainability and Cradle-to-Cradle Design

Part Two - Fundamentals
2. Engineering Decisions

3. Engineering Calculations
   Engineering Dimensions and Units / Approximations in Engineering Calculations / Information Analysis

4. Material Balances and Separations
   Material Balances with a Single Material / Material Balances with Multiple Materials / Material Balances with Reactors

5. Reactions
   Zero-Order Reactions / First-Order Reactions / Second-Order and Noninteger-Order Reactions / Half-Life and Doubling Time / Consecutive Reactions

6. Reactors
   Mixing Model / Reactor Models

7. Energy Flows and Balances
   Units of Measure / Energy Balances and Conversion / Energy Sources and Availability

8. Ecosystems
   Energy and Material Flows in Ecosystems / Human Influence on Ecosystems

Part Three - Applications
9. Water Quality
   Measures of Water Quality / Assessing Water Quality / Water Quality Standards

10. Water Supply and Treatment
    The Hydrologic Cycle and Water Availability / Water Treatment / Distribution of Water

11. Wastewater Treatment
    Wastewater / Preliminary and Primary Treatment / Secondary Treatment / Tertiary Treatment / Sludge Treatment and Disposal / Selection of Treatment Strategies

12. Air Quality
    Meteorology and Air Movement / Major Air Pollutants / Sources and Effects of Air Pollution / Air Quality Standards

13. Air Quality Control
    Treatment of Emissions / Dispersion of Air Pollutants / Control of Moving Sources

14. Solid Waste

15. Hazardous Waste

16. Noise Pollution
    Sound / Measurement of Sound / Effect of Noise on Human Health / Noise Abatement / Noise Control

17. Ethics of Green Engineering
    Green Engineering / Motivations for Practicing Green Engineering / Conclusions
Solid Waste Engineering

Second Edition
William A. Worrell, Integrated Waste Management Authority
P. Aarne Vesilind, Bucknell University


Also Available in SI Units

Solid Waste Engineering addresses the growing and increasingly intricate problem of controlling and processing the refuse created by our urban society. While the authors discuss issues such as regulations and legislation, their main emphasis is on solid waste engineering principles. They maintain their focus on principles by first explaining the basic principles of the field, then demonstrating how these principles are applied in real-world settings through worked examples. Students will emerge being able to think reflectively and logically about the problems and solutions in solid waste engineering.

New to This Edition
- Updated and expanded discussion of recycling, conversion technology, and the move to zero waste. Provides students with an understanding of the history and future direction of solid waste management.
- Additions and expansions to legislation and regulation section, including November 2008 European adoption of new solid waste goals and regulations.
- Waste generation and waste characterization data has been updated with the most recent findings.
- New discussion on the evolution of recyclables, starting with separate containers by commodities to single stream approach, as well as updated data on collection of recyclables.
- Chapter on Landfills has been updated and expanded to reflect changes in the field since 2002, including the planning, siting, and permitting sections.
- Includes new advances in waste combustion technology, such as gasification and new clean air act regulations.
- Updated to include high solids anaerobic digestion and new studies that evaluate this technology.
- New sections on Product Stewardship and Environmental Justice, as well as an updated flow control section to reflect new Supreme Court decisions.

Key Features
- This is the first textbook on solid waste engineering written by engineers, for engineering students.
- Content features up-to-date technology on solid-waste collection, processing, and disposal.
- Students will learn engineering economics applied to solid-waste engineering.
- The text includes a focus on ethical considerations in the design of solid-waste management systems.
- Includes a supplementary design problem that can be used as a semester-long project with weekly submissions of reports and a final compilation of an assimilated full engineering report.

Contents
1. Integrated Solid Waste Management
   Solid Waste in History / Materials Flow / The Need for Integrated Solid Waste Management / Special Wastes
2. Municipal Solid Waste Characteristics and Quantities
   Definitions / Municipal Solid Waste Generation / Municipal Solid Waste Characteristics / Appendix: Measuring Particle Size
3. Collection
   Refuse Collection Systems / Commercial Wastes / Transfer Stations / Collection of Recyclable Materials / Litter and Street Cleanliness / Appendix: Design of Collection Systems
4. Landfills
   Planning, Siting, and Permitting of Landfills / Landfill Processes / Landfill Design / Landfill Operations / Post-closeup Care and Use of Old Landfills / Landfill Mining
5. Process of Municipal Solid Waste
   Refuse Physical Characteristics / Storing MSW / Conveying / Compacting / Shredding / Pulping / Roll Crushing / Granulating / Appendix: The Pi Breakage Theorem
6. Materials Separation
   General Expressions for Materials Separation / Picking (Hand Sorting) / Screens / Float/Sink Separators / Magnets and Electromechanical Separators / Other Devices for Materials Separation / Materials Separation Systems
7. Combustion and Energy Recovery
   Heat Value of Refuse / Materials and Thermal Balances / Combustion Hardware Used for MSW / Undesirable Effects of Combustion
8. Biochemical Processes
   Methane Generation by Anaerobic Digestion / Composting
   Life Cycle Analysis and Management / Flow Control / Public or Private Ownership and Operation / Contracting for Solid Waste Services / Financing Solid Waste Facilities / Hazardous Materials / Environmental Justice / The Role of the Solid Waste Engineer

Appendix A. The Lewisburg Solid Waste Problem
Appendix B. Bulk Densities of Refuse Components
Appendix C. Conversions

Geotechnology of Waste Management

Second Edition
Issa Oweis
Raj Khera, New Jersey Institute of Technology


The second edition of Geotechnology of Waste Management provides an up-to-date discussion of environmental geotechnology, an increasingly important area of study and real-world application in the field of civil engineering.

Unlike encyclopedic references that provide little context for understanding and applying the subject matter, Oweis and Khera’s text guides students through practical discussions of solid wastes, their index properties, settlement characteristics, strength behavior, and hydraulic properties. Landfill design coverage includes site investigation and selection, geosynthetic and soil liner systems, leachate generation and detection, erosion control and caps, gas generation and management, foundation and slope stability, and applicable regulatory guidelines.

Contents
1. Forms of Waste
2. Index Properties
3. Clay Minerals
4. Compressibility and Settlement
5. Shear Strength
6. Hydraulic Properties
7. Site Investigation
8. Site Selection
9. Ground Modification and Compaction
10. Liners
11. Leachate Generation and Collection
12. Caps
13. Foundation and Slope Stability
14. Gas Management
15. Regulations Governing Solid Waste Disposal

www.cengage.com/engineering
Unit Operations and Processes in Environmental Engineering

Second Edition
Tom D. Reynolds, Texas A&M University
Paul Richards, University of Southwestern Louisiana


The text is written for both Civil and Environmental Engineering students enrolled in Wastewater Engineering courses, and for Chemical Engineering students enrolled in Unit Processes or Transport Phenomena courses. It is oriented toward engineering design based on fundamentals. The presentation allows the instructor to select chapters or parts of chapters in any sequence desired.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Chemical Concepts
2. Biological Concepts
4. Water Quantities and Water Quality
5. Wastewater Quantities and Wastewater Quality
6. Water and Wastewater Treatment Plants
7. Preliminary Unit Operations and Processes
8. Coagulation and Flocculation
9. Sedimentation
10. Filtration
11. Ammonia Removal
12. Adsorption
13. Ion Exchange
14. Membrane Processes
15. Activated Sludge
16. Oxygen Transfer and Mixing
17. Trickling Filters and Rotary Biological Contactors
18. Stabilization Ponds and Aerated Lagoons
19. Anaerobic Digestion
20. Aerobic Digestion
21. Solids Handling
22. Land Treatment of Municipal Wastewater and Sludges
23. Other Unit Operations and Processes
24. Disinfection

Sustainable Energy

First Edition
Richard Dunlap, Dalhousie University

608 pages. Softbound. 8 x 10. 4-Color. ©2015.

Also Available in SI Units

Sustainable Energy focuses directly on energy-related issues and includes a thorough treatment of all potentially viable energy sources, containing enough material for a typical one-semester course, with additional material to allow flexibility in coverage. Author Richard Dunlap covers past, current, and future energy needs and production methods in separate chapters on each alternative energy technology. While maintaining a quantitative approach to the study of energy in our society, the text and accompanying problems show the complexity and interdisciplinary nature of the topic. The author uses the CURVE analysis (Clean, Unlimited, Renewable, Versatile, and Economical) to help students remember the important criteria when assessing the viability of an alternative energy source. The end-of-chapter problems are predominantly quantitative in nature but are not just based on substituting values from the chapter into the appropriate formula. Problems are designed to require the students to analyze information, to make use of material from previous chapters, to correlate data from outside sources, and in many cases, to estimate quantities based on interpretation of graphical data, interpolation of values, and sometimes just plain common sense. The overall approach of the book provides an appreciation for the real problems engineers encounter in the understanding of how we produce and use energy, stressing the necessity of broadly-based analyses grounded in rigorous scientific calculations.

Key Features
- Comprehensive coverage of sustainable energy spans current energy production methods and energy needs through potentially viable alternative energy sources.
- The complexity of energy issues is emphasized, as is the need for a multidisciplinary approach to solving our energy problems. This approach provides students with an appreciation for the real problems that are encountered in the understanding of how we produce and use energy.
- CURVE criteria and approach (clean, unlimited, renewable, versatile, and economical) makes it easy for students to analyze and compare different technologies.
- Each chapter starts with learning objectives and chapter summaries to aid students.
- Energy-Extra boxes provide insight into specific aspects of energy and often emphasize the complex nature of the decisions and critical analysis required to plan for our future energy needs.
- Instructor’s companion website contains Lecture Builder PowerPoint slides, Test Banks, links to resources, and the Instructor’s Solutions Manual.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Ancillaries
Instructor’s Solution Manual
SI Version Instructor’s Solution Manual
MindTap

Contents
PART I: BACKGROUND
1. Energy Basics
2. Past, Present, and Future World Energy Use

PART II: FOSSIL FUELS
3. Fossil Fuel Resources and Use
4. Environmental Consequences of Fossil Fuel Use

PART III: NUCLEAR ENERGY
5. Some Basic Nuclear Physics
6. Energy from Nuclear Fission
7. Energy from Nuclear Fusion

PART IV: RENEWABLE ENERGY
8. Direct Use of Solar Energy
9. Electricity from Solar Energy
10. Wind Energy
11. Hydroelectric Energy
12. Wave Energy
13. Tidal Energy
14. Ocean Thermal Energy Conversion and Ocean Salinity Gradient Energy
15. Geothermal Energy
16. Biomass Energy

PART V: ENERGY CONSERVATION, ENERGY STORAGE, AND TRANSPORTATION
17. Energy Conservation
18. Energy Storage
Geotechnical/Soil Dynamics

Principles of Soil Dynamics

Second Edition
Braja M. Das, California State University-Sacramento
Gunturi V. Ramana, India Institute of Technology

Principles of Soil Dynamics is an unparalleled reference book designed for an introductory course on Soil Dynamics. Authors Braja M. Das, best-selling authority on Geotechnical Engineering, and Ramana V. Gunturi, Dean of the Civil Engineering Department at the India Institute of Technology in New Delhi, present a well-revised update of this already well-established text. The primary focus of the book is on the applications of soil dynamics, and not on the underlying principles. The material covered includes the fundamentals of soil dynamics, dynamic soil properties, foundation vibration, soil liquefaction, pile foundation, and slope stability.

Key Features
- Contains complete pedagogical apparatus including worked-out examples, practical engineering applications, and extensive sets of homework problems that help students grasp the basic concept of soil dynamics.
- Students learn concepts that are reinforced by practical, “real-world” use.
- Extensive lists of references are provided in each chapter.
- A complete chapter (Chapter 8) on lateral earth pressure on retaining walls gives students a thorough introduction to this important topic.

Contents

1. Introduction
2. Fundamentals of Vibration
3. Waves in Elastic Medium
4. Properties of Dynamically Loaded Soils
5. Foundation Vibration
6. Dynamic Bearing Capacity of Shallow Foundations
7. Earthquake and Ground Vibration
8. Lateral Earth Pressure on Retaining Walls
9. Compressibility of Soils Under Dynamic Loads
10. Liquefaction of Soil
11. Machine Foundations on Piles
12. Seismic Stability of Earth Embankments

Appendix A: Primary and Secondary Forces of Single-Cylinder Engines

Introduction to Geotechnical Engineering

Braja M. Das, California State University-Sacramento


Introduction to Geotechnical Engineering takes intensive research and observation in the field and the laboratory that have refined and improved the science of foundation design, and presents them in a simple and concise form. This non-calculus based text is primarily designed for classroom instruction in civil engineering technology programs where soil mechanics and foundation engineering are combined into one course. It is also a useful and convenient reference tool for civil engineering practitioners, as minimal supplementary material is necessary for its use.

Key Features
- Liberally illustrated for better understanding of the material by the students.
- English units are used throughout the text, with only few exceptions.
- Numerous example homework problems are included.
- A solid background in soil mechanics is provided for a greater understanding of foundation design.

Ancillaries
Instructors Solution Manual

Contents

1. Introduction
   - Soil – Particle Size / General Soil Deposits / Some Local Terms for Soils
2. Weight – Volume Relationships
   - Volume Relationships / Weight Relationships / Specific Gravity of Soil Solids / Relationships Among Unit Weight, Void Ratio, Moisture Content, and Specific Gravity / Relationships Among Unit Weight, Porosity, and Moisture Content / Relative Density
3. Grain Size Analysis, Plasticity, and Soil Classification
   - Grain Size Analysis / Grain Size Distribution Curve / Consistency of Soils – Atterberg Limits / Liquid Limit (LL) / Plastic Limit (PL) / Shrinkage Limit (SL) / Engineering Classification of Soil / AASHTO Soil Classification System / Unified Soil Classification System
4. Permeability and Capillarity
   - Darcy’s Law / Hydraulic Conductivity / Laboratory Determination of Hydraulic Conductivity / Relationships for Hydraulic Conductivity – Granular Soils / Relationships for Hydraulic Conductivity – Cohesive Soils / Permeability Test in the Field by Pumping from Wells / Capillary Rise in Soils
5. Stresses in a Soil Mass
   - Effective Stress Concept: Stresses in Saturated Soil without Seepage / Stresses in Saturated Soil with Upward Seepage / Vertical Stress Increase Due to Various Types of Loading: Stress Caused by a Point Load / Vertical Stress below the Center of a Uniformly Loaded Circular Area / Vertical Stress Caused by a Rectangularly Loaded Area
6. Consolidation
   - Fundamentals of Consolidation / One-Dimensional Laboratory Consolidation Test / Void Ratio – Pressure Plots / Normally Consolidated and Overconsolidated Clays / Effect of Disturbance on Void Ratio-Pressure Relationship / Calculation of Settlement from One-Dimensional Primary Consolidation / Compression Index (Cc) and Swell Index (Cs) / Settlement from Secondary Consolidation / Time-Rate Consolidation / Coefficient of Consolidation
7. Shear Strength of Soils
   - Mohr-Coulomb Failure Criteria / Direct Shear Test / Triaxial Shear Test / Consolidated-Drained Test / Consolidated-Undrained Test / Unconsolidated-Undrained Test / Unconfined Compression Test on Saturated Clay
8. Subsurface Exploration
   - Subsurface Exploration Program / Exploratory Borings in the Field / Procedures for Sampling of Soil / Observation of Water Levels / Vane Shear Test / Cone Penetration Test / Coring of Rocks / Preparation of Boring Logs / Subsurface Exploration Report
9. Lateral Earth Pressure: At-Rest, Rankine and Coulomb
   - At-Rest, Rankine and Passive Pressures / At-Rest Lateral Earth Pressure: Earth Pressure at Rest / Earth Pressure at Rest for Partially Submerged Soil / Rankine’s Earth Pressure: Rankine Active Pressure / Rankine Active
13. Slope Stability

14. Soil Compaction
Compaction – General Principles / Standard Proctor Test / Factors Affecting Compaction / Modified Proctor Test / Effect of Compaction on Cohesive Soil Properties / Pile Compaction / Specifications for Field Unit Weight of Compaction

Answers to Selected Problems

Principles of Geotechnical Engineering

Eighth Edition
Brajta M. Das, California State University-Sacramento
Khaled Sobhian, Florida Atlantic University


Also Available in SI Units

Intended as an introductory text in soil mechanics, the eighth edition of Principles of Geotechnical Engineering offers an overview of soil properties and mechanics together with coverage of field practices and basic engineering procedure. Background information needed to support study in later design-oriented courses or in professional practice is provided through a wealth of comprehensive discussions, detailed explanations, and more figures and worked out problems than any other text in the market.

New to This Edition
• Case histories have been added in appropriate chapters in order to familiarize the student with the unpredictable variability of soil in the field.
• Challenging critical thinking problems have been added to the end-of-chapter problem sections for increased understanding of the content.
• A 16-page color insert of photographs including rocks and rock-forming minerals has been added to this edition in order to fully capture the unique coloring that helps geotechnical engineers distinguish one mineral/rock from the other.
• Chapter introductions and summaries have been expanded in this edition in order to more clearly lay out the content, both before and after its been read.
• Questions for self-study along with answers are provided on a free companion website for students to use for practice and examination preparation.

Key Features
• Includes a comprehensive discussion on weathering of rocks and the formation of sedimentary and metamorphic rocks.
• Presents a detailed explanation for the variation of the maximum and minimum void ratios of granular soils due to grain size, shape, and non plastic fine contents.
• The Kozeny-Carman equation and modifications thereof to estimate hydraulic conductivity of granular soils is discussed in detail.

Also Available
Principles of Geotechnical Engineering, Sixth Edition

•  Questions for self-study along with answers
•  Chapter introductions and summaries have been clearly lay out the content, both before and after its been read.
•  A 16-page color insert of photographs

Contents
1. Geotechnical Engineering – A Historical Perspective

2. Origin of Soil and Grain Size
Rock Cycle and the Origin of Soil / Rock-Forming Minerals, Rocks, and Rock Structures / Soil–Particle Size / Clay Minerals / Specific Gravity (Gs) / Mechanical Analysis of Soil / Particle–Size Distribution Curve / Particle Shape

3. Weight-Volume Relationships
Weight–Volume Relationships / Relationships Among Unit Weight, Void Ratio, Moisture Content, and Specific Gravity / Relationships Among Unit Weight, Porosity, and Moisture Content / Various Unit-Weight Relationships / Relative Density / Comments on emax and emin / Correlations between emax, emin, emax – emin, and Median Grain Size (D50)

4. Plasticity and Structure of Soil
Liquid Limit (LL) / Plastic Limit (PL) / Shrinkage Limit (SL) / Liquidity Index and Consistency Index / Activity / Plasticity Chart / Soil Structure

5. Classification of Soil
Textural Classification / Classification by Engineering Behavior / AASHTO Classification System / Unified Soil Classification System / Comparison between the AASHTO and Unified Systems

6. Soil Compaction
7. Permeability
Bernoulli’s Equation / Darcy’s Law / Hydraulic Conductivity / Laboratory Determination of Hydraulic Conductivity / Relationships for Hydraulic Conductivity - Granular Soil / Relationships for Hydraulic Conductivity - Cohesive Soils / Directional Variation of Permeability / Equivalent Hydraulic Conductivity in Stratified Soil / Permeability Test in the Field by Pumping from Wells / In Situ Hydraulic Conductivity of Compacted Clay Soils

8. Seepage

9. In Situ Stresses
Stresses in Saturated Soil without Seepage / Stresses in Saturated Soil with Upward Seepage / Stresses in Saturated Soil with Downward Seepage / Seepage Force / Heaving in Soil Due to Flow Around Sheet Piles / Use of Filters to Increase the Factor of Safety Against Heave / Effective Stress in Partially Saturated Soil / Capillary Rise in Soils / Effective Stress in the Zone of Capillary Rise

10. Stresses in a Soil Mass
Normal and Shear Stresses on a Plane / The Pole Method of Finding Stresses Along a Plane / Stresses Caused by a Point Load / Vertical Stress Caused by a Line Load / Vertical Stress Caused by a Horizontal Line Load / Vertical Stress Caused by a Strip Load (Finite Width and Infinite Length) / Vertical Stress Due to Embankment Loading / Vertical Stress below the Center of a Uniformly Loaded Circular Area / Vertical Stress at Any Point Below a Uniformly Loaded Circular Area / Vertical Stress Caused by a Rectangularly Loaded Area / Influence Chart for Vertical Pressure

11. Compressibility of Soil
Contact Pressure and Settlement Profile / Relations for Elastic Settlement Calculation / Fundamentals of Consolidation / One-Dimensional Laboratory Consolidation Test / Void Ratio – Pressure Plot / Normally Consolidated and Overconsolidated Clays / General Comments on Conventional Consolidation Test / Effect of Disturbance on Void Ratio – Pressure Relationship / Calculation of Settlement from One-Dimensional Primary Consolidation / Compression Index (Cc) / Swell Index (Cs) / Secondary Consolidation Settlement / Time Rate of Consolidation / Coefficient of Consolidation / Calculation of Consolidation Settlement Under a Foundation / A Case History – Settlement Due to a Preload Fill for Construction of Tampa VA Hospital / Method of Accelerating Consolidation Settlement / Precompression

12. Shear Strength of Soils
Mohr–Coulomb Failure Criterion / Inclination of the Plane of Failure Caused by Shear / Laboratory Tests for Determination of Shear Strength Parameters / Direct Shear Test / Drained Direct Shear Test on Saturated Sand and Clay / General Comments on Direct Shear Test / Triaxial Shear Test – General / Consolidated-Drained Triaxial Test / Consolidated-Undrained Triaxial Test / Unconsolidated–Undrained Triaxial Test / Unconfined Compression Test on Saturated Clay / Empirical Relationships Between Undrained Cohesion and Effective Overburden Pressure / Sensitivity and Thixotropy of Clay / Strength Anisotropy in Clay / Vane Shear Test / Other Methods for Determining Undrained Shear Strength / Shear Strength of Unsaturated Cohesive Soils / Stress Path

13. Lateral Earth Pressure: At-Rest, Rankine and Coulomb
At-Rest, Active, and Passive Pressures / Earth Pressure At-Rest / Earth Pressure At-Rest for Partially Submerged Soil / Rankine’s Theory of Active Pressure / Theory of Rankine’s Passive Pressure / Yielding of Wall of Limited Height / Rankine Active and passive Pressure with Sloping Backfill / Diagrams for Lateral Earth-Pressure Distribution Against Retaining Walls / Coulomb’s Active Pressure / Graphical Solution for Coulomb’s Active Earth Pressure / Coulomb’s Passive Pressure / Active Force on Retaining Walls with Earthquake Forces / Common Types of Retaining Walls in the Field

14. Lateral Earth Pressure: Curved Failure Surface
Retaining Walls with Friction / Properties of a Logarithmic Spiral / Procedure for Determination of Passive Earth Pressure (Pp) – Cohesionless Backfill / Coefficient of Passive Earth Pressure (Kp) / Caquot and Kerisel Solution for Passive Earth Pressure (Granular Backfill) / Passive Force on Walls with Earthquake Forces / Braced Cuts – General / Determination of Active Thrust on Bracing Systems of Open Cuts – Granular Soil / Determination of Active Thrust on Bracing Systems for Cuts – Cohesive Soil / Pressure Variation for Design of Sheetings, Struts, and Walls

15. Slope Stability

16. Soil-Bearing Capacity for Shallow Foundations
Ultimate Soil-Bearing Capacity for Shallow Foundations / Terzaghi’s Ultimate Bearing Capacity Equation / Effect of Groundwater Table / Factor of Safety / General Bearing Capacity Equation / A Case History for Evaluation of the Ultimate Bearing Capacity / Ultimate Load for Shallow Foundations Under Eccentric Load / Bearing Capacity of Sand Based on Settlement / Plate-Load Test

17. Landfill Liners and Geosynthetics

Appendix A. A Generalized Case for Rankine Active and Passive Pressure – Granular Backfill

Principles of Foundation Engineering
Seventh Edition
Braja M. Das, California State University-Sacramento


Also Available in SI Units

Originally published in the fall of 1983, Braja M. Das’ seventh edition of Principles of Foundation Engineering continues to maintain the careful balance of current research and practical field applications that has made it the leading text in foundation engineering courses. Featuring a wealth of worked-out examples and figures that help students with theory and problem-solving skills, the book introduces civil engineering students to the fundamental concepts and application of foundation analysis design. Throughout, Das emphasizes the judgment needed to properly apply the theories and analysis to the evaluation of soils and foundation design, as well as the need for field experience.

New to This Edition
• Numerous new case studies have been added to familiarize students with the derivations from theory to practice.
• Over 30 new photographs have been added for better understanding and visualization of the ideas and field practices.
• Now in 2-color format for enhanced clarity of figures and diagrams.
• New and updated content in many areas.
• New sections on the ultimate bearing capacity of weaker soils underlain by a stronger soil, seismic bearing capacity of foundations at...
the edge of a granular slope, foundations on rocks, and stress characteristic solution for foundations located on the top of granular slopes, have been added.

• New recommendations based on recent publications for estimating the load-bearing capacity of drilled shafts extending to rock.

Key Features
• Presents balanced coverage of the most up-to-date research and practical field applications.
• Presents multiple theories and empirical correlations where applicable. Students learn that the soil parameters obtained from different empirical correlations are not always the same.
• Offers more worked-out examples and figures than any other text.
• Contains a selection of end-of-chapter problems, as well as a list of references for further information and study.

Ancillaries

Also Available

Contents
1. Geotechnical Properties of Soil
   - Grain-Size Distribution / Size Limits for Soils / Weight-Volume Relationships / Relative Density / Atterberg Limits / Liquidity Index / Activity / Soil Classification Systems / Hydraulic Conductivity / Steady-State Seepage / Effective Stress / Consolidation / Calculation of Primary Consolidation Settlement / Time Rate of Consolidation / Degree of Consolidation Under Ramp Loading / Shear Strength / Unconfined Compression Test / Comments on Friction Angle, φ’ / Correlations for Undrained Soil / Unconfined Compression Test / Strength / Sensitivity
2. Natural Soil Deposits and Subsoil Exploration
   - Soil Origin / Residual Soil / Gravity Transported Soil / Alluvial Deposits / Lacustrine Deposits / Glacial Deposits / Aeolian Soil Deposits / Organic Soil / Some Local Terms for Soils / Purpose of Subsurface Exploration / Subsurface Exploration Program / Exploratory Borings in the Field / Procedures for Sampling Soil / Split-Spoon Sampling / Sampling with a Scraper Bucket / Sampling with Thin-Walled Table / Sampling with a Piston Sampler / Observation of Water Tables / Vane Shear Test / Cone Penetration Test / Pressuremeter Test (PMT) / Dilatometer Test / Coring of Rocks / Preparation of Boring Logs / Subsoil Exploration Report
3. Shallow Foundations: Ultimate Bearing Capacity
   - General Concept / Terzaghi’s Bearing Capacity Theory / Factor of Safety / Modification of Bearing Capacity Equations for Water Table / The General Bearing Capacity Equation / Case Studies on Ultimate Bearing Capacity / Effect of Soil Compressibility / Eccentrically Loaded Foundations / Ultimate Bearing Capacity under Eccentric Loading – One-Way Eccentricity / Bearing Capacity with Two-Way Eccentricity / Bearing Capacity of a Continuous Foundation Subjected to Eccentric Inclined Loading
4. Ultimate Bearing Capacity of Shallow Foundations: Special Cases
5. Shallow Foundations: Allowable Bearing Capacity and Settlement
   - Stress Due to a Concentrated Load / Stress Due to a Circularly Loaded Area / Stress Below a Rectangular Area / Average Vertical Stress Increase Due to a Rectangularly Loaded Area / Stress Increase Under an Embankment / Westergaard’s Solution for Vertical Stress Due to a Point Load / Stress Distribution for Westergaard Material / Elastic Settlement of Foundations on Saturated Clay / Settlement Based on the Theory of Elasticity / Improved Equation for Elastic Settlement / Settlement of Sandy Soil: Use of Strain Influence Factor / Settlement of Foundation on Sand Based on Standard Penetration Resistance / Settlement in Granular Soil Based on Pressuremeter Test (PMT) / Primary Consolidation Settlement Relationships / Three-Dimensional Effects on Primary Consolidation Settlement / Settlement Due to Secondary Consolidation / Field Load Test / Presumptive Bearing Capacity / Tolerable Settlement of Buildings
6. Mat Foundations
7. Lateral Earth Pressure
   - Lateral Earth Pressure at Rest / Rankine Active Earth Pressure / A Generalized Case for Rankine Active Pressure / Coulomb’s Active Earth Pressure / Active Earth Pressure Due to Surcharge / Active Earth Pressure for Earthquake Conditions / Active Pressure for Wall Rotation about the Top: Braced Cut / Active Earth Pressure for Translation of Retaining Wall – Granular Backfill / Rankine Passive Earth Pressure / Rankine Passive Earth Pressure: Vertical Backfill and Inclined Backfill / Coulomb’s Passive Earth Pressure / Comments on the Failure Surface Assumption for Coulomb’s Pressure Calculations / Passive Pressure under Earthquake Conditions
8. Retaining Walls
9. Sheet Pile Walls
10. Braced Cuts
   - Pressure Envelope for Braced-Cut Design / Pressure Envelope for Cuts in Layered Soil / Design of Various Components of a Braced Cut / Case Studies for Braced Cuts / Bottom Heave of a Cut in Clay / Stability of the Bottom of a Cut in Sand / Lateral Yielding of Sheet Piles and Ground Settlement
11. Pile Foundations
12. Drilled- Shaft Foundations
   - Types of Drilled Shafts / Construction Procedures / Other Design Considerations
Fundamentals of Geotechnical Engineering

Fourth Edition
Brajë M. Das, California State University-Sacramento


Fundamentals of Geotechnical Engineering is a concise combination of the essential components of Brajë Das’ market-leading texts, Principles of Geotechnical Engineering and Principles of Foundation Engineering. The text includes the fundamental concepts of soil mechanics and foundation engineering without becoming cluttered with excessive details and alternatives. Fundamentals of Geotechnical Engineering features a wealth of worked-out examples, as well as figures to help students with theory and problem-solving skills. Das maintains the careful balance of current research and practical field applications that has made his books the leaders in the field.

New to This Edition
• Chapters have been reorganized from 14 in total to 19, in order to make content coverage and selection simpler and more efficient for instructors.
• New “Problems for Self Study” available via free student download, equipped with full solutions.
• New content on the process of the formation of various types of rock (i.e., rock cycle).
• New chapter solely dedicated to Soil Classification.
• Several recently developed empirical relationships to estimate maximum dry unit weight and optimum moisture content have been added to the chapter on “Soil Compaction”.
• “Hydraulic Conductivity” and “Seepage” are now presented in two separate chapters (Chapters 6 and 7), with flow net construction in anisotropic soils as a new topic covered under “Seepage”.
• New chapter on “Ground Improvement” briefly treating topics related to chemical and mechanical stabilizations.
• New section on geophysical exploration has been added to the chapter on Subsurface Exploration.
• The chapter on shallow foundations presented in Chapter 12 in the previous edition, is now treated in two separate chapters—“Bearing Capacity” and “Settlement”. “Pile Foundations” and “Drilled Shafts” are also now two separate chapters (previously “Deep Foundations—Piles and Drilled Shafts”).
• A new appendix on “Geosynthetics” has been added, primarily introducing readers to geotextile and geogrid as they relate to the construction of mechanically stabilized earth (MSE) retaining walls.
• The majority of example and homework problems are new and many new photographs have been added to this edition.

Key Features
• Large number of example problems in all chapters.
• Provides a comprehensive treatment of soil mechanics and foundation engineering that can be used to teach a combined, one-semester course.
• Covers topics such as bearing capacity and settlement of shallow foundations (spread footings and mats), retaining walls, braced cuts, piles, drilled shafts, and much more.
• Abundantly illustrated to help students understand the material.
• Several examples are included in each chapter as well as numerous problems provided for homework and assignment.
• All units presented using SI.
• A historical perspective (pre-18th century—present) provides detailed background and content development.
• Contains a list of references for further information and study in each chapter.
• Full Instructor’s Solutions Manual and PowerPoint slides of all images are available for free Instructor-Only Download.

Ancillaries
Instructor’s Solutions Manual

Also Available
Fundamentals of Geotechnical Engineering, First Edition
Spanish Version

Contents
1. Geotechnical Engineering—From the Beginning

2. Soil Deposits—Origin, Grain-Size, and Shape
Rock Cycle and the Origin of Soil/Soil Deposits—General/Residual Soil/Gravity Transported Soil/Alluvial Deposits/Lacustrine Deposits/Glacial Deposits/Aeolian Soil Deposits/Organic Soil/Soil—Particle Size/Clay Minerals/Specific Gravity (Gs)/Mechanical Analysis of Soil/Effective Size, Uniformity Coefficient, and Coefficient of Gradation/Particle Shape

3. Weight-Volume Relationships and Plasticity
Weight-Volume Relationships/Relationships among Unit Weight, Void Ratio, Moisture Content, and Specific Gravity/Relationships among Unit Weight, Porosity, and Moisture Content/Relative Density/Consistency of Soil/Activity/Liquidity Index/Plasticity Chart

4. Soil Classification
AASHTO Soil Classification System/Unified Classification System

5. Soil Compaction
Compaction—General Principles/Standard Proctor Test/Factors Affecting Compaction/Modified Proctor Test/Emplirical Relationships/Field Compaction/Specifications for Field Compaction/Determination of Field Unit Weight after Compaction/Effect of Compaction on Cohesive Soil Properties

6. Hydraulic Conductivity
Bernoulli’s Equation/Darcy’s Law/Hydraulic Conductivity/Laboratory Determination of Hydraulic Conductivity/Emplirical Relations for Hydraulic Conductivity/Equivalent Hydraulic Conductivity in Stratified Soil/Permeability Test in the Field by Pumping from Wells

7. Seepage
Laplace’s Equation of Continuity/Flow Nets/Seepage Calculation from a Flow Net/Flow Nets in Anisotropic Soil

8. Stresses in Soil Mass
Stresses in Saturated Soil without Seepage/Stresses in Saturated Soil with Seepage/Seepage Force/Heaving in Soil Due to Flow/Around Sheet Piles/Stress Cause by a Point Load/Vertical Stress Caused by a Line Load/Vertical Stress Below a Uniformly Loaded Circular Area/Vertical Stress Caused by a Rectangularly Loaded Area

9. Consolidation
Fundamentals of Consolidation / One-Dimensional Laboratory Consolidation Test / Void Ratio-Pressure Plots / Normally Consolidated and Overconsolidated Clays / Effect of Disturbance on Void Ratio – Pressure Relationship / Calculation of Settlement from One-Dimensional Primary Consolidation / Compression Index (Cc) and Swell Index (Cs) / Settlement from Secondary Consolidation / Time Rate of Consolidation / Coefficient of Consolidation / Calculation of Primary Consolidation Settlement under a Foundation / Skempton-Bozajian Modification for Consolidation Settlement

10. Shear Strength of Soil
Mohr-Coulomb Failure Criteria / Inclination of the Plane of Failure Caused by Shear / Direct Shear Test / Triaxial Shear Test / Consolidated-Drained Test / Consolidated-Undrained Test / Unconsolidated-Undrained Test / Unconfined Compression Test on Saturated Clay / Sensitivity and Anisotropy of Clay / Anisotropy in Undrained Shear Strength

11. Ground Improvement
Lime Stabilization / Cement Stabilization / Fly-Ash Stabilization / Vibroflotation / Dynamic Compaction / Blasting / Precompression / Sand Drains

12. Subsurface Exploration
Subsurface Exploration Program / Exploratory Borings in the Field / Procedures for Sampling Soil / Split-Spoon Sampling / Sampling with Thin Wall Tube / Observation of Water Levels / Vane Shear Test / Cone Penetration Test / Pressuremeter Test (PMT) / Dilatometer Test / Coring of Rocks / Preparation of Boring Logs / Geophysical Exploration / Soil Exploration Report

13. Slope Stability
Factor of Safety / Stability in Infinite Slopes / Finite Slopes / Analysis of Infinite Slope with Circularly Cylindrical Failure Surface – General / Mass Procedure of Stability Analysis (Circularly Cylindrical Failure Surface) / Method of Slices / Bishop's Simplified Method of Slices / Analysis of Simple Slopes Steady-State Seepage / Mass Procedure for Stability of Clay Slopes with

14. Lateral Earth Pressure
Earth Pressure at Rest / Rankine's Theory of Active and Passive Earth Pressures / Diagrams for Lateral Earth Pressure Distribution against Retaining Walls / Rankine's Active Pressure with Sloping Granular Backfill / Coulomb's Earth Pressure Theory - Retaining Walls with Friction / Passive Pressure Assuming Curved Failure Surface in Soil

15. Retaining Walls and Braced Cuts
Retaining Walls – General / Proportioning Retaining Walls / Application of Lateral Earth Pressure Theories to Design / Check for Overturning / Check for Sliding along the Base / Check for Bearing Capacity Failure / Mechanically Stabilized Earth / General Design Considerations / Retaining Walls with Metallic Strip Reinforcement / Step-by-Step Design Procedure using Metallic Strip Reinforcement / Retaining Walls with Geotextile Reinforcement / Retaining Walls with Geogrid Reinforcement / Braced Cuts – General / Lateral Earth Pressure in Braced Cuts / Soil Parameters for Cuts in Layered Soil / Design of Various Components of a Braced Cut / Heave of the Bottom of a Cut in Clay / Lateral Yielding of Sheet Piles and Ground Settlement

16. Shallow Foundations – Bearing Capacity

17. Settlement of Shallow Foundations
Elastic Settlement of Foundations on Saturated Clay Soils / Elastic Settlement Based on Theory of Elasticity / Range of Material Parameters for Computing Elastic Settlement / Settlement of Sandy Soil: Use of Strain Influence Factor / Allowable Bearing Pressure for Spread Footings in Sand Basin on Settlement Consideration / Allowable Bearing Pressure for Mat Foundations in Sand

18. Pile Foundations
Need for Pile Foundations / Types of Piles and Their Structural Characteristics / Estimation of Pile Length / Installation of Piles / Load Transfer Mechanism / Equations for Estimation of Pile Capacity / Calculation of Qp – Meyerhof’s Method / Frictional Resistance Qs / Allowable Pile Capacity / Load-Carrying Capacity of Pile Point Resting on Rock / Elastic Settlement of Piles / Pile Load Tests / Pile-Driving Formulas / Negative Skin Friction / Group Piles - Efficiency / Elastic Settlement of Group Piles / Consolidation Settlement of Group Piles

19. Drilled Shafts
Types of Drilled Shafts / Construction Procedures / Estimation of Load-Bearing Capacity / Drilled Shafts in Sand – Net Ultimate Load / Drilled Shafts in Clay Ultimate Load / Load Bearing Capacity Based on Settlement

Appendix A. Geosynthetics

Reclamation and Ground Improvement
M.W. Bo, Bullen Consultants Ltd. - London
V. Choa, Nanyang Technological University-Singapore

Written by authors with years of teaching, research, and project experience in reclamation and ground improvement, this book illustrates both theoretical and practical aspects in the design of reclamation and ground improvement works. It covers not only improvement of soft natural soil, but also densification of granular fill material. Methods of reclamation, site and equipment selection, and construction procedure of shore protection works are also described in this comprehensive book. Additionally, site investigation and characterization required for reclamation and ground improvement projects are explained extensively.

Key Features
- Describes procedures of reclamation methods.
- Discusses site investigation procedures required for land reclamation and ground improvement projects.
- Provides methods of ground improvement for both soft foundation soils and granular fill.
- Presents methods for characterizing soft clay and granular material usually encountered in land reclamation works at foreshore areas.
- Outlines design procedures for land reclamation, ground improvement and shore protection structures.
- Discusses performance monitoring applying geotechnical instrumentation.
- Presents contract management procedures and examples of technical specifications.

Contents
1. Introduction
2. Site Selection
3. Sourcing of Reclamation Materials
4. Site Investigation
5. Reclamation Equipment
6. Reclamation Methods
7. Environmental Control During Reclamation
8. Type of Coastal Protection
9. Stability of Slopes and Retaining Structures
10. Improvement of Compressible Soil
11. Characterization of Soft Clay
12. Design Process for Land Reclamation and Soil Improvement
Soil Improvement: Prefabricated Vertical Drain Techniques
M.W. Bo, Bullen Consultants Ltd. - London
J. Chu, Nanyang Technological University-Singapore
B.K. Low, Nanyang Technological University-Singapore
V. Choa, Nanyang Technological University-Singapore


This distinct text illustrates both theoretical and practical aspects, with frequent references to several land reclamation and soil improvement projects that have been chosen by the authors to be specifically located in Asia. Consolidation theories and numerical methods involving vertical drains are discussed. Projects implementation and monitoring of performance are described. Several case studies are also presented.

Key Features
- Presents consolidation theories and numerical methods involving vertical drains.
- Several land reclamation and soil improvement projects, including case studies, are discussed in this book.
- Describes performance and assessment of improvement using geotechnical instrumentation, in-situ, and laboratory testing methods.
- Provides a selection of appropriate design parameters for soil improvement using prefabricated vertical drains.

Contents
1. Introduction
2. Theories, Computations, and Design Procedures Involving Vertical Drains
3. Geotechnical Properties of Soft Soil and their Determination
4. Properties of Prefabricated Vertical Drain

Traffic & Highway Engineering
Fifth Edition
Nicholas Garber, University of Virginia
Lester Hoel, University of Virginia

1272 pages. Casebound. 8 x 10. 1-Color. © 2015.

Also Available in SI Units

This new edition of Garber and Hoel’s best-selling text focuses on giving students insight into all facets of traffic and highway engineering. Students generally come to this course with little knowledge or understanding of the importance of transportation, much less of the extensive career opportunities within the field. Transportation is an extremely broad field, and courses must either cover all transportation modes or focus on specifics. While many topics can be covered with a survey approach, this often lacks sufficient depth and students leave the course without a full understanding of any of the fields. This text focuses exclusively on traffic and highway engineering beginning with a discussion of the pivotal role transportation plays in our society, including employment opportunities, historical impact, and the importance of transportation on our daily lives. This approach gives students a sense of where the field is about as well as an opportunity to consider some of its challenges. Later chapters focus on specific issues facing transportation engineers. The text uses pedagogical tools such as worked problems, diagrams and tables, reference material, and realistic examples to demonstrate how the material is applied.

New to This Edition
- In addition to the updates for each chapter, substantial changes have been made in several chapters to reflect new methods, procedures, and technology based on the availability of new editions of relevant professional publications.
- New Learning Objectives have been added for each chapter.
- Problem Sets have been thoroughly revised and updated to match the new content in the book, adding approximately 150 new and revised problems.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Key Features
- Designed to provide a comprehensive treatment focused on the subject of traffic and highway - specific and unambiguous, allowing the subject matter to be directly applied in practice.
- Contemporary and complete text that can be used both at the undergraduate and at the graduate level for courses that emphasize highway and traffic engineering topics.
- Useful as a study guide for preparing for the professional engineering license exam, review courses, and preparation for graduate comprehensive exams in transportation engineering.
- Each chapter presents material that will help students understand the basis for transportation, its importance, and the extent to which transportation pervades our daily lives.
- Provides information about all of the basic areas in which transportation engineers work: traffic operation and management, planning, design, construction, and maintenance.

Ancillaries
Instructor’s Solution Manual
SI Version Instructor’s Solutions Manual
MindTap
SI Version MindTap

Contents
Part I: INTRODUCTION
1. The Profession of Transportation
2. Transportation Systems and Organizations

Part II: TRAFFIC OPERATIONS
3. Characteristics of the Driver, the Pedestrian, the Bicyclist, the Vehicle, and the Road
4. Traffic Engineering Studies
5. Highway Safety
6. Fundamental Principles of Traffic Flow
7. Intersection Design
8. Intersection Control
9. Capacity and Level of Service for Highway Segments
10. Capacity and Level of Service at Signalized Intersections

Part III: TRANSPORTATION PLANNING
11. The Transportation Planning Process
12. Forecasting Travel Demand
13. Evaluating Transportation Alternatives

Part IV: LOCATION, GEOMETRICS, AND DRAINAGE
14. Highway Surveys and Location
15. Geometric Design of Highway Facilities
16. Highway Drainage

Part V: MATERIALS AND PAVEMENTS
17. Soil Engineering for Highway Design
18. Bituminous Materials
19. Design of Flexible Highway Pavements
20. Design of Rigid Pavements
21. Pavement Management

Appendix A: Critical Values for the Student’s t and χ² Distributions
Appendix B: Developing Equations for Computing Regression Coefficients
Appendix C: Fitting Speed and Density Data for Example 6.3 to the Greenshields Model Using Excel
Appendix D: An Example of Level of Service Determination using HCS™ 2010
Appendix E: Metric Conversion Factors for Highway Geometric Design.

Introduction to Traffic Engineering: A Manual for Data Collection and Analysis
Second Edition
Thomas R. Currin, Southern Polytechnic University


Research leading to the continuous improvement of traffic analysis techniques depends on the ongoing collection of data relating to driver behavior. Introduction to Traffic Engineering: A Manual for Data Collection and Analysis is meant to aid both the student of traffic engineering and the transportation professional in sound data collection and analysis methods. It presents step-by-step techniques for several traffic engineering topics. Each topic is introduced in a consistent manner, and data collection and analysis forms are provided for each study. Studies are organized to facilitate inclusion in a formal transportation engineering report.

New to This Edition
• New content on the role of iPhones and other smart-phone applications, such as traffic counting applications and video applications, has been added.
• New “Headway Study” chapter addresses the new basis for determining the quality of traffic flow at an intersection.
• Now includes a review of the latest standards from the Transportation Research Board’s Highway Capacity Manual 2010 and the Institute of Transportation Engineers.
• New “Freeway Density” chapter, dealing with the collection of data needed to compute traffic density on roadways having few intersections, teaches students the methods used in determining the capacity and level of service on an uninterrupted flow facility.
• Includes updated references to standard traffic analysis methods.

Transportation Infrastructure Engineering: A Multi-Modal Integration
Lester Hoel, University of Virginia
Nicholas Garber, University of Virginia
Adel Sadek, University of Vermont


Also Available in SI Units

Transportation Infrastructure Engineering: A Multi-Modal Integration, intended to serve as a resource for courses in transportation engineering, emphasizes transportation in an overall systems perspective. It can serve as a textbook for an introductory course or for upper-level undergraduate and first-year graduate courses. This book, unlike the widely used textbook Traffic and Highway Engineering by Garber and Hoel, serves a different purpose and is intended for a broader audience. Its objective is to provide an overview of transportation from a multimodal viewpoint, rather than emphasizing a particular mode in great detail. By placing emphasis on explaining the environment in which transportation operates, this book presents the “big picture” to assist students in understanding why transportation systems operate as they do and the role they play in a global society.

Key Features
• Organized around the fundamentals within the field of transportation engineering.
• Pedagogical approach with an extensive use of solved examples in each chapter that illustrate text material.
• Homework problems are provided at the end of each chapter, as well as a summary and list of suggestions for further reading.
• PowerPoint Slides featuring all images from the text available for download.

Ancillaries
Instructors Solution Manual
SI Version Instructor’s Solutions Manual

Contents
1. Overview of Transportation
   Transportation and Society / Career Opportunities in Transportation / Transportation History
2. Transportation Systems Models
   Systems and Their Characteristics / Components of Transportation Systems / Tools and Techniques for Analyzing Transportation Systems
3. Human, Vehicle and Travelway Characteristics
4. Transportation Capacity and Analysis
   The Capacity Concept / The Level of Service Concept / Highway Capacity / Transit Capacity / Pedestrian Facilities / Bicycle Facilities / Airport Runway Capacity
5. Transportation Planning and Evaluation
   A Context for Multimodal Transportation Planning / Factors in Choosing a Freight or Passenger Mode / The Transportation Planning Process / Estimating Future Travel Demand / Evaluating Transportation Alternatives
6. Geometric Design of Travelways
7. Structural Design of Travelways
   Structural Components of Travelways / General Principles of Structural Design of Travelways
8. Transportation Safety
9. Intelligent Transportation and Information Technology
   Freeway and Incident Management Systems / Advanced Arterial Traffic Control (AATC) Systems / Multimodal Traveler Information Systems / Advanced Technologies for Rail
manuals such as the Institute of Transportation Trip Generation Rate Manual.

- New Instructor and Student Support websites include Excel templates of the data collection forms, as well as all data summary and analysis forms. Recordings of intersections, as well as a database of traffic cameras available for viewing online are also available for use in instruction.

Key Features
- Presents traffic engineering topics, such as spot speeds, turning movements, queue length and intersection capacity, and teaches the evaluative procedures needed when compiling a traffic impact study.
- Transportation planning oriented topics, such as traffic compliance, vehicle occupancy, trip generation and origin-destination studies, are also covered.
- Consistent format throughout follows a lesson-plan type template allowing easy modification by the instructor.
- Real-world scenarios show where and how the studies can be implemented and how they contribute to the overall analysis of the situation.
- Each study has been class-tested in a full-semester, transportation-engineering course. These studies have been used and refined in courses for over 10 years.
- Standard equations show linkages between field data collection and estimation of field conditions. Such linkages allow students to see how the estimation equations were developed and how they compare to an observed set of data.
- Each procedure can be accomplished by undergraduate engineering students within a reasonable amount of time and with proper understanding of the material.
- Data-collection and data-analysis forms are provided for each study in both electronic and hard copy formats.
- Perforated pages in the book make data collection forms easy to use.

Contents
1. Introduction - How to Use This Manual
2. Spot Speed Study - Determining Roadway Speeds
3. Turning Movement Counts - Assessing the Signalized Intersection I
4. Vehicle Delay Study - Assessing the Signalized Intersection II
5. Parking Study - On- and Off-Street Analysis
6. Saturation Flow Rate - Assessing the Signalized Intersection III
7. Poisson Distribution - Assessing the Signalized Intersection IV
8. Queue Length - Assessing the Signalized Intersection V
9. Headway Study - Capacity and the Unsignalized Intersection
10. Traffic Control Compliance Study - Obeying the Law
11. Freeway Density - Uninterrupted Flow
12. Vehicle Occupancy Study - Measuring Persons per Vehicle
13. Origin-Destination Study - Where and How

When Do They Travel?
14. Trip Generation Study - Land Use and Trip Production

Appendix

Hydraulics

Elementary Hydraulics

First Edition
James F. Cruise, University of Alabama-Huntsville
Vijay P. Singh, Louisiana State University
Mohsen M. Sherif, United Arab Emirates University


Elementary Hydraulics is written for the undergraduate level and contains material to appeal to a diversified class of students. The book, divided into three parts, blends fluid mechanics, hydraulic science, and hydraulics engineering. The first part of the text draws upon fluid mechanics and summarizes the concepts deemed essential to the teaching of hydraulics. The second part builds on the first section while discussing the science of hydraulics. The third section looks at the engineering practice of hydraulics and illustrates practical applications of the material covered in the text. In addition to these applications, the text contains a number of numerical problems and a reading aid at the end of each chapter to enhance student learning.

Key Features
- Students require no previous experience in hydraulics as this book was written at the elementary level.
- “Reading Aids” are located at the end of each chapter to aid student learning.
- The text is divided into 3 parts: Fluid Mechanics (an introduction), Hydraulic Science (core of text), and Hydraulic Engineering (applications and design).
- Large selection of homework problems.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Introduction

Part 1: Fluid Mechanic Preliminaries
2. Fundamental Properties of Fluids and Flow Types
- Measures of Fluid Mass and Weight / Viscosity / Compressibility of Fluids / Thermal Expansion / Surface Tension / Vapor Pressure

3. Forces, Motion, and Energy

4. Hydrostatics
Pressure at a Point / Pressure Field / Variation of Pressure in a Fluid at Rest / Standard Atmosphere / Hydrostatic Force on Immersed Surfaces / Graphical Representation of Hydrostatic Forces / Buoyancy and Stability / Measurement of Pressure / Manometer

Part 2: Hydraulic Principles
5. Governing Equations

6. Dimensional Analysis and Hydraulic Similarity

7. Flow Resistance and Velocity Distributions

8. Closed Conduit Flow

9. Pumps
Introduction / Overall Efficiency of Hydraulic Machines / Classification of Pumps / Positive (Displacement) Pumps / Dynamic Pressure Pumps / Pumps Operating in Combination

10. Channel Geometry
Channel Flow / Types of Open Channels / Channel Geometry / Geometric Elements / Cross Section Asymmetry / Compound Sections / Channel Slope / River Hydraulic Geometry / Hydraulic Geometry of Basins / Measurement of Geometric Elements of Natural Rivers

11. Resistance in Open Channels

www.cengage.com/engineering
Steel Design

12. Energy Principle in Open Channels

13. Momentum Principle in Open Channels

14. Gradually Varied Flow
   Gradually Varied Flow Equation / Water Surface Profiles / Outlining Water Surface Profiles Between Steep and Mild Reaches / Control Sections

Part 3: Hydraulic Applications and Design

15. Computation of Water Surface Profiles
   Numerical Integration Method / Direct Step Method / Standard StMod / HEC-RAS / Geographical Information Systems Applications

16. Design of Hydraulic Controls and Structures
   Basic Principles / Design of Hydraulic Drainage and Control Structures

Appendix A: Conversion Factors
Appendix B: Table for Determining F (U, N) for Positive Slopes

Steel Design

Fifth Edition
William T. Segui, University of Memphis


Steel Design covers the fundamentals of structural steel design with an emphasis on the design of members and their connections, rather than the integrated design of buildings. The book is designed so that instructors can easily teach LRFD, ASD, or both, time-permitting. The application of fundamental principles is encouraged for design procedures as well as for practical design, but a theoretical approach is also provided to enhance student development. While the book is intended for junior and senior-level engineering students, some of the later chapters can be used in graduate courses, and practicing engineers will find this text to be an essential reference tool for reviewing current practices.

New to This Edition
- Content has been updated to conform to the newest AISC Specification and Steel Construction Manual.
- Includes a new discussion on frame analysis methods.
- Modified beam design examples.
- Expanded material on the moment amplification method.
- New material on shear strength of bolts, incorporating the new strength values given in the Specification, as well as the new AISC equation for slip-critical bolt strength.
- A new emphasis on the use of the lower-bound moment of inertia in computing deflections.
- Majority of problems have been revised from the previous edition.

Key Features
- Designed so that instructors can easily teach either LRFD or ASD, or both, with most examples incorporating both LRFD and ASD solutions.
- Assigned problems are given at the end of each chapter, providing practice with both approaches, and where appropriate, the required approach is specified in the statement of the problem.

- Answers to selected problems are given at the back of the book.
- Although this book is oriented toward practical design, sufficient theory is included to avoid a “cookbook” approach.
- Instructor Resources including a full Instructor’s Solutions Manual, PowerPoint slides, and Lecture Builder PowerPoints are available for free download for Instructors.

Ancillaries
Instructor’s Solution Manual

Also Available
Steel Design, Fourth Edition
Korean Version

Contents

1. Introduction
   Structural Design / Loads / Building Codes / Design Specifications / Structural Steel / Standard Cross Sectional Shapes

2. Concepts in Structural Steel Design
   Design Philosophies / American Institute of Steel Construction Specifications / Load Factors, Resistance Factors, and Load Combinations for LRFD / Safety Factors and Load Combinations for ASD / Probabilistic Basis of Load and Resistance Factors / Steel Construction Manual / Design Computations and Precision

3. Tension Members
   Introduction / Tensile Strength / Effective Area / Staggered Fasteners / Block Shear / Design of Tension Members / Threaded Rods and Cables / Tension Members in Roof Trusses / Pin-Connected Members

4. Compression Members
   Introduction / Column Theory / AISC Requirements / Local Stability / Tables for Compression Members / Design / More on Effective Length / Torsional and Flexural-Torsional Buckling / Built up Members

5. Beams

6. Beam Columns
   Definition / Interaction Formulas / Methods of Analysis for Required Strength / Moment Amplification Method / Braced Versus Unbraced Frames / Members in Braced Frames / Members in Unbraced Frames / Design of Beam-Columns / Trusses with Top-Chord Loads Between Joints

7. Simple Connections
   Introduction / Bolted Shear Connections: Failure Modes / Bearing Strength, Spacing, and Edge-Distance Requirements / Shear Strength / Installation of High-Strength Bolts / Slip-Critical and Bearing Type Connections / Design Examples / High-Strength Bolts in Tension /
Combined Shear and Tension in Fasteners / Welded Connections / Fillet Welds

8. Eccentric Connections
Examples of Eccentric Connections / Eccentric Bolted Connections: Shear Only / Eccentric Bolted Connections: Shear Plus Tension / Eccentric Welded Connections: Shear Only / Eccentric Welded Connections: Shear Plus Tension / Moment-Resisting Connections / Column Stiffeners and Other Reinforcement / End-Plate Connections

9. Composite Construction
Introduction / Shored Versus Unshored Construction / Effective Flange Width / Steel Headed Stud Anchors / Design / Deflections / Composite Beams with Formed Steel Deck / Tables for Composite Beam Analysis and Design / Continuous Beams / Composite Columns

10. Plate Girders
Introduction / General Considerations / AISC Requirements for Proportions of Plate Girders / Flexural Strength / Shear Strength / Bearing Stiffeners / Design

Appendix - Plastic Analysis and Design
Introduction / AISC Requirements / Analysis / Design

References
Answers to Selected Problems

New to This Edition
- All of the material on loads has been updated to meet the latest AISC standards.
- Chapter 14 of the previous edition has been deleted, with the method of least work now covered in Chapter 13 and the treatment of the three-moment equation moved to a new Appendix D.
- All artwork for this book has been redrawn in two colors to enhance clarity.
- Fifteen percent new problems now totalling over 600.
- Included software has been updated.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Key Features
- Clear and valuable explanations of the basic concepts, supported by detailed step-by-step procedures for analysis, enables students to make an easier transition from theory to problem solving.
- Worked-out examples provide extra support.
- Each chapter begins with an introductory section defining its objective and ends with a helpful summary.
- Chapter 17: Introduction to Matrix Structural Analysis prepares readers for the follow-up course in matrix structural analysis.
- Free accompanying software, upgraded for this new edition, for analyzing plane framed structures is available for download via the companion site; can be used to simulate a variety of structural loading configurations and to determine cause versus effect relationships between loading and various structural parameters, thereby enhancing the students’ understanding of the behavior of structures.

Ancillaries
MindTap
SI Version MindTap

Contents
Part I: Introduction to Structural Analysis and Loads
1. Introduction to Structural Analysis
2. Loads on Structures
Part II: Analysis of Statically Determine Structures
3. Equilibrium and Support Reactions
4. Plane and Space Trusses
5. Beams and Frames: Shear and Bending Moment
6. Deflection of Beams: Geometric Methods
7. Deflections of Trusses, Beams and Frames:

Work-Energy Methods
8. Influence Lines
9. Application of Influence Lines
10. Analysis of Symmetric Structures

Part III: Analysis of Statically Indeterminate Structures
11. Introduction to Statically Indeterminate Structures
12. Approximate Analysis of Rectangular Building Frame
13. Method of Consistent Deformations-Force Method
15. Slope-Deflection Method
16. Moment-Distribution Method
17. Introduction to Matrix Structural Analysis

Appendix A: Areas and Centroids of Geometric Shapes
Appendix B: Review of Matrix Algebra
Appendix C: Computer Software
Appendix D: Three-Moment Equation

Matrix Analysis of Structures
Second Edition
Aslam Kassimali, Southern Illinois University-Carbondale

Also Available in SI Units

This book takes a fresh, student-oriented approach to teaching the material covered in the senior and first-year graduate-level matrix structural analysis course. Unlike traditional texts for this course that are difficult to read, Kassimali takes special care to provide understandable and exceptionally clear explanations of concepts, step-by-step procedures for analysis, flowcharts, and interesting and modern examples, producing a technically and mathematically accurate presentation of the subject.

New to This Edition
- New chapter on introduction to geometrically nonlinear structural analysis. This chapter will cover the second-order analysis (also called the P-Δ and P-δ analysis) of frames.
- MATLAB® code, used for various flowcharts in the textbook, is now available to instructors via the companion web site.
- Computer exercises have been added in
the end-of-chapter problems to familiarize students with the use of general-purpose structural analysis software.

- Numerous new problems, many of which involve practical real-world structures to enhance students’ understanding of the subject matter.
- Expanded coverage of the “angle of roll.”
- Upgraded computer software, available via companion website.

**Key Features**

- Each chapter begins with an introduction defining its objectives, and ends with a summary reviewing its salient features.
- Throughout the book, all relationships necessary for the matrix stiffness analysis are formulated using the basic principles of the mechanics of deformable bodies. Thus, a prior knowledge of the classical methods of structural analysis is not essential for understanding the material presented in this book.
- Basic stiffness relations are derived, using both the traditional mechanics of materials principles and the finite element approach (via the principle of virtual work), to familiarize the students with the finite element terminology (e.g., shape functions, etc.) that they will encounter in advanced level courses.
- The format of the book is flexible enough to enable instructors to emphasize topics that are consistent with the goals of the course.
- Windows-based software for analysis of two and three-dimensional framed structures is available for downloading by the users of the book.

**Ancillaries**

Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

**Contents**

1. Introduction
   - Historical Background / Classical, Matrix, and Finite-Element Methods of Structural Analysis / Flexibility and Stiffness Methods / Classification of Framed Structures / Analytical Models / Fundamental Relationships for Structural Analysis / Linear Versus Nonlinear Analysis / Software

2. Matrix Algebra
   - Definition of a Matrix / Types of Matrices / Matrix Operations / Gauss-Jordan Elimination Method

3. Plane Trusses
   - Global and Local Coordinate Systems / Degrees of Freedom / Member Stiffness Relations in the Local Coordinate System / Finite-Element Formulation Using Virtual Work / Coordinate Transformations / Member Stiffness Relations in the Global Coordinate System / Structure Stiffness Relations / Procedure for Analysis

4. Computer Program for Analysis of Plain Trusses
   - Data Input / Assignment of Structure Coordinate Numbers / Generation of the Structure Stiffness Matrix / Formation of the Joint Load Vector / Solution for Joint Displacements / Calculation of Member Forces and Support Reactions

5. Beams
   - Analytical Model / Member Stiffness Relations / Finite-Element Formation Using Virtual Work / Member Fixed-End Forces Due to Loads / Structure Stiffness Relations / Structure Fixed-Joint Forces and Equivalent Joint Loads / Procedure for Analysis / Computer Program

6. Plane Frames
   - Analytical Model / Member Stiffness Relations in the Local Coordinate System / Coordinate Transformations / Member Stiffness Relations in the Global Coordinate System / Structure Stiffness Relations / Procedure for Analysis / Computer Program

7. Member Releases and Secondary Effects
   - Member Releases in Plane Frames and Beams / Computer Implementation of Analysis for Member Releases / Support Displacements / Computer Implementation of Support Displacement Effects / Temperature Changes and Fabrication Errors

8. Three-Dimensional Framed Structures
   - Space Trusses / Grids / Space Frames

9. Special Topics and Modeling Techniques
   - The Structure Stiffness Matrix Including Restrained Coordinates—An Alternative Formulation of the Stiffness Method / Approximate Matrix Analysis of Rectangular Building Frames / Condensation of Degrees of Freedom, and Substructuring / Inclined Roller Supports / Offset Connections / Semirigid Connections / Shear Deformations / Nonprismatic Members / Solution of Large Systems of Stiffness Equations

10. Introduction to Nonlinear Structural Analysis
    - Basic Concept of Geometrically Nonlinear Analysis / Geometrically Nonlinear Analysis of Plane Trusses

Appendix A - Computer Software
Appendix B - Flexibility Method
Appendix A. FE Exam Review Problems

On-Line Content

10. Review of Centroids and Moments of Inertia
   Centroids of Plane Areas / Centers of Composite Areas / Moments of Inertia of Plane Areas / Parallel-Axis Theorem for Moments of Inertia / Polar Moments of Inertia / Products of Inertia / Rotation of Axes / Principal Axes and Principal Moments of Inertia References and Historical Notes

Appendix B. Systems of Units and Conversion Factors

Appendix C. Problem Solving

Appendix D. Mathematical Formulas

Appendix E. Properties of Plane Areas

Appendix F. Properties of Structural-Steel Shapes

Appendix G. Properties of Structural-Lumber

Appendix H. Deflections and Slopes of Beams

Appendix I. Properties of Materials

Mechanics of Materials

Eighth Edition

James M. Gere, Stanford University
Barry Goodno, Georgia Institute of Technology

1130 pages. Casebound. 8 x 10. 4-Color. ©2013.

Also Available in SI Units


The eighth edition of Mechanics of Materials continues its tradition as one of the leading texts on the market. With its hallmark clarity and accuracy, this text develops student understanding along with analytical and problem-solving skills. The main topics include analysis and design of structural members subjected to tension, compression, torsion, bending, and more. The book includes more material than can be taught in a single course giving instructors the opportunity to select the topics they wish to cover, while leaving any remaining material as a valuable student reference.

New to This Edition

- New CengageNOW online teaching and learning resource gives you more control in less time and delivers better outcomes NOW! Includes interactive eBook, assignable and gradable homework and testing, personalized learning plans for students, and more.
- Learning Objectives have been added to the beginning of each chapter.
- Chapter Overview sections have been updated with all important concepts highlighted.
- Updated Chapter Summary and Review sections at the end of each chapter now include key formulas derived, discussed, and applied to problem solutions.
- Many new/updated/revised example problems have been added in each chapter; some are based on actual structures and photos have been added where appropriate.
- An enhanced step-by-step solution approach has been implemented so that important fundamental concepts can be highlighted and emphasized.
- Over 100 new problems typical in type and format of those found on the FE Examination have been added in an additional appendix to assist students in preparing for the FE Exam.
- All problems have been reviewed for appropriateness and accuracy; many problems were revised or updated to improve clarity in presentation of fundamental concepts. In some cases, problem solutions were revised to enhance learning. MathCAD solutions for many problems are now available for use by instructors.
- New section on failure theories for components in multiaxial states of stress and made from ductile or brittle materials has been added.
- New section added to Chapter 1 to assist the student in making the transition from the prerequisite course on Statics to Mechanics of Materials; fundamental concepts of equilibrium are reviewed and then applied to solution of sample problems, like those they will encounter in later chapters.

Key Features

- 4-color format provides better visualization of graphs and worked-out problems.
- Clarity and Accuracy: Considerable effort was spent in designing, checking, and proofreading the text and figures.
- Problems: The text offers more than 1000 problems for homework assignments and classroom discussions. The exercises are arranged in order of difficulty and placed at the end of the chapter making them easy to find without breaking up the subject matter.
- Examples: Numerous examples illustrate the theoretical concepts and show how those concepts may be used in practical situations. In some cases, photographs have been added showing actual engineering structures or components to reinforce the tie between theory and application.
- Both the International System of Units (SI) and the U.S. Customary System (USCS) are used in the examples and problems allowing students to gain proficiency using both.

Ancillaries

Instructor’s Solutions Manual

CengageNOW

SI Version Instructor’s Solutions Manual

CengageNOW – SI Version
Also Available
Mechanics of Materials, Seventh Edition
Spanish Edition
Mechanics of Materials

Contents
1. Tension, Compression and Shear
2. Axially Loaded Members
3. Torsion
4. Shear Forces and Bending Moments
   Types of Beams, Loads, and Reactions / Shear Forces and Bending Moments / Relationships Between Loads, Shear Forces, and Bending Moments / Shear-Force and Bending-Moment Diagrams
5. Stresses in Beams (Basic Topics)
   Pure Bending and Non-uniform Bending / Curvature of a Beam / Longitudinal Stains in Beams / Normal Stresses in Beams (Linearly Elastic Materials) / Design of Beams for Bending Stresses / Nonprismatic Beams / Shear Stresses in Beams of Rectangular Cross Section / Shear Stresses in Beams of Circular Cross Section / Shear Stresses in the Webs of Beams with Flanges / Built-Up Beams and Shear Flow / Beams with Axial Loads / Stress Concentrations in Bending
6. Stresses in Beams (Advanced Topics)
   Composite Beams / Transformed-Section Method / Doubly Symmetric Beams with Inclined Loads / Bending of Unsymmetric Beams / The Shear- Center Concept / Shear Stresses in Beams of Thin-Walled Open Cross Sections / Shear Stresses in Wide-Flange Beams / Shear Centers of Thin-Walled Open Sections / Elastoplastic Bending
7. Analysis of Stress and Strain
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8. Applications of Plane Stress (Pressure Vessels, Beams, and Combined Loadings)
   Spherical Pressure Vessels / Cylindrical Pressure Vessels / Maximum Stresses in Beams / Combined Loadings
9. Deflection of Beams
   Differential Equations of the Deflection Curve / Deflections by Integration of the Bending-Moment Equation / Deflections by Integration of the Shear-Force and Load Equations / Method of Superposition / Moment-Area Method / Nonprismatic Beams / Strain Energy of Bending / Castigliano’s Theorem / Deflections Produced by Impact / Temperature Effects
10. Statically Indeterminate Beams
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11. Columns
12. Review of Centroids and Moments of Inertia
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References and Historical Notes
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Appendix B. Systems of Units and Conversion Factors
Appendix C. Problem Solving
Appendix D. Mathematical Formulas
Appendix E. Properties of Plane Areas
Appendix F. Properties of Structural Steel Shapes
Appendix G. Properties of Structural Lumber
Appendix H. Deflection and Slopes of Beams
Answers to Problems

Mechanics of Materials
Second Edition
Andrew Pytel, Pennsylvania State University
Jaan Kiusalaas, Pennsylvania State University


Also Available in SI Units

The second edition of Mechanics of Materials by Pytel and Kiusalaas is a concise examination of the fundamentals of Mechanics of Materials. The book maintains the hallmark organization of the previous edition, as well as the time-tested problem solving methodology that incorporates outlines of procedures and numerous sample problems to help ease students through the transition from theory to problem analysis. Emphasis is placed on giving students the introduction to the field that they need, along with the problem-solving skills that will help them in their subsequent studies. This is demonstrated in the text by the presentation of fundamental principles before the introduction of advanced/special topics.

New to This Edition
• Now includes the analysis of the torsion of rectangular bars, discussing an important applied problem within engineering design.
• Expanded article on reinforced concrete beams now includes Ultimate Moment Analysis based upon the most recent code of the American Concrete Institute (ACI).
• Revised article on the design of intermediate columns now includes the most recent specifications of the American Institute of Steel Construction (AISC).
• Increased amount of figures to accompany homework problems.
• New and revised sample and homework problems.
• First edition Study Guide material now available online – complementary for students.

Key Features
• Offers concise coverage of all of the required material for a Mechanics of Materials course.
• Covers fundamental concepts – clearly and simply – without clouding students’ understanding with details about special cases.
• Advanced topics are found in later chapters
and are not interwoven into the early chapters on the basic theory, allowing the core material to be efficiently taught without skipping over topics within chapters.

- The general transformation equations for stress (including Mohr’s Circle) are deferred until Chapter 8, after students have gained experience with the basics of axial, torsional, and bending loads.

- In the derivation of formulas, the authors emphasize the physical situation before implementing mathematics to model the problem.

- Free-body diagrams are used throughout the text to identify unknown quantities and to recognize the number of independent equations.

- Virtually every article is immediately illustrated by sample problems and homework problems that illustrate the principles and the problem-solving procedure introduced in the article.

- End-of-chapter homework exercises serve as a review of the material covered in the chapter.

- Design-oriented computer problems are included at the end of most chapters, intended to be solved using computer languages such as MathCAD and/or MATLAB®.

- The text contains an equal number of problems using SI and US Customary Units.

- Basic equations are summarized inside the back cover of the textbook for easy access.

Ancillaries
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Also Available
Mechanics of Materials, Second Edition
Advantage – Binder Ready Version

Contents
1. Stress
   Analysis of Internal Forces: Stress / Axially Loaded Bars / Shear Stress / Bearing Stress
2. Strain
   Axial Deformation; Stress-Strain Diagram / Axially Loaded Bars / Generalized Hooke’s Law / Statically Indeterminate Problems / Thermal Stresses
3. Torsion
   Torsion of Circular Shafts / Torsion of Thin-Walled Tubes / Torsion of Rectangular Bars
4. Shear and Moment in Beams
   Supports and Loads / Shear-Moment Equations and Shear-Moment Diagrams / Area Method for Drawing Shear- Moment Diagrams
5. Stresses in Beams
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6. Deflection of Beams
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7. Statically Indeterminate Beams
   Double-Integration Method / Double-Integration Using Bracket Functions / Moment-Area Method / Method of Superposition
8. Stresses Due to Combined Loads
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9. Composite Beams
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10. Columns
11. Additional Beam Topics
    Shear Flow in Thin-Walled Beams / Shear Center / Unsymmetrical Bending / Curved Beams
12. Special Topics
    Energy Methods / Dynamic Loading / Theories of Failure / Stress Concentration / Fatigue Under Repeated Loading
13. Inelastic Action
    Limit Torque / Limit Moment / Residual Stresses / Limit Analysis
Appendix A: Review of Properties of Plane Areas
Appendix B: Tables
Key Features

- The early introduction to the relationship between force and acceleration used in this pedagogy allows students to realize much sooner how Newton’s laws of motion can be used to analyze problems.
- Where appropriate, sample problems are solved using both scalar and vector notations allowing for increased problem-solving skills.
- Equilibrium analysis of problems is uniquely taught using three steps: (1) how to draw free-body diagrams; (2) how to analyze problems using given free-body diagrams; (3) how to perform complete problem analyses by combining the previous two steps.
- The solutions of sample problems that require equilibrium analysis are discussed using a unique and orderly technique using three general subdivisions: (1) Method of Analysis; (2) Mathematical Details; (3) Other Methods of Analysis.
- The equilibrium analysis of a single body and connected bodies (often referred to as “frames and machines”) are discussed in detail in a single comprehensive chapter.
- Sample problems requiring numerical integration are included.

Ancillaries

Engineering Mechanics: Statics Study Guide
SI Version Study Guide
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual
Engineering Mechanics: Dynamics Study Guide
SI Version Study Guide
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

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Engineering Mechanics: Statics + Dynamics
Engineering Mechanics: Statics + Study Guide
Engineering Mechanics: Dynamics + Study Guide
Engineering Mechanics: Statics + Dynamics + Study Guides

Contents

Engineering Mechanics: Statics
1. Introduction to Statics
   Newtonian Mechanics / Fundamental Properties of Vectors / Representation of Vectors Using Rectangular Components / Vector Multiplication
2. Basic Operations with Force Systems
   Equivalence of Vectors / Force / Reduction of Concurrent Force Systems / Moment of Force About a Point / Moment of Force About an Axis / Couples / Changing the Line of Action of a Force
3. Resultants of Force Systems
   Reducing a Force System to a Force and a Couple / Definition of Resultant / Resultants of Coplanar Force Systems / Resultants of Noncoplanar Force Systems / Introduction to Distributed Normal Loads
4. Coplanar Equilibrium Analysis
5. Non-Coplanar Equilibrium
   Definition of Equilibrium / Free-Body Diagram / Independent Equilibrium Equations / Imposed Conventions / Writing and Solving Equilibrium Equations / Equilibrium Analysis
6. Beams and Cables
7. Dry Friction
   Coulomb’s Theory of Dry Friction / Problem Classification and Analysis / Impacting Tipping / Angle of Friction / Wedges and Screws / Ropes and Flat Belts / Disk Friction
8. Centroids and Distributed Loads
   Centroids of Plane Areas and Curves / Centroids of Curved Surfaces, Volumes, and Space Curves / Theorems of Pappus-Guldinus / Center of Gravity and Center of Mass / Distributed Normal Loads
9. Moments and Products of Inertia of Areas
   Moments of Inertia of Areas and Polar Moments of Inertia / Products of Inertia of Areas / Transformation Equations and Principal Moments of Inertia of Areas / Moments and Products of Inertia
10. Virtual Work and Potential Energy
    Planar Kinematics of a Rigid Body / Virtual Work / Method of Virtual Work / Instant Center of Rotation / Equilibrium and Stability of Conservative Systems
    Appendix A. Numerical Integration
    Appendix B. Finding Roots of Functions
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    Index
Engineering Mechanics: Dynamics
11. Introduction to Dynamics
    Derivatives of Vector Functions / Position, Velocity, and Acceleration of a Particle / Newtonian Mechanics
12. Dynamics of a Particle: Rectangular Coordinates
13. Dynamics of a Particle: Curvilinear Coordinates
14. Work Energy and Impulse-Momentum Principle for a Particle
    Work of a Force / Principle of Work and Kinetic Energy / Conservative Force and the Conservation of Mechanical Energy / Power and Efficiency / Principle of Impulse and Momentum / Principle of Angular Impulse and Momentum / Space Motion under a Gravitational Force
15. Dynamics of Particle Systems
16. Planar Kinematics of Rigid Bodies
    Plane Angular Motion / Rotation about a Fixed Axis / Relative Motion of Two Points in a Rigid Body / Method of Relative Velocity / Instant Center for Velocities / Method of Relative Acceleration / Absolute and Relative Derivatives of Vectors / Motion Relative to a Rotating Reference Frame / Method of Constraints
19. Rigid-Body Dynamics in Three Dimensions
20. Vibrations
    Appendix D. Proof of the Relative Velocity
    Appendix E. Numerical Differentiation
    Appendix F. Mass Moments and Products of Inertia
    Answers
    Index
Late courses.

Ancillaries
Also Available

Contents
1. Introduction
Mechanics / Basic Concepts / Units / SI Units / Customary Units / Conversion between Systems of Units / Numerical Calculations / Problem-Solving Strategy / Computational Software
2. Vector Analysis
Vectors / Definition of a Scalar and a Vector / Vector Addition / Multiplication of a Vector by a Scalar / Vector Components / Resolution of a Vector into Components / Forces and Their Characteristics / Concurrent Coplanar Forces / Three-dimensional Cartesian Coordinates and Unit Base Vectors / Unit Base Vectors / Vector Equality in Component Notation / Vector Addition by Components / Multiplication of a Vector by a Scalar / Vector Subtraction / General Unit Vectors / Vector Directions in Space / Matrix Notation for Vectors / Computation of Vector Operations / Components of a Vector in Nonorthogonal Directions / Systems of Linear Equations / Matrices / Scalar Product of Two Vectors / Applications of the Scalar Product / Vector Product or Cross Product / Multiple Products of Vectors / Direct Vector Solutions
3. Particle Equilibrium
Free-body Diagrams of a Particle / Equilibrium of a Particle / Springs / Statically Indeterminate Problems / Special Sections / An Introduction to Friction / Keystone of the Arch
4. Rigid Bodies: Equivalent Force Systems
5. Distributed Forces: Centroids and Center of Gravity
Center of Mass and Center of Gravity / Center of Mass / Center of Gravity / Average Position: Centroids of Areas, Volumes, and Lines; The First Moment / Centroid of an Area / Centroid of a Volume / Centroid of a Line / Centroid of a Curve in Space / Theorems of Pappus and Guldinus / Centroids of Composite Bodies / Distributed Loads on Beams / Forces Due to Fluid Pressure Acting on a Submerged Surface / Buoyancy
6. Equilibrium of Rigid Bodies
7. Analysis of Structures
Planar Trusses / Simple Trusses / Method of Joints / Method of Joints Using Matrix Techniques / Method of Sections / Space Trusses / Compound Trusses / Frames and Machines
8. Internal Forces in Structural Members
Internal Forces in a Member / Types of Loading and Supports in Beams / Shear and Bending Moments in Beams / Relationship between the Load Distribution, the Shear Force, and the Bending Moment / Discontinuity Functions for Beam Equations / Cables / Cable Subjected to Concentrated Loads / Cables Supporting Loads Distributed Uniformly along a Horizontal Line / Cable Supporting Loads Distributed Uniformly along its Own Length
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1. Kinematics of a Particle
   Rectilinear Motion of a Particle: Single Degree of Freedom / Classification of the Kinematics or Dynamics Problem / Inverse Dynamics Problem / The Direct Dynamics Problem: Rectilinear Motion When the Acceleration is Given / Classification of Differential Equations / Separable First Order Scalar Differential Equations / Special Rectilinear Motions / Solution of a Liner First Order Differential Equation by Use of An Integrating Factor / Second Order Linear Differential Equations / Numerical Solution of Differential Equations / Curvilinear Motion of a Particle / Vector Differential Equation / Projectile Motion / Normal and Tangential Coordinates / Circular Motion / Normal and Tangential Coordinates in Three Dimensions / Radial and Transverse Coordinates (Polar Coordinates) / Three-Dimensional Coordinate Systems / Cylindrical Coordinates / Spherical Coordinates / relative Rectilinear Motion of Several particles / General Relative Motion between Particles / Navigation using Relative Velocity / Dependent Motions Between Two or More Particles / Kinematic Parametric Equations / Trajectories Expressed as Function of Parameters / Parametric Equations for Three-Dimensional Trajectories

2. Kinetics of a Particle
   Equations of Motion for a Particle / Solution Strategy for Particle Dynamics / Review of the Concepts of Static and Kinetic Friction / Determination of the Direction of the Normal and Friction Forces / Discontinuity and Singularity Functions / Normal and Tangential Coordinates / Two-Dimensional Parametric Equations of Dynamics / Polar Coordinates / Angular Momentum of a Particle / Central Force Motion / Three-Dimensional Particle Dynamics in Curvilinear Coordinates / Cylindrical Coordinates / Spherical Coordinates / Parametric Equations in Tangential, Normal and Binormal Coordinates

3. Work – Energy and Impulse – Momentum

4. System of Particles

5. Kinematics of Rigid Bodies
   Translation of a Rigid Body / Rotation About a Fixed Axis / Planar Pure Rotation about an Axis Perpendicular to the Plane of Motion / Vector Relations for Rotation in a Plane / Constraints to the Motion / General Plane Motion / Absolute and Relative Velocities in Plane Motion of a Rigid Body / Experimental Motion Data / Angular Velocity for Noisy Experimental Data / Direct Vector Method to Obtain the Angular Velocity / Instantaneous Center of Rotation in Plane Motion / Instantaneous Center of Rotation between Two Rigid Bodies / Absolute and Relative Acceleration of a Rigid Body in Plane Motion / Alternate Solution of the Acceleration of Rigid Bodies / Kinematics of a System of Rigid Bodies / Analysis of Plane Motion in Terms of a Parameter / General Three-Dimensional Motion of a Rigid Body / Linear and Angular Acceleration / Constraints to the General Three-Dimensional Motion of a Rigid Body / Rigid Body with a Fixed Point in Space / Other Constraints / Instantaneous Helical Axis, or Screw Axis / Motion of a Rigid Body Having a Fixed Point in Space / Instantaneous Helical Axis of Rotation between Two Rigid Bodies / Motion with Respect to Rotating Reference Frame or Coordinate System

6. Dynamics of Rigid Bodies in Plane Motion
   Linear and Angular Momentum / Equations of Motion for Rigid Bodies in Plane Motion / Constraints on the Motion / Computational Methods for Plane Dynamic Systems / Systems of Rigid Bodies or Particles / D’Alembert’s Principle


8. Three-Dimensional Dynamics of Rigid Bodies
   Rotational Transformation between Coordinate Systems / Coordinate Transformations / Eulerian Angles / Angular Motion / Joint Coordinate System / Equations of Motion / Euler’s Equations of Motion / Stability of Rotation about a Principle Axis / Motion of an Axisymmetric Object / Heavy Axisymmetric Top / Gyroscopic Motion with Steady Precession / Motion of an Axisymmetric Body Subjected to no External Forces / The Gyroscope

9. Vibration

Appendix A - Mass Moment of Inertia
Appendix B - Vector Calculus and Ordinary Differential Equations
Dynamics Index Dictionary
Answers to Selected Problems
Introduction to Electrical Engineering

The Digital Information Age: An Introduction to Electrical Engineering

Second Edition
Roman Kuc, Yale University

400 pages. Softbound. 8 ½ x 11. -Color. ©2015.

Also Available in AISE
AISE The Digital Information Age

The Digital Information Age Second Edition by bestselling author Roman Kuc is designed for students considering electrical engineering as a major, and non-engineering majors interested in understanding digital communication systems. Communication between humans and smart devices takes place through sensors and actuators, with logic circuits manipulating binary data to implement useful tasks. The text then examines the basic problem of communicating audio and video data over a network connecting computers and smart devices. System operation is described from analog-to-digital conversion, signals that encode data, through the processing that extracts data from noise-corrupted signals and error correction techniques, to data packet transmission over wired and wireless networks. Basic topics from probability and digital signal processing are presented as needed and illustrated with relevant examples. Ideas are illustrated and extended by problems and projects completed in Excel, with sophistication that evolves along with the course, starting with spreadsheet formulas and graphs, through macros, to simple Visual Basic for Applications (VBA) programming that produces animations that simulate system operation. The accrued facility with Excel techniques is a course outcome valued by students in all majors.

Key Features
- The text presents a narrative that describes data transmission over a network, from data generated by smart device users to the data that is enjoyed by the user in audio and video transmissions.
- Practical examples demonstrate how smart devices work, including touch screens and digital displays, and how data are reliably transmitted through networks by detecting errors and packet collisions.
- Excel allows students to explore system operation through simulations and animations using VBA programming.
- The emphasis on real-world systems makes engineering tangible and approachable for non-majors, while providing beginning majors with a background context and motivation for their heavy load of math, physics, programming, and major-specific engineering courses.
- Numerous figures, examples, problems, and projects relate the material to actual systems.
- Mathematical principles are introduced gently, as needed, with interesting applications and examples at each stage.
- Practical applications of probability are illustrated through Excel’s pseudo-random number generators to simulate data sources, to add random noise to signals, and to observe system performance.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

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   Introduction / Electrical Engineering for the Digital Age / Analog & Digital Signals / Where is EE Going? / Overview of Chapters / For Further Reading / Summary / Problems / Excel Projects

2. Sensors & Actuators
   Introduction / Analog & Digital Sensors / Mechanical Sensors & Actuators / Acoustic Sensors & Actuators / Optical Sensors & Actuators / Proprioception / Active Sensors / Summary / Problems / Excel Projects

3. Combinational Logic Circuits
   Introduction / Logic Variables and Logic Equations / Elementary Logic Gates / Building Block Gates / From Logic Gates to Logic Circuits / Logic Circuit Implementation Using Sum of Products / Truth Table from Logic Equation and Logic Circuit / Designing Efficient Logic Circuits / Useful Logic Circuits / Summary / Problems / Excel Projects

4. Sequential Logic Circuits
   Introduction / Sequential Circuits / Set-Reset Flip-Flop / Toggle Flip-Flop / Counting with T-FFs / Summary / Problems / Excel Projects

5. Converting Between Analog & Digital Signals
   Introduction / Analog-to-Digital Conversion / Spatial Frequencies / Quantization / Digital-to-Analog Conversion / Summary / Problems / Excel Projects

6. Modeling Random Data & Noise
   Introduction / Using Probability to Model Uncertainty / Histograms / Probability Density Functions / Probability Mass Function / Pseudo-Random Number Generators / Random Number Arithmetic / Summary / Problems / Excel Projects

7. Detecting Data Signals in Noise
   Introduction / Data Transmission Model / Processing Data Signals in Noise / Estimating Probability of Error with Simulations / Summary / Problems / Excel Projects

8. Designing Signals for Multiple-Access Systems
   Introduction / Multiple Simultaneous User Systems / Orthogonality Condition / Signals Orthogonal in Time - TDMA / Signals Orthogonal in Frequency - FDMA / Signals with Orthogonal Codes - CDMA / Detecting Orthogonal Signals in Noise / Summary / Problems / Excel Projects

9. Source Coding
   Introduction / Data Compression / Encryption / Summary / Problems / Excel Projects

10. Channel Coding
   Introduction / Data Structures / Coding for Error Correction / Data Rate / Channel Capacity / Summary / Problems / Excel Projects

11. Data Networks
   Introduction / Evolution of Data Networks / Asynchronous Data Transmission / Internet Data Packets / Detecting Packet Collision / Cloud Computing / Summary / Problems / Excel Projects

12. Symbology
   Introduction / Credit Card Codes / Bar Codes / Machine Un-readable Codes / Steganography / Summary / Problems / Excel Projects

13. Excel Best Practices

Glossary
Electrical Engineering in Context: Smart Devices, Robots & Communications

Roman Kuc, Yale University

First Edition

Contents
1. Introduction
2. Sensors & Actuators
3. Electric Circuits
4. Electronics
5. Combinational Logic Circuits
6. Sequential Logic Circuits
7. Converting Between Analog & Digital Signals
8. Digital Signal Processing
9. Spectral Analysis
10. Detecting Data Signals in Noise
11. Designing Signals for Multiple-Access Systems
12. Source Coding
13. Channel Coding
14. Symbology
15. Data Networks
16. MATLAB® Best Practices
17. Appendix – Math Details
18. Appendix – Probability
19. Appendix – ASCII Code
Glossary

Key Features
- Presents a narrative to describe data transmission over a network, from data generated by smart device users to the audio, image, and video data they consume.
- Practical examples demonstrate how smart devices work, including touch screens and digital displays, and how data are reliably transmitted through networks by detecting errors and packet collisions.
- MATLAB® projects allow students to explore system operation through simulations and animations, as well as processing actual speech and image data.
- The emphasis on real-world systems provides beginning majors with a background context and motivation for their heavy load of math, physics, programming, and major-specific engineering courses.
- Numerous figures, examples, problems, and projects relate the material to actual systems.
- Mathematical principles are introduced gently, as needed, with interesting applications and examples at each stage.
- Practical applications of Probability are illustrated through MATLAB’s pseudo-random number generators to simulate data sources, to add random noise to signals, and to observe system performance.
- An entire chapter devoted to best practices in MATLAB®, with sophistication that evolves with topics covered in the text.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Anchillaries
Instructor’s Solutions Manual
MindTap

AISE Electrical Engineering in Context

Roman Kuc, Yale University

First Edition

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1. Introduction
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4. Electronics
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8. Digital Signal Processing
9. Spectral Analysis
10. Detecting Data Signals in Noise
11. Designing Signals for Multiple-Access Systems
12. Source Coding
13. Channel Coding
14. Symbology
15. Data Networks
16. MATLAB® Best Practices
17. Appendix – Math Details
18. Appendix – Probability
19. Appendix – ASCII Code
Glossary

Key Features
- Basic concepts of DC circuit analysis are presented more deliberately and in greater detail (in Chapters 1-3) than in traditional texts, laying the groundwork for student comprehension of more advanced topics and how circuit analysis relates to subsequent courses.
- This text uses differential operators to unify the treatment of the three major divisions of introductory circuit analysis.
- Bound-in CD-ROM contains: Web-based self-test software that tests students’ knowledge of each chapter, providing explanations for correct and incorrect answers.
- The Evaluation Version of MicroSim PSpice® for Windows-based computers.
- The Evaluation Version of the Student Edition of Electronics Workbench® for Windows-based computers, which will load a set of files keyed to the text and allow students to work their own problems.
- MATLAB® and Mathcad® files that enable
students to work and extend specific examples in the text.

Ancillaries
Online Instructor’s Solutions Manual

Contents
Part I: DC Analysis
1. Basic Concepts
2. Simple Resistive Circuits and Subcircuits
3. Circuit Analysis Using Subcircuits
4. Nodal and Mesh Analysis
Part II: Time Domain Analysis
5. Active Circuits
6. Energy Storage Elements
7. Time Response of First-Order Circuits
8. Complex Signals and Systems
9. Time Response of Higher-Order Circuits
10. Stability and Forced Response
Part III: Frequency Domain Analysis
11. Fourier Analysis of AC Circuits
12. Frequency Response and Filtering
13. Laplace Transform Analysis of Circuits
14. The Fourier Transform
15. Two-Port Subcircuits
16. The Transformer
Appendix A: Linear Algebra, Determinants, and Matrices
Appendix B: Tellegen’s Theorem
Appendix C: Integration by Parts (Tabular Method)
Appendix D: Generalized Functions

Communication Systems

Contemporary Communications Systems Using MATLAB®
Third Edition
John G. Proakis, Northeastern University
Masoud Salehi, Northeastern University
Gerhard Bauch, University of Munich


Featuring a variety of applications that motivate students, this book serves as a companion or supplement to any of the comprehensive textbooks on communication systems. The book provides a variety of exercises that may be solved on the computer using MATLAB®. By design, the treatment of the various topics is brief. The authors provide the motivation and a short introduction to each topic, establish the necessary notation, and then illustrate the basic concepts by means of examples.

New to this Edition
• New chapter: Multi-carrier Modulation and OFDM.
• New chapter: Multiple Antenna Systems.
• New chapter: Digital Transmission Through Wireless Channels.
• New examples with additional practical real-life engineering problems now included.
• New sections on: DPCM, ADPCM, and DM; turbo codes and decoding; LDPC codes and decoding.
• Compliant with the latest version of MATLAB®.
• Augmented coverage of Random Processes.
• Revised and updated SIMULINK® supplement with tutorial problems available online.

Key Features
• Promotes problem-solving and critical-thinking skills through the use of MATLAB® as a “virtual laboratory” and challenges readers to understand and apply these techniques on their own.
• Presents a basic background of signals and systems.
• Covers the performances of analog modulation and demodulation techniques in the presence and absence of additive noise.
• Companion website includes all the MATLAB® and SIMULINK® files used in the text with numerous comments added to most files to make them easier to understand.

Also Available
Contemporary Communication Systems Using MATLAB®
Simplified Chinese Version
Complex Chinese Version

Contents
1. Signals and Linear Systems
Fourier Series / Fourier Transforms / Power and Energy / Lowpass Equivalent of Bandpass Signals
2. Random Processes
Generation of Random Variables / Gaussian and Gaussian-Markov Processes / Power Spectrum of Random Processes and White Processes / Linear Filtering of Random Processes / Lowpass and Bandpass Processes / Monte Carlo Simulation of Digital Communication Systems
3. Analog Modulation
Amplitude Modulation (AM) / Demodulation of AM Signals / Angle Modulation
4. Analog-to-Digital Conversion
Measure of Information / Quantization
5. Baseband Digital Transmission
Binary Signal Transmission / Multi-amplitude Signal Transmission / Multidimensional Signals
6. Transmission Through Bandlimited Channels
The Power Spectrum of a Digital PAM Signal / Characterization of Bandlimited Channels and Channel Distortion / Characterization of Intersymbol Interference / System Design for Bandlimited Channels / Linear Equalizers / Nonlinear Equalizers
7. Digital Transmission via Carrier Modulation
Carrier-Amplitude Modulation / Carrier-Phase Modulator / Quadrature Amplitude Modulation / Carrier-Frequency Modulation / Synchronization in Communication Systems
8. Multicarrier Modulation and OFDM
Generation of an OFDM Signal / Demodulation of OFDM Signals / Use of a Cyclic Prefix to Elliminate Channel Dispersion / Spectral Characteristics of OFDM Signals / Peak-to-Average Power Ratio in OFDM Systems
9. Transmission Through Wireless Channels
Channel Models for Time-Variant Multipath Channels / Binary Modulation in Rayleigh Fading Channel
10. Channel Capacity and Coding
Channel Model and Channel Capacity / Channel Coding / Turbo Codes and Iterative Decoding / Low Density Parity Check Codes
11. Multiple Antenna Systems
Channel Models for Multiple Antenna Systems / Transmission in a Slow Fading Frequency Nonselective MIMO Channel / Capacity of MIMO Channels / Space-Time Codes for MIMO Systems
12. Spread Spectrum Communication Systems
Direct-Sequence Spread Spectrum Systems / Generation of PN Sequences / Frequency-Hopped Spread Spectrum
Computer Organization and Architecture: Themes and Variations

First Edition
Alan Clements, University of Teesside, United Kingdom


Computer Organization and Architecture: Themes and Variations stresses the structure of the complete system (CPU, memory, buses and peripherals) and reinforces that core content with an emphasis on divergent examples. This approach to computer architecture is an effective arrangement that provides sufficient detail at the logic and organizational levels appropriate for EE/ECE departments as well as for Computer Science readers. The text goes well beyond the minimal curriculum coverage and introduces topics that are important to anyone involved with computer architecture in a way that is both thought provoking and interesting to all.

Key Features
• Written primarily to be easy to understand and interesting to read. The author provides simple explanations of complex concepts and provides high-quality, 2-color figures and illustrations.
• Instead of focusing on the heart of the computer, the CPU, this book covers all elements of the computer system and provides a more balanced approach.
• Extensive coverage of Input/Output techniques and computer buses is provided as well as in-depth material on both system memory and secondary storage.
• Includes an entire chapter devoted to Multimedia processing, outlining the way in which computers have been developed to facilitate the processing of audio and video.
• Uses the ARM processor, with its simple architecture and wide range of applications, as the prime example for illustrate computer architecture concepts.

Ancillaries
Instructor’s Solutions Manual

Contents
Part I. The Beginning
1. Computer Systems Architecture
What is a Computer Systems Architecture? / Architecture and Organization / Development of Computers / The Stored Program Computer / The Stored Program Concept / Overview of the Computer System / Modern Computing

2. Computer Arithmetic and Digital Logic
What is Digital? / Numbers / Binary Arithmetic / Signed Integers / Introduction to Multiplication and Division / Floating-point Numbers / Floating-point Arithmetic / Floating-point Arithmetic and the Programmer / Computer Logic / Sequential Circuits / Buses and Tristate Gates of AM Signals / Angle Modulation

Part II. Instruction Set Architectures
3. Architecture and Organization

4. Instruction Set Architectures – Breadth and Depth
Historical Background / The Stack and Data Storage / Privileged Modes and Exceptions / MIPS; Another RISC / Data Processing and Data Movement / Memory Indirect Addressing / Compressed Code, RISC, Thumb, and MIPS16 / Variable-length Instructions

5. Computer Architecture and Multimedia
Applications of High-Performance Computing / Multimedia Influences – Reinventing the CISC / Introduction to SIMD Processing / Streaming Extensions and the Development of SIMD Technology

Part III. Organization and Efficiency
6. Performance – Meaning and Metrics
Progress and Computer Technology / The Performance of a Computer / Computer Metrics / Amdahl’s Law / Benchmarks / SPEC / Averaging Metrics

7. Processor Control
The Generic Digital Processor / RISC Organization / Introduction to Pipelining / Branches and the Branch Penalty / Branch Prediction / Dynamic Branch Prediction

8. Beyond RISC: Superscalar, VLIW and ITANIUM
Superscalar Architecture / Binary Translation / EPIC Architecture

Part IV. The System
9. Cache Memory and Virtual Memory
Introduction to Cache Memory / Performance of Cache Memory / Cache Organization / Considerations in Cache Design / Virtual Memory and Memory Management

10. Main Memory
Introduction / Primary Memory / DRAM / The Read-Only Memory Family / New and Emerging Non-Volatile Technologies

11. Secondary Storage
Magnetic Disk Drives / Magnetism and Data Storage / Data Organization on Disk / Secure Memory and RAID Systems / Solid-state Disk Drives / Magnetic Tape / Optical Storage Technology

12. Input/Output
Fundamental Principles of I/O / Data Transfer / I/O Strategy / Performance of I/O Systems / The Bus / Arbitrating for the Bus / The PCI and PCIe Buses / The SCSI and SAS Interfaces / Serial Interface Buses

13. Processor-Level Parallelism
Why Parallel Processing? / Performance Revisited / Flynn’s Taxonomy and Multiprocessor Topologies / Multiprocessor Topologies / Memory in Multiprocessor Systems / Multithreading / Multicore Processors / Parallel Programming

Control Theory

Introduction to Control Engineering
Jinxing Dong, Tsinghua University
Changde Zhao, Tsinghua University
Dr. Shenshu Xiong, Tsinghua University
Dr. Meifeng Guo, Tsinghua University


This book presents comprehensive coverage of the analysis and design of control systems. It is intended to be used as a textbook for the first course in control systems or control theory in the departments of Electrical, Mechanical, Aerospace and Chemical Engineering. Throughout the text, there are plenty of worked examples and problems using MATLAB to help the reader have a clear understanding of this subject.

www.cengage.com/engineering
Advanced Control Theory: A Relay Feedback Approach

Somanath Majhi, Indian Institute of Technology, Guwhati


Advanced Control Theory: A Relay Feedback Approach is primarily designed to serve as a textbook for specialized or elective courses in Control Systems Engineering. The book presents a number of important new phenomena related to relay-based identification and automatic tuning of controllers. Pedagogical features such as high quality illustrations, solved problems, exercises, and end-of-chapter summaries serve to make it a complete and comprehensive textbook.

Key Features
- Provides prominence to mechanical movement control engineering problems, including mathematical modeling and system analysis and synthesis.
- Emphasizes basic concepts and methods for solving electro-mechanical control problems while simplifying or ignoring complicated mathematics.
- Introduces more examples and problems, making it also suitable for a self-study resource on this subject.
- New technology and analysis methods are introduced, which can help practicing engineers solve their design problems.

Contents
1. Introduction
2. Dynamic Mathematical Models of Physical Systems
3. Transient Response Analysis in the Time-Domain
4. Frequency Response Analysis
5. Control System Stability Analysis
6. Control System Error Analysis and Calculation
7. Control System Synthesis and Compensation
8. Computer Control Systems
9. The Application of MATLAB® in Control System Analysis and Compensation
Appendix A. Table of Laplace Transforms
Appendix B. Proof of the Optimal Frequency Ratio for the High-Order Optimum Model

Discrete-Time Control Problems using MATLAB®

Joe H. Chow, Rensselaer Polytechnic Institute
Dean K. Frederick, Rensselaer Polytechnic Institute
Nicolas W. Chbat, General Electric CRD


Using the power of MATLAB® and its Control System Toolbox, this book is the ideal supplement for a digital control systems course. Students are able to use a digital computer to rapidly work a wide range of numerical problems and gain deeper insight in control design. The book is built around illustrative examples that demonstrate the steps involved in the analysis and design process. The examples are followed by a variety of problems including follow-up “what if” questions, textbook-type reinforcement, open-ended exploratory and realistic comprehensive problems.

Key Features
- Each example illustrates a specific concept and usually contains a script of the MATLAB® commands used for the model creation and the computation.
- Comprehensive problems deal with real-life systems and cover the various stages of analysis and design. Students gain a firm notion of the complexity of practical control design problems.
- The state-space modeling of systems is introduced early, in Chapter 4, to emphasize its importance in modeling real-world problems. (Chapter 4 can be skipped without any loss of continuity).
- A sound track illustrates feedback stability of a public address system. The student can experiment with the system stability on a personal computer.

An extensive set of MATLAB® m-files, that will solve all of the examples, “what-ifs”, reinforcement problems, and comprehensive problems, are available on the website.

Contents
1. Introduction
2. Single-Block Models and Their Responses
3. Building and Analyzing Multi-Block Models
4. State-Space Models
5. Sample-Data Control Systems
6. Frequency Response, Digital Filters, and Discrete Equivalents
7. System Performance
8. Proportional-Integral-Derivative Control
9. Frequency-Response Design
10. State-Space Design Methods

Appendix A: Models of Practical Systems / Ball and Beam System / Inverted Pendulum / Electric Power System / Hydro-Turbine and Penstock / Appendix A: Limitations of PID Controllers / Appendix C: MATLAB® Commands

Automatic Control: The Power of Feedback Using MATLAB®

Theodore E. Djaferis, University of Massachusetts-Amherst


This unique, brief, interdisciplinary text uses the concept of automatic control as a unifying idea to explain the field of engineering and the kinds of problems engineers solve to first-year students. The author focuses on the basic principles of feedback and shows how it is used to design automatic controllers. Students learn how to develop explicit engineering models expressed as linear differential equations with constant coefficients for each of the systems they study. Then they will learn to solve these equations both analytically and numerically. Numerical solutions are performed using SIMULINK®. System stability and system performance are introduced, and the book concludes with a capstone project in which students use simulations and experiments to develop automatic controllers for a computer-controlled model car.

Key Features
- Uses automatic control systems as a vehicle to teach mathematical concepts, such as differential equations, in the context of real-world engineering, while introducing students to engineering design.
- Covers basic engineering concepts such as feedback, system stability, and system performance at a level appropriate for first-year students.
- MATLAB® simulations using SIMULINK® provide tangible, interactive experiments; a step-by-step procedure for building SIMULINK® block diagrams is provided.
- Concise and inexpensive enough to serve as a supplement for an Introduction to Engineering course, with the advantage of effectively integrating the use of MATLAB® into the course.
3. Building and Analyzing Multi-block Models

2. Single-Block Models and Their Responses

Digital Logic/Digital Design

Digital Logic Applications and Design

John M. Yarbrough, Oregon Institute of Technology


Digital Logic Applications and Design offers the right balance of classical and up-to-date treatment of combinational and sequential logic design for first digital logic design class. The author provides a thorough explanation of the design process, including completely worked examples beginning with simple one and going on to problems of increasing complexity. This text contains PLD (Programmable Logic Device) coverage. Chapter 9 develops complete, worked EPROM, PLA and EPLD design examples. The problems are developed in Chapter 7 as standard designs using SSI and MSI devices so that students can see the difference between the two approaches.

Ancillaries

Instructor’s Solutions Manual

Contents

1. Digital Concepts and Number Systems
2. Boolean Switching Algebra
3. Principles of Combined Logic
4. Analysis and Design of Combinational Logic
5. Flip-Flops, Simple Counters, and Registers
6. Introduction to Sequential Circuits
7. Sequential Circuit Design
8. Asynchronous Sequential Circuits
9. Programmable Logic and Memory
10. Digital Integrated Circuits

Also Available in ISE

ISE Fundamentals of Logic Design
ISBN: 978-1-133-62848-4

Updated with modern coverage, a streamlined presentation, and excellent companion software, this seventh edition of Fundamentals of Logic Design achieves yet again an unmatched balance between theory and application. Authors Charles H. Roth, Jr. and Larry L. Kinney carefully present the theory that is necessary for understanding the fundamental concepts of logic design while not overwhelming students with the mathematics of switching theory. Divided into 20 easy-to-grasp study units, the book covers such fundamental concepts as Boolean algebra, logic gates design, flip-flops, and state machines. By combining flip-flops with networks of logic gates, students will learn to design counters, adders, sequence detectors, and simple digital systems. After covering the basics, this text presents modern design techniques using programmable logic devices and the VHDL hardware description language.

New to This Edition

• The material on representation of negative numbers has been reorganized allowing the discussions on one’s complement and sign magnitude to be easily omitted if desired.
• Reorganized discussion of and clearer distinction between switching algebra and Boolean algebra.
• Newly added introduction to asynchronous circuits.
• NAND and NOR gates are now introduced earlier in the text.
• New content on carry-look-ahead adders has been added.
• Expanded discussion of hazard detection in Multi-level circuits.
• Alternative implementations of multiplexers are now given using different types of gates as well as smaller multiplexers to implement larger ones.
• Content on gated SR latches is now included with an emphasis on input change restrictions and how it relates to hazards. Also included are alternative implementations of gated latches such as the Earle latch.
2. Boolean Algebra

1. Introduction: Number Systems and Conversion

Digital Systems and Switching Circuits / Number Systems and Conversion / Binary Arithmetic / Representation of Negative Numbers / Binary Codes

2. Boolean Algebra

Basic Operations / Boolean Expressions and Truth Tables / Basic Theorems / Commutative, Associative, and Distributive Laws / Implication Theorems / Simplification Theorems / Multiplying Out and Factoring / DeMorgan's Laws

3. Boolean Algebra (Cont)

Multiplying Out and Factoring Expressions / Exclusive-OR and Equivalence Operations / The Consensus Theorem / Algebraic Simplification of Switching Expressions / Proving Validity of an Equation

4. Applications of Boolean Algebra: Minterm and Maxterm Expressions

Conversion of English Sentences to Boolean Equations / Combinational Logic Design Using a Truth Table / Minterm and Maxterm Expansions / General Minterm and Maxterm Expansions / Incompletely Specified Functions / Examples of Truth Table Construction / Design of Binary Adders

5. Karnaugh Maps

Minimum Forms of Switching Functions / Two- and Three-Variable Karnaugh Maps / Four-Variable Karnaugh Maps / Determination of Minimum Expressions Using Essential Prime Implicants / Five-Variable Karnaugh Maps / Other Uses of Karnaugh Maps / Other Forms of Karnaugh Maps

6. Quine-McCluskey Method

Determination of Prime Implicants / The Prime Implicant Chart / Patrick's Method / Simplification of Incompletely Specified Functions / Simplification Using Map-Entered Variables / Conclusion

7. Multi-Level Gate Circuits: NAND and NOR Gates

Multi-Level Gate Circuits / NAND and NOR Gates / Design of Multi-Level Circuits Using NAND and NOR Gates / Design of Multi-Level NAND and NOR Gate Circuits / Circuit Conversion Using Alternative Gate Symbols / Design of Two-Level, Multiple-Output Circuits Determination of Essential Prime Implicants for Multiple-Output Realization / Multiple-Output NAND and NOR Circuits

8. Combinational Circuit Design and Simulation Using Gates

Review of Combinational Circuit Design / Design of Circuits with Limited Gate Fan-In / Gate Delays and Timing Diagrams / Hazards in Combinational Logic / Simulation and Testing of Logic Circuits

9. Multiplexers, Decodes, and Programmable Logic Devices

Multiplexers / Three-State Buffers / Decoders and Encoders / Read-Only Memories / Programmable Logic Devices / Complex Programmable Logic Devices / Field Programmable Gate Arrays

10. Introduction to VHDL


11. Latches and Flip-Flops

Set-Reset Latch / Gated D Latch / Edge-Triggered D Flip-Flop / S-R Flip-Flop / J-K Flip-Flop / T Flip-Flop / Flip-Flops with Additional Inputs

12. Registers and Counters


13. Analysis of Clocked Sequential Circuits

A Sequential Parity Checker / Analysis by Signal Tracking and Timing Charts / State Tables and Graphs / General Models for Sequential Circuits

14. Derivation of State Graphs and Tables

Design of a Sequence Detector / More Complex Design Problems / Guidelines for Construction of State Graphs / Serial Data Code Conversion / Alphanumeric State Graph Notation

15. Reduction of State Tables State Assignment

Elimination of Redundant States / Equivalent States / Determination of State Equivalence Using an Implication Table / Equivalent Sequential Circuits / Incompletely Specified State Tables / Derivation of Flip-Flop Input Equations / Equivalent State Assignments / Guidelines for State Assignment / Using a One-Hot State Assignment

16. Sequential Circuit Design


17. VHDL for Sequential Logic


18. Circuits for Arithmetic Operations

Adders with Accumulator / Design of a Parallel Multiplier / Design of a Binary Divider

19. State Machine Design with SM Charts

State Machine Charts / Derivation of SM Charts / Realization of SM Charts

20. VHDL for Digital System Design


A First Course in Digital Systems Design: An Integrated Approach

John P. Uyemura, Georgia Institute of Technology


This book provides a new paradigm for teaching digital systems design. It puts forth the view that modern digital logic consists of several interacting areas that combine in a cohesive fashion. This includes traditional subjects, such as Boolean algebra, logic formalisms, Karnaugh maps, and other classical topics. It also goes beyond these subject areas by including VHDL, CMOS, VLSI and RISC architectures to show what the field looks like to a modern logic designer. Modern digital design is no longer practiced as a stand-alone art. The integrated approach used in this book is designed to ensure that graduating engineers are prepared to meet the challenges of the new century.

Key Features

- Strong emphasis on design hierarchies. Using this view as a central theme, the book introduces design processes at all levels, from the bottom-up and from the top-down.
- Written in three basic modules for maximum flexibility: traditional logic design, integration and VLSI, and basic computer architecture.
- Chapter 5 on VHDL presents the structure and main ideas of an important tool in modern design, allowing students to see how theory...
Analysis and Design of Digital Systems with VHDL

Allen Dewey, Duke University

and physical implementations are related.

• Chapters 6 and 7 on VLSI design are unique to this text. They provide a real-world perspective often missing from more standard treatments.

• Chapters 11 and 12 cover computer fundamentals, teaching the basics while reinforcing the idea of system hierarchies.

Ancillaries
Instructor’s Solutions Manual

Also Available
A First Course in Digital Systems Design, An Integrated Approach
Complex Chinese Version
Simplified Chinese Version
Portuguese Version

Contents
1. Concepts in Digital Systems
2. Boolean Algebra and Logic Gates
3. Combinational Logic Design
4. Digital Hardware
5. First Concepts in VHDL
6. CMOS Logic Circuits
7. Silicon Chips and VLSI
8. Logic Components
9. Memory Elements and Arrays
10. Sequential Logic Networks
11. Computer Basics

it succinctly captures the basic concepts of digital systems engineering and harnesses the power of design automation technology. This book first presents combinational and sequential systems and their design, along with logic families and integrated circuits. It then interlocks these subjects with discussions of structural and data flow modeling, synchronous behavior, and algorithmic modeling of digital systems in VHDL. This dual-track organization of conceptual and VHDL-related material makes the book easily adaptable to one or two-semester courses and a variety of teaching approaches.

Contents
1. Introduction
2. Representing Information
3. Combinational Systems: Definition and Analysis
4. Combinational Design: Synthesis
5. Combinational Design: Implementation
Part II: Digital Engineering: Manufacturing Technologies
6. Logic Families
7. Integrated Circuits
Part III: Digital Engineering: Sequential Systems
8. Sequential Systems: Definition and Analysis
9. Sequential Design: Synthesis
10. Sequential Design: Implementation
Part IV: VHDL: Combinational Systems
11. VHDL: A First Look
12. Structural Modeling in VHDL: Part I
13. Data Flow Modeling in VHDL
14. Structural Modeling in VHDL: Part II
Part V: Manufacturing Technologies
15. VHDL Technology Information: Part I
16. VHDL Technology Information: Part II
Part VI: VHDL: Sequential Systems
17. Describing Synchronous Behavior in VHDL
18. Algorithmic Modeling in VHDL
19. VHDL: A Last Look
Appendix A: Powers of Two
Appendix B: VHDL Reserved Keywords
Appendix C: Introduction to Semiconductor Physics

Analysis and Design of Digital Systems with VHDL

Allen Dewey, Duke University


Analysis and Design of Digital Systems with VHDL integrates VHDL technology into the undergraduate digital logic course. Author Allen Dewey observes that the widespread use of VHDL in specifying digital system designs is driving change and innovation in industry, and defining a new skill set that engineering students must master to design, model, communicate, and implement digital systems. VHDL provides a formal mechanism for describing digital systems in a format easily processed by computers;
necessary for digital design and omits some of the less-used features.

- Material is presented in a generalized fashion, with references to specific products as examples, to enhance understanding of the basic principles in the construction of programmable devices.
- A variety of examples are presented so that instructors can select their favorite designs for teaching.

Ancillaries
Instructor's Solution Manual

Also Available
Digital System Design Using VHDL, Second Edition
Korean Version

Contents
1. Review of Logic Design Fundamentals
   - Combinational Logic / Boolean Algebra and Algebraic Simplification / Karnaugh Maps
   - Designing with NAND and NOR Gates / Hazards in Combinational Circuits / Flip-Flops and Latches / Mealy Sequential Circuit Design / Design of a Moore Sequential Circuit / Equivalent States and Reduction of State Tables / Sequential Circuit Timing / Tri-state Logic and Busses
2. Introduction to VHDL
3. Introduction to Programmable Logic Devices
   - Brief Overview of Programmable Logic Devices / Simple Programmable Logic Devices (SPLDs) / Complex Programmable Logic Devices (CPLDs) / Field-Programmable Gate Arrays (FPGAs)
4. Design Examples
   - BCD to 7-Segment Display Decoder / A BCD Adder / 32-Bit Adders / Traffic Light Controller / State Graphs for Control Circuits / Scoreboard and Controller / Synchronization and Deobunding / A Shift-and-Add Multiplier / Array Multiplier / A Signed Integer/Fraction Multiplier / Keypad Scanner / Binary Dividers
5. SM Charts and Microprogramming
   - State Machine Charts / Derivation of SM Charts / realization of SM Charts / Implementation of the Dice Game / Microprogramming / Linked State Machines
6. Designing with Field Programmable Gate Arrays
   - Implementing Functions in FPGAs / Implementing Functions Using Shannon’s Decomposition / Carry Chains in FPGAs / Cascade Chains in FPGAs / Examples of Logic Blocks in Commercial FPGAs / Dedicated Memory in FPGAs / Dedicated Multipliers in FPGAs / Cost of Programmability / FPGAs and One-Hot State Assignment / FPGA Capacity: Maximum Gates Versus Usable Gates / Design Translation (Synthesis) / Mapping, Placement, and Routing
7. Floating-Point Arithmetic
   - Representation of Floating-Point Numbers / Floating-Point Multiplication / Floating-Point Addition / Other Floating-Point Operations
8. Additional Topics in VHDL
   - VHDL Functions / VHDL Procedures / Attributes / Creating Overloaded Operators / Multi-Valued Logic and Signal Resolution / The IEEE 9-Valued Logic System / SRAM Model Using IEEE 1164 / Model for SRAM Read/Write System / Generics / Named Association / Generate Statements / Files and TEXTIO
9. Design of a RISC Microprocessor
   - The RISC Philosophy / The MIPS ISA / MIPS Instruction Encoding / Implementation of a MIPS Subset / VHDL Model
10. Hardware Testing and Design for Testability
    - Testing Combinational Logic / Testing Sequential Logic / Scan Testing / Boundary Scan / Built-In Self-Test
11. Additional Design Examples
    - Design of a Wristwatch / Memory Timing Models / A Universal Asynchronous Receiver Transmitter (UART)

Appendix A – VHDL Language Summary
Appendix B – IEEE Standard Libraries
Appendix C – TEXTIO Package
Appendix D – Projects

Key Features
- Emphasis on “advanced” digital logic design.
- Uses synthesizable VHDL code throughout. Each code example can be synthesized into working hardware.
- Includes many fully worked-out practical design examples. Students and engineers reading this textbook can learn many useful details about such designs.
- Emphasizes the use of a systematic problem-solving approach based on state machines. Students will learn how to approach a complex digital logic circuit design problem in a systematic manner.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Condensed Overview of Introductory Digital Logic Design
   - Number Formats / Combinational Logic / Combinational Logic Devices / Combinational Logic Circuit Design / Sequential Logic / Sequential Logic Devices / Synchronous Sequential Circuit Design / Hazards and Glitches / Mestability
2. Digital Logic Design Using Hardware Description Languages
   - Hardware description Languages / Design Flow / Synthesis / Register Transfer Level Notation / Logic Simulation / Properties of Actual Circuits
3. Introduction to VHDL and Test Benches
4. High-Level VHDL Coding for Synthesis
5. State Machine Design
Advanced Digital Logic Design Using Verilog, State Machines, and Synthesis for FPGAs

Sunggu Lee, Pohang University of Science and Technology


This textbook is intended to serve as a practical guide for the design of complex digital logic circuits, such as digital control and network interface circuits, pipelined arithmetic units, and RISC microprocessors. It is an advanced digital logic design textbook that emphasizes the use of synthesizable Verilog code, and provides numerous fully worked-out practical design examples including a Universal Serial Bus interface, a pipelined multiply-accumulate unit, and a pipelined microprocessor for the ARM THUMB architecture.

Key Features
- Emphasis on “advanced” digital logic design.
- Uses synthesizable Verilog code throughout. Each code example can be synthesized into working hardware.
- Includes many fully worked-out practical design examples. Students and engineers reading this textbook can learn many useful details about such designs.
- Emphasizes the use of a systematic problem-solving approach based on state machines. Student will learn how to approach a complex digital logic circuit design problem in a systematic manner.

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   Number Formats / Combinational Logic / Combinational Logic Devices / Combinational Logic Circuit Design / Sequential Logic / Sequential Logic Devices / Synchronous Sequential Circuit Design / Hazards and Glitches / Mestastability
2. Digital Logic Design Using Hardware Description Languages
   Hardware Description Languages / Design Flow / Synthesis / Register Transfer Level Notation / Logic Simulation / Properties of Actual Circuits
Implementations / HDL Implementation Overview / HDL Design for a Pipelined Multiply-Accumulate Unit / Test Bench and Simulation Results

9. Design of a Pipelined RISC Microprocessor
Introduction to Microprocessors / Reduced Instruction Set Computers / Basic Computer Operation / The THUMB Microprocessor Architecture / Thumb Programming Model / Overview of the THUMB Instruction Set / Instruction Pipeline Design / Pipeline Hazards / Hazard Prevention Techniques / Pipeline Hazard Solutions Adopted / HDL Implementation of the THUMB Pipeline / VHDL THUMB Implementation / Test Bench Based Verification

A - THUMB Instruction Set Listing

Digital Logic and Microprocessor Design with VHDL

Enoch O. Hwang, La Sierra University


This book will teach students how to design digital logic circuits, specifically combinational and sequential circuits. Students will learn how to put these two types of circuits together to form dedicated and general-purpose microprocessors. This book is unique in that it combines the use of logic principles with the building of individual components to create data paths and control units, as well as the building of real dedicated custom microprocessors and general-purpose microprocessors. After understanding the material in the book, students will be able to design simple microprocessors and implement them in real hardware.

Key Features
• Contains many complete examples.
• Both schematic and VHDL code for all examples.
• Actual implementation of the circuits on the optional Altera UP2 development board.
• Teaches students how to implement a working microprocessor that they have designed on a FPGA chip (real hardware).

Ancillaries
Instructor’s Solutions Manual

Contents

1. Designing Microprocessors
Overview of a Microprocessor / Design Abstraction Levels / Examples of a 2-to-1 Multiplexer / Introduction to VHDL / Synthesis / Going Forward

2. Digital Circuits

3. Combinational Circuits
Analysis of Combinational Circuits / Synthesis of Combinational Circuits / *Technology Mapping / Minimization of Combinational Circuits / *Timing Hazards and Glitches / 7-Segment Decoder Example / VHDL for Combinational Circuits

4. Standard Combinational Components
Signal Naming Conventions / Adder / Two's Complement Binary Numbers / Subtractor / Adder-Subtractor Combination / Arithmetic Logic Unit / Decoder / Encoder / Multiplexer / Tri-state Buffer / Comparator / Shifter-Rotator / Multiplier

5. Implementation Technologies
Physical Abstraction / Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET) / CMOS Logic / CMOS Circuits / Analysis of CMOS Circuits / Using ROMs to Implement a Function / Using PLAs to Implement a Function / Using PALs to Implement a Function / Complex Programmable Logic Device (CPLD) / Field-Programmable Gate Array (FPGA)

6. Latches and Flip-Flops

7. Sequential Circuits

8. Standard Sequential Components
Registers / Shift Registers / Counters / Register Files / Static Random Access Memory / *Larger Memories / More Memory Locations

9. Datapaths
General Datapath / Using a General Datapath / Timing Issues / A More Complex General Datapath / Dedicated Datapath / Designing Dedicated Datapaths / Using a Dedicated Datapath / VHDL for Datapaths

10. Control Units
Constructing the Control Unit / Examples / Generating Status Signals / Timing Issues / Standalone Controllers / *ASM Charts and State Action Tables / VHDL for Control Units

11. Dedicated Microprocessors
Manual Construction of a Dedicated Microprocessor / Examples / VHDL for Dedicated Microprocessors

12. General-Purpose Microprocessors
Overview of the CPU Design / The EC-1 General-Purpose Microprocessor / The EC-2 General-Purpose Microprocessor / VHDL for General-Purpose Microprocessors

Appendix A - Schematic Entry Tutorial 1
Getting Started / Using the Graphic Editor / Specifying the Top-Level File and Project / Synthesis for Functional Simulation / Circuit Simulation / Creating and Using the Logic Symbol

Appendix B - VHDL Entry Tutorial 2
Getting Started / Synthesis for Functional Simulation / Circuit Simulation

Appendix C - UP2 Programming Tutorial 3
Getting Started / Synthesis for Programming the PLD / Circuit Simulation / Using the Floorplan Editor / Fitting the Netlist and Pins to the PLD / Hardware Setup / Programming the PLD / Testing the Hardware / MAX7000S EPM7128SLC84-7 Summary / FLEX10K EPF10K70RC240-4 Summary

Appendix D - VHDL Summary
Basic Language Elements / Dataflow Model / Concurrent Statements / Behavioral Model / Sequential Statements / Structural Model / Statements / Conversion Routines

Digital Signal Processing/Signals and Systems

Kaliappan Gopalan, Purdue University-Calumet


The approach taken in this text is to introduce students to the concepts and mathematical tools necessary to understand and appreciate the wide array of exciting fields within electrical engineering, such as signal processing, control systems, and communications. The book is structured to introduce the basic continuous-time signal and system analysis concepts as an extension of familiar circuit analysis methods. A strong theoretical foundation for signal analysis is built, leading students to successfully discuss the various system analysis methods used in practice today. Use of MATLAB® with appropriate examples has been integrated throughout the book.
Key Features

- Each chapter begins with an introduction to the chapter contents and ends with a summary of key concepts and mathematical results, followed by homework problems.
- Continuous and Discrete-Time signals and systems are treated in parallel for better understanding of the two, and to motivate digital simulation and problem solving.
- Sufficient mathematical rigor is provided relating to practical systems, while minimizing discussions on less-often used topics.
- Numerous examples are provided throughout to illustrate the concepts and practical applicability.
- End-of-chapter problems are thoughtfully designed to test and extend the understanding of concepts, and to apply the concepts in practical applications.
- MATLAB® examples are integrated throughout to assist in understanding the concepts by visualizing the results, as well as to aid in solving practical problems.
- Appendices are provided to give a quick background on complex number solving practical problems.
- Applicability.
- The book uses plain language and emphasizes core issues.
- To accommodate students with different educational backgrounds, the technical depth starts at an elementary level in the first few chapters and increases gradually.
- Theory is presented in a way that builds upon the core concepts and strengthens students' intuition.

Ancillaries

Instructor's Solutions Manual

Contents

1. Introduction
   - Basic Definitions / Classification of Signals and Systems / Frequency spectrum in Signal and System Analysis / Scope of the Text
2. Mathematical Modeling and Properties of Basic Signals and Systems
   - Mathematical Modeling of Systems and Signals / Basic Signal Operations and Properties / Basic CT Signals / Basic DT Signals / Basic System Properties / Frequency Response and CT Filters / Discretization of CT Signal and System Models / Linearization of Nonlinear Systems
3. Continuous-Time System Analysis in Time Domain
4. Discrete-Time System Analysis in the Time Domain - The Convolution Summation and Classical Analysis
5. Frequency Domain Analysis of CT Signals and Systems
   - The Fourier Series and the Fourier Transform Analysis Introduction / Representation of Signals using Basic Functions / Representation of Periodic Functions - The Exponential Fourier Series / Frequency Spectrum of Aperiodic Signals - The Fourier Transform / LTI System Analysis in the Frequency Domain / Ideal and Practical Filters
6. System Analysis Using the Laplace Transform
7. The z-Transform and Discrete-Time System Analysis
8. Frequency Domain Analysis of DT Signals and Systems - The DTFT and DFT Analysis
   - Spectrum of Sampled Signals and the Sampling Theorem / The Discrete-Time Fourier Transform / Properties of the Discrete-Time Fourier Transform / Frequency Domain Analysis of DT Systems / Discrete Fourier Transform and its Properties / Applications of the DFT in Signal and System Analysis
9. State Variable Analysis of Continuous and Discrete-Time Systems
   - State Variable Representation of CT Systems / State Variable Representation and Analysis of DT Systems

Appendix A - Complex Numbers
Appendix B - Some Useful Mathematical Operations
Appendix C - Basic Matrix Operations
Appendix D - Mathematical Tables

An Introduction to Signals and Systems
John Alan Stuller, Missouri University of Science and Technology


This book provides a concise and clear introduction to signals and systems theory, with emphasis on fundamental analytical and computational techniques. It develops continuous-time and discrete-time concepts/methods in separate chapters — highlighting the similarities and differences — and features introductory treatments of the applications of these basic methods in such areas as filtering, communication, sampling, discrete-time processing of continuous-time signals, and feedback. This text is written for introductory courses in continuous-time and/or discrete-time signals and systems for electrical engineering students. It is also accessible to a broad range of engineering and science students, as well as valuable to practicing engineers seeking an insightful review.

Key Features

- The development of the core material is academically sound, concise, and easy to understand. New derivations not found in other texts and a modernized placement of topics helps students to learn faster and appreciate the unity of the overall theory.
- DT and CT topics are described in parallel chapters. The parallel development brings to light the similarities and the differences between DT and CT. Either CT or DT can be covered first, or they can be covered in parallel, chapter by chapter, or section by section.
- The book uses plain language and emphasizes core issues.
- To accommodate students with different educational backgrounds, the technical depth starts at an elementary level in the first few chapters and increases gradually.
- Theory is presented in a way that builds upon and strengthens students’ intuition.

Ancillaries

Instructor's Solution Manual
Digital Signal Processing: A Modern Introduction
Ashok Ambardar, Michigan Technical University


Intended for a one-semester junior or senior level undergraduate course, this book provides a modern and self-contained introduction to digital signal processing (DSP). It is supplemented by a vast number of end-of-chapter problems, such as worked examples, drill exercises, and application-oriented problems, that require the use of computational resources such as MATLAB®. Also, many figures have been included to help the student grasp and visualize critical concepts. Results are tabulated and summarized for easy reference and access. It also attempts to provide a broader perspective by introducing useful applications and additional special topics in each chapter. These form the background for more advanced graduate courses and allow the book to be used as a source of basic reference for professionals across various disciplines interested in DSP.

Key Features
• Useful for engineers in the industry as an overview for self-study.
• Drill problems with answers follow most examples to help understand concepts.
• Many end-of-chapter exercises.
• Relevant information on analog signals is summarized in a separate appendix.
• Includes application-oriented material.

Ancillaries
Instructor’s Solutions Manual

Contents
1.  Overview
   Introduction / Signals / Digital Filters / Signal Processing / The DFT and FFT / Advantages of DSP
2.  Discrete Signals
   Scope and Objectives / Discrete Signals / Operations on Discrete Signals / Decimation and Interpolation / Common Discrete Signals / Discrete-Time Harmonics and Sinusoids / The Sampling Theorem / An Introduction to Random Signals
3.  Time-Domain Analysis
4.  z-Transform Analysis
   Scope and Objectives / The Tow-Sided z-Transform / Properties of the Two-Sided z-Transform / Poles, Zeros, and the z-Plane / The Transfer Function / Interconnected Systems / Transfer Function Realization / Causality and Stability of LTI Systems / The Inverse z-Transform / The One-Sided z-Transform / The z-Transform and System Analysis
5.  Frequency Domain Analysis
   Scope and Objectives / The DTFT from the z-Transform / Properties of the DTFT / The DTFT of Discrete-Time Periodic Signals / The Inverse DTFT / The Frequency Response / System Analysis Using the DTFT / Connections
6.  Filter Concepts
   Scope and Objectives / Frequency Response and Filter Characteristics / FIR Filters and Linear-Phase IIR Filters / Allpass Filters
7.  Digital Processing of Analog Signals
8.  Design of FIR Filters
   Scope and Objectives / Ideal Filters / Design Process / Symmetric Sequences and Linear Phase / Window-Based Design / Half-Band FIR Filters / FIR Filter Design by Frequency Sampling / Design of Optimal Linear-Phase FIR Filters / Application: Multistage Interpolation and Decimation / Maximally Flat FIR Filters / FIR Differentiators and Hilbert Transformers / Least Squares and Adaptive Signal Processing
9.  Design of IIR Filters
10. The Discrete Fourier Transform and Its Applications
    Scope and Objectives / Introduction / The Cepstrum and Homomorphic Filtering / Optimal Filtering / Matrix Formulation of the DFT and IDFT / The FFT / Why Equal Lengths for the DFT and IDFT?
11. MATLAB® Examples
    Introduction / Examples of MATLAB® Code Appendix A - Useful Concepts from Analog Theory
    Scope and Objectives / Signals / System Analysis / Convolution / The Laplace Transform / The Fourier Transform / Bode Plots / Classical Analog Filter Design

Analog and Digital Signal Processing
Second Edition
Ashok Ambardar, Michigan Technological University


Analog and Digital Signal Processing teaches the basic principles and applications of signals, systems, transforms and filters, using both a visual and a mathematical approach. The book helps readers develop a thorough understanding of time-domain and frequency-domain relationships, encouraging them to think clearly in both domains and switch easily from one to the other. Available for free download is a set of powerful software routines running under MATLAB® that can be used for reinforcing and visualizing concepts, as well as for problem solving and advanced design. The extensively revised and reorganized second edition incorporates new practical applications and design-oriented examples in every chapter.

Key Features
• Extensive new illustrations and examples help students understand concepts visually as well as mathematically.
• A careful and complete treatment of convolution is given in Chapters 6 and 7.
• New Review Panels summarize and reinforce key concepts in each chapter.
• New practical applications (dealing with digital audio effects, echo cancellation, spectrum estimation, DTMF signaling, and other topics) and design-oriented examples appear in each chapter.
• Expanded end-of-chapter problems are organized into three sections: drill/reinforcement; review/extension; and computation/design.
• A new chapter provides a do-it-yourself guide to MATLAB®, with practical examples and accompanying explanations of MATLAB® code.
• A set of new menu-driven GUIs with point-and-click features is now supplied for ease of use in visualizing basic signal processing principles and concepts.

Ancillaries
Instructor’s Solutions Manual

Contents
1.  Overview
2.  Analog Signals
3.  Discrete Signals
4.  Analog Systems
5.  Discrete-Time Systems
6.  Continuous Convolution
7.  Discrete Convolution
8.  Fourier Series
9.  The Fourier Transform
10. Modulation
11. The Laplace Transform
12. Applications of the Laplace Transform
13. Analog Filters
14. Sampling and Quantization

www.cengage.com/engineering
Fundamentals of Digital Signal Processing Using MATLAB®

Second Edition
Robert J. Schilling, Clarkson University
Sandra L. Harris, Clarkson University


This second edition text focuses on the fundamentals of digital signal processing with an emphasis on practical applications. In order to motivate students, many of the examples illustrate the processing of speech and music. This theme is also a focus of the course software and website contains a comprehensive MATLAB® software package called the Fundamentals of Digital Signal Processing (FDSP) Toolbox Version 2.0. The FDSP Toolbox includes chapter GUI modules, an extensive library of DSP functions, all computational examples that appear in the text, the text figures, solutions to selected problems, and online help documentation. Using the interactive GUI modules, students can explore, compare, and directly experience the effects of signal processing techniques without any need for programming.

New to This Edition
• New design – now divided into three major parts.
• Expanded introduction to signals and systems.
• New examples and case studies, as well as numerous new end-of-chapter problems.
• New sections on system identification and equalization, the inclusion of a novel quadrature filter design technique, as well as a discussion of sigma-delta ADC.
• Important definitions, propositions, algorithms, tables, and case studies are now summarized at the end of each chapter.
• Version 2.0 of the FDSP Toolbox companion software with expanded functionality.
• Expanded treatment of many topics such as: difference equations and block diagrams; Noncausal signals and systems; the discrete-time Fourier transform (DFT); zero-phase FIR filters; polyphase filter realizations; quadrature mirror filter banks.

Key Features
• Provides enough material and sufficient flexibility in pedagogy for courses of different lengths.
• Experience with MATLAB® programming is useful, but is not essential.
• A graphical user interface (GUI) module is included at the end of each chapter that allows students to investigate meaningful numerical applications without any need for programming.
• An FDSP toolbox and computational problems are supplied for those users who are familiar with MATLAB®, or are prepared to learn it, and are interested in developing their own implementations.
• Important terms are set apart for convenient reference using definitions, and key results are stated as theorems in order to highlight their significance. Detailed algorithms are also included to summarize the steps used to implement important design procedures.
• Each chapter starts with a concise summary of student learning objectives, with each objective cross-referenced to a section or sections within the chapter.
• Motivation sections in each chapter introduce one or more examples of practical problems that can be solved using techniques covered in the chapter.
• A series of analysis tools and signal processing techniques applicable to the type of problems covered are introduced in each chapter. Within these sections the analysis methods and processing techniques go from simple to more complex.
• Each chapter concludes with a generous set of homework problems organized by section and problem type.
• Instructor’s Solution Manual with complete solutions to all problems includes the functions, examples, figures, and problems from the text, all directly accessible from an easy-to-use GUI driver program available exclusively for instructors.
• Homework Builder Module helps instructors create and distribute homework assignments and solutions using problems selected from the end-of-chapter exercise set.

Contents
Part I. Signal and System Analysis
1. Signal Processing
   Signals and Systems / Sampling of Continuous-Time Signals / Reconstruction of Continuous-Time Signals / Prefilters and Postfilters / DAC and ADC Circuits / The FDSP Toolbox
2. Discrete-Time Systems in the Time Domain
3. Discrete-Time Systems in the Frequency Domain
4. Fourier Transforms and Signal Analysis
   Fourier Series / Fourier Transform (FT) / Fast Fourier Transform (FFT) / Fast Fourier Transform (FFT) / Fast Convolution and Correlation / White Noise / Auto-Correlation / Zero Padding and Spectral Resolution / The Spectrum / Power Density Spectrum Estimation
Part II. Digital Filter Design
5. Filter Design Specifications
   Frequency-Selective Filters / Linear-Phase and Zero-Phase Filters / Minimum-Phase and Allpass Filters / Quadrature Filters / Notch Filters and Resonators / Narrowband Filters and Filter Banks / Adaptive Filters
6. FIR Filter Design
   Windowing Method / Frequency-Sampling Method / Least-Squares Method / Equiripple Filters / Differentiators and Hilbert Transformers / Quadrature Filters / Filter Realization Structures / Finite Word Length Effects
7. IIR Filter Design
   Filter Design by Pole-Zero Placement / Filter Design Parameters / Classical Analog Filters / Bilinear Transformation Method / Frequency Transformations / Filter Realization Structures / Finite Word Length Effects
Part III. Advanced Signal Processing
8. Multirate Signal Processing
   Integer Sampling Rate Converters / Rational Sampling Rate Converters / Multirate Filter Realization Structures / Narrowband Filters and Filter Banks / A Two-Channel QMF Bank / Oversampling ADC / Oversampling DAC
   Mean Square Error / The Least Mean Square (LMS) Method / Performance Analysis of the LMS Method / Modified LMS Methods / Adaptive Filter Design / The Recursive Least Squares (RLS) Method / Active Noise Control / Nonlinear System Identification

References and Further Reading
Appendices
Transform Tables. Mathematical Identities. FDSP Toolbox Functions.
• Treats the analysis and design of filters and

• Extensive integration of MATLAB® with both

• Teaches and applies MATLAB® to make it

Key Features
• Now includes 3-D illustrations of the

• New section on Discrete-Time Sinusoids, plus

• Revised and updated exercise sets.

New to This Edition
• Integration of the most current version of

• Revised and updated exercise sets.

• New section on Applications of DSP with

• New section on Discrete-Time Sinusoids, plus
detailed examples on system linearity and
time-invariance.

• A new subsection on DTFT pairs, along with a
table of common pairs.

• Now includes 3-D illustrations of the

• Earlier introduction of Number Representation,

• Simplified discussion on the Parks-McClellan
algorithm to enable easier understanding of
this complex topic.

• New section on special filters.

Key Features
• Teaches and applies MATLAB® to make it

• Provides MATLAB® functions and scripts,
enabling students to modify problem values and
parameters, and study scripts to gain
insight into MATLAB® procedures.

• Extensive integration of MATLAB® with both

• Treats the analysis and design of filters and

Contents
1. Introduction
Overview of Digital Signal Processing / A Brief
Introduction to MATLAB®/ Applications of
Digital Signal Processing / Brief Overview of
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The Properties of the DTFT / The Frequency
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Sampling and Reconstruction of Analog
Signals

4. The z-Transform
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the z-Domain / Solutions of the Difference
Equations

5. The Discrete Fourier Transform
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Reconstruction in the z-Domain / The Discrete
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6. Implementation of Discrete-Time Filters
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Representation of Numbers / The Process
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Quantization of Filter Coefficients

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Lowpass Filter Design Using MATLAB® /
Frequency-Band Transformations

9. Sampling Rate Conversion
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Interpolation by a Factor I / Sampling Rate
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Designs for Sampling Rate Conversion /
FIR Filter Structures for Sampling Rate Conversion

10. Round-Off Effects in Digital Filters
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Effects in IIR Digital Filters / Round-off Effects
in FIR Digital Filters

11. Applications in Adaptive Filtering
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System Identification of System Modeling /
Suppression of Narrowband Interference in a
Wideband Signal / Adaptive Line Enhancement /
Adaptive Channel Equalization

12. Applications in Communications
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PCM (DPCM) / Adaptive PCM and DPCM
(ADPCM) / Delta Modulation (DM) / Linear
Predictive Coding (LPC) of Speech / Dual-
tone Multifrequency (DTMF) Signals / Binary
Digital Communications / Spread-Spectrum
Communications

Modern Digital Signal Processing
Roberto Cristi, Naval Postgraduate School


Roberto Cristi conveys the excitement of the
Digital Signal Processing field in which students
can experiment with sounds, images, and video.
Using a wealth of applications, the book covers
digital Signal Processing material well suited to
today’s diverse student population. The author
presents the material in a logical sequence so that
students can appreciate how concepts develop.
The book can be effectively used in a university
classroom or as a base for self-study.

Key Features
• Proves (not just states) most of the presented
statements.

• Reviews signals and systems in Chapter 1.

• Ensures that students understand how to
make continuous-time and discrete-time
signals and systems coexist (Chapter 2).

• Covers the most common approaches to
Digital and Analog Filter Design (Finite Impulse
Response and Infinite Impulse Response),
and makes students aware of the theory and
limitations behind each technique.

• Presents the fundamentals of Multirate digital
signal processing, with applications to signal
resampling, efficient filter design, and signal
digitization.

• Introduces signal decomposition by Filter
Banks with particular attention to DFT in
Chapter 7 and Maximally Decimated structures
in Chapter 8. They both are the basis of the
Time Frequency decomposition presented in
the last chapter (Chapter 9), such as the Short
Time Fourier Transform, the Gabor Transform
(from the DFT Filter Banks), and the Wavelet
Transform (from the Maximally Decimated
Filter Banks).

• Introduces Transmultiplexers with particular
attention to applications to digital
communications techniques, such as Time
Division and Frequency Division Multiple
Access (TDMA and FDMA), and Multi Carrier
(MC) modulation, also called Orthogonal
Frequency Division Multiplexing (OFDM).

Ancillaries
Instructor’s Solutions Manual

Contents
1. Fundamentals of Signals And Systems
Signals / Systems / Fourier Analysis of Discrete
Digital Signal Processing Implementations Using DSP Microprocessors with Examples from TMS320C54xx

Avtar Singh, San Jose State University
S. Srinivasan, Indian Institute of Technology


Bridging the gap between Digital Signal Processing theory and design, this implementation-oriented textbook is based on the authors' extensive experience in teaching graduate and undergraduate courses on the subject. The objective of the book is to help students understand the architecture, programming, and interfacing of commercially available programmable DSP devices, and to effectively use them in system implementations. Throughout the book, the authors utilize the popular family of DSP devices, TMS320C54xx, from Texas Instruments. In the end, students will be comfortable in using both hardware and software for designing with the programmable DSP devices.

Key Features
- Features exhaustive end-of-chapter assignments and laboratory exercises. The lab exercises require the use of MATLAB® as an analysis/design tool, and DSK416 with Code Composer Studio as a hardware and software development tool.
- Introduces Texas Instruments' TMS320C54xx family of fixed-point DSP processors with discussion of their architecture, software, and hardware features. These devices are used in programming and design examples throughout the book.
- Gives sufficient exposure to the architecture of programmable DSP devices so that students can use them effectively and optimally in designing systems.
- Presents several applications of programmable DSP devices that motivate students to design systems around these devices for their specific requirements.

Also Available
Digital Signal Processing Implementations Using DSP Microprocessors with Examples from TMS320C54xx
Simplified Chinese Version

Contents
1. Introduction
A Digital Signal Processing System / Programmable Digital Signal Processors / Major Features of Programmable Digital Signal Processors / The Scope of the Book

2. Introduction to Digital Signal Processing

3. Computational Accuracy in DSP Implementations
Number-Formats for Representation of Signals and Coefficients in DSP Structures / Dynamic Range and Precision / Sources of Errors in a DSP Implementation / A/D Conversion Errors / DSP Computational Errors / D/A Conversion Errors

4. Architectures for Programmable Digital Signal Processing Devices
Basic Architectural Features / Computational Building Blocks / Bus Architecture and Memory / Data Addressing Capabilities / Address Generation Unit / Programmability and Program Execution / Speed Issues / Features for External Interfacing

5. Programmable Digital Signal Processors
Commercial Digital Signal Processing Devices / The Architecture of TMS320C54xx Digital Signal Processors / Addressing Modes of the TMS320C54xx Processors / Memory Spaces of TMS320C54xx Processors / Program Control / TMS320C54xx Instructions and Programming / On-Chip Peripherals / Interrupts / Pipeline Operation of the TMS320C54xx Processors


7. Implementations of Basic DSP Algorithms
The Q-notation / FIR Filters / IIR Filters / Interpolation Filters / Decimation Filters / PID Controller / Adaptive Filters / 2-D Signal Processing

8. Implementation of FFT Algorithms
An FFT Algorithm for DFT Computation / A Butterfly Computation / Overflow and Scaling / Bit-Reversed Index Generation / An 8-point FFT Implementation of TMS320C54xx / Computation of Signal Spectrum

9. Interfacing Memory and Parallel I/O Peripherals to Programmable DSP Devices
Memory Space Organization of the TMS320C54xx Devices / Memory and I/O Signals of the TMS320C54xx Devices / Memory Interface / Parallel I/O / Programmed I/O / Interrupts and I/O / Direct Memory Access (DMA)

10. Interfacing Serial Converters to a Programmable DSP Device
Synchronous Serial Interface between the DSP and an AIC / A Multi-channel Buffered Serial Port (McBSP) / The McBSP Programming / A CODEC Interface Circuit / CODEC Programming / A CODEC-DSP Interface Example

11. Applications of Programmable DSP Devices
A DSP System / DSP Based Biotelemetry System / A Speech Processing System / An Image Processing System / A Position Control System for a Hard Disk Drive / DSP Based Power Meter

1. Introduction
2. Discrete Time Processing of Continuous Time Signals
3. Fourier Analysis of Discrete Time Signals
4. Digital Filters
5. Multirate Digital Signal Processing: Fundamentals
6. DFT Filter Banks And Transmultiplexers
7. Maximally Decimated Filter Banks
8. Time Frequency Expansion: An Introduction
9. Time Frequency Expansion: An Introduction
10. Interfacing Serial Converters to a Programmable DSP Device
11. Applications of Programmable DSP Devices

www.cengage.com/engineering
Appendix B: Useful Formulae and Definitions

11. State-Space Topics for Discrete Systems
9. The Moving Average Filter
8. Basic Filter Types
7. Filter Transient Response
6. Butterworth Filter Design

Part IV: Quantization
13. A/D Quantization Error
14. Multiplication Quantization Error
15. Multiplication Quantization Error in Direct Form
16. Multiplication Quantization Error in DF Realizations

Electromagnetics

Third Edition
Liang C. Shen, University of Houston
Jin Au Kong, Massachusetts Institute of Technology


In their successful text, Shen and Kong cover fundamentals of static and dynamic electromagnetic fields and waves. The authors employ a unique approach, beginning with a study of Maxwell’s equations and waves, and covering electromagnetic fields later. This presentation allows students to work with electromagnetic concepts using relatively simple computational analysis, building in a logical progression to more complex topics and mathematical methods for analysis. This third edition provides computer-based problems, homework problems, and end-of-chapter summaries. It also includes a rich collection of real-world application examples that include the discussion of cellular phone and microwave exposure limits set by IEEE, safety concerns about electromagnetic fields from power lines, new and covering electromagnetic fields. This third edition provides computer-based problems, homework problems, and end-of-chapter summaries. It also includes a rich collection of real-world application examples that include the discussion of cellular phone and microwave exposure limits set by IEEE, safety concerns about electromagnetic fields from power lines, new and powerful magnets, and single-mode optical fibers.

Ancillaries
Instructor’s Solutions Manual

Contents
1. Complex Vectors
2. Maxwell’s Equations
3. Uniform Plane Waves
4. Reflection and Transmission of Waves
5. Waveguides and Resonators
6. Transmission Lines
7. Antennas
8. Topics in Waves
9. Electrostatic Fields
10. Electric Force and Energy

Discrete Systems Laboratory Using MATLAB®, 2nd Edition
Martin Schetzen, Northeastern University
Vinay K. Ingle, Northeastern University


This brief supplement provides 16 hands-on laboratory experiments that students can perform using MATLAB® in lab sections that accompany lecture courses in Linear Systems or DSP. The 16 experiments are grouped into four main topic areas: sampling and digital-to-analog (D/A) conversion; the discrete-time Fourier transform; gain and phase-shift studies of digital filters; and analog-to-digital (A/D) quantization. The goal of these experiments is to enable students to understand the full physical significance of key concepts through a deeper understanding of the underlying mathematical formulas—not to teach MATLAB®. In each experiment, students enter problem parameter values, plot the results using MATLAB®’s powerful plotting functions, and then respond to questions in the manual that require them to analyze and interpret these results. The experiments challenge students to approach the study of these topics in the role of an experimental investigator; students are required to define the quantitative values and size properties of each design criterion in a problem. As a result, students develop an appreciation of the physical meaning of the derived results, their theoretical and physical implications, and the use of the scientific method.

Key Features
• Meets the general ABET requirements for increased lab, design and technology components for undergraduates, for the Linear Systems course in EE.
• Students learn basic concepts of linear systems through hands-on, experimental studies that teach how theoretical and experimental studies complement each other.
• Printed manual contains 16 lab experiments, with MATLAB® screen illustrations explaining how to run each supporting MATLAB® lab program, and questions guiding student exploration.
• Labs are designed to promote original thinking by enabling students to analyze physical situations simulated on the computer in the MATLAB® environment.

Contents
Part I: Sampling and Reconstruction
1. Ideal Sampling and Reconstruction
2. Non-Ideal Reconstruction
3. Practical Interpolators
4. Sampling and Reconstruction of Periodic Signals
5. Sampling and Pendulum Motion

Part II: The Discrete-Time Fourier Transform
6. Resolution of Two Sinusoids
7. Separation of Two Sinusoids
8. Analysis of Periodic Waveforms

Part III: Gain and Phase-Shift

Contemporary Linear Systems Using MATLAB®, 2nd Edition
Robert D. Strum, Naval Postgraduate School, Emeritus
Donald E. Kirk, San Jose State University


This book thoroughly integrates the use of the MATLAB® computing environment into the standard sequence of courses taken by electrical engineering majors. Use of this text makes it possible to focus on the problems being solved rather than on the programming necessary to obtain a solution. The authors utilize a computer-based approach in which computer solutions and theory are viewed as mutually reinforcing, rather than as an either/or proposition. Additionally, they adhere to the axiom that one learns by doing rather than by listening. This text features more than 100 examples, 200 exercises, and 250 MATLAB® scripts that directly support the authors’ flexible treatment of discrete and continuous time.

Key Features
• Proven pedagogical organization with each chapter designed as follows: Preview (for motivation); Basic Concepts (including Illustrative Examples); Solved Examples and MATLAB® Applications (including comprehensive illustrations); Reinforcement and Exploration Problems; Definitions-Techniques-Connections (summary of important relationships); MATLAB® Functions Used (a list).
• “Retrospectives” are provided after Chapters 6, 8, 9, and 11, which integrate the material by pausing and reconsidering the interrelationships of the material that has gone before.
• Scripts provided on the book’s website include answers to problems, solved examples, chapter figures plotted with MATLAB®, and plots used as problem statements.
• Can be used as a core text or as a MATLAB® supplement to a primary textbook.

Contents
1. Signals and Sequences
2. Continuous Systems
3. Laplace Transforms and Applications
4. Frequency Response of Continuous Systems
5. Continuous-Time Fourier Series and Transforms
6. State-Space Topics for Continuous Systems
7. Discrete Systems
8. z-Transforms and Applications
9. Frequency Response of Discrete Systems
10. Discrete Fourier Transforms
11. State-Space Topics for Discrete Systems

Appendix A: MATLAB®: An Overview
Appendix B: Useful Formulae and Definitions
of five successful texts on PSpice and power circuits and how they operate within ICs. He then moves on to a more detailed study of devices and circuit design and analysis techniques. He then provides a thorough introduction to the use of PSpice for testing, verification, and refinement of circuit designs. Includes text screen captures from OrCAD and PSpice schematic capture.

The "breadth first" approach introduces students to electronics at the circuit level before moving to the device level, therefore making topic coverage more understandable and flexible.

Numerous, worked-out examples and figures provide specific, applied illustrations of theoretical concepts.

Student Learning Outcomes (SLOs) and Key Points clearly indicate what students should know after reading the chapter and identify and assimilate the major ideas presented.

Design Integration helps to develop the ability to design a system, component, or process to meet desired ends.

Worked-out examples and PSpice Simulation and Verifications serve as a road map for the complete and effective program of learning that is presented.

A Top-Down Approach to support one- or two-term electronics courses with a study of electronics at the circuit level, and then moves on to the device level.

Microelectronic Circuits: Analysis and Design combines a "breadth-first" approach to teaching electronics with a strong emphasis on electronics design and simulation. Professor Rashid first introduces students to the general characteristics of circuits (ICs) to prepare them for the use of circuit design and analysis techniques. He then moves on to a more detailed study of devices and circuits and how they operate within ICs. This approach makes the text easily adaptable to both one and two-semester electronics courses. Students gain a strong systems perspective and can readily fill in device-level detail as the course (and their job) requires. In addition, Rashid, author of five successful texts on PSpice and power electronics, directly addresses students needs for applying theory to real-world design problems and mastering the use of PSpice for testing and verifying their designs. More than 50% of the problems and examples in the text concentrate on design, with PSpice used extensively in the design problems.

New to This Edition
- New chapters on MOSFETs and amplifiers, as well as Semiconductors and PN Junctions.
- Increased emphasis on MOSFETs and active biasing techniques so that students can move easily to differential amplifiers and ICs.
- Extensive revision of power amplifiers content to include MOSFET circuits with class C, D and E amplifiers.
- Complete revision of the chapter on BJTs.

- Integrated PSpice/OrCad software for both analysis and design verifications.
- Integrated MathCAD files for calculations of worked out examples so that students can try similar problems and explore the effects of design parameters.

Key Features
- Gives students a solid working appreciation for circuit design issues and processes, with numerous worked-out design examples, end-of-chapter design problems, and clearly outlined design guidelines and procedures.
- Provides a thorough introduction to the use of PSpice for testing, verification, and refinement of circuit designs. Includes text screen captures from OrCAD and PSpice schematic capture.
- The "breadth first" approach introduces students to electronics at the circuit level before moving to the device level, therefore making topic coverage more understandable and flexible.
- Numerous, worked-out examples and figures provide specific, applied illustrations of theoretical concepts.
- Student Learning Outcomes (SLOs) and Key Points clearly indicate what students should know after reading the chapter and identify and assimilate the major ideas presented.
- Design Integration helps to develop the ability to design a system, component, or process to meet desired ends.
- Worked-out examples and PSpice Simulation and Verifications serve as a road map for the complete and effective program of learning that is presented.
- A Top-Down Approach to support one- or two-term electronics courses with a study of electronics at the circuit level, and then moves on to the device level.

Ancillaries

Also Available
Microelectronic Circuits: Analysis and Design
First Edition, Complex Chinese Version

Contents
1. Introduction to Electronics and Design

2. Introduction to Amplifiers and Frequency Response
   Amplifier Characteristics / Amplifier Types / Cascaded Amplifiers / Frequency Response of Amplifiers / Miller’s Theorem / Frequency Response Methods / PSpice/SPICE Amplifier Models / Amplifier Design

3. Introduction to Operational Amplifiers and Applications

4. Semiconductor Diodes
   Diodes / Transfer Characteristics of Diode Circuits / Practical Diodes / Analysis of Practical Diode Circuits / Modeling of Practical Diodes / Zener Diodes / Light-Emitting Diodes / Power Rating / Diode Data Sheets

5. Applications of Diodes

6. Semiconductors and pn Junctions
   Characteristics
   Semiconductor Materials / Zero-Biased pn Junction / Reverse-Biased pn Junction / Forward-Biased pn Junction / Junction Current Density / Temperature Dependence / High-Frequency AC Model

7. Metal Oxide Semiconductor Field-Effect Transistors
   Metal Oxide Field-Effect Transistors / Enhancement MOSFETs / Depletion MOSFETs / MOSFET Models and Amplifier / A MOSFET Switch / DC Biasing of MOSFETs / Common-Source (CS) Amplifiers / Common-Drain Amplifiers / Common-Gate Amplifiers / Multistage Amplifiers / DC Level Shifting and Amplifier / Frequency Response of MOSFET Amplifiers / Design of MOSFET Amplifiers

8. Bipolar Junction Transistors and Amplifiers
   Bipolar Amplifiers / Bipolar Junction Transistors / Principles of BJT Operation / Input and Output Characteristics / BJT Circuit Models / The BJT Switch / DC Biasing of Bipolar Junction Transistor / Common-Collector Amplifiers / Common-Emitter Amplifiers / Common-Base Amplifiers / Multistage Amplifiers / The Darlington Pair / DC Level Shifting and Amplifier / Frequency Model and Response of Bipolar Junction Transistors / Frequency Response of BJT Amplifiers / Low Cutoff Frequencies / MOSFETs versus BJTs / Design of Amplifiers

9. Differential Amplifiers

10. Feedback Amplifiers

11. Power Amplifiers
   Classification of Power Amplifiers / Power Transistors / Class A Amplifiers / Class B Push-Pull Amplifiers / Complementary Class AB Push-Pull Amplifiers / Class C Amplifiers / Class D Amplifiers / Class E Amplifiers / Short-Circuit and Thermal Protection / Power Op-Amps / Thermal Considerations / Design of Power Amplifiers
12. Active Filters
Active versus Passive Filters / Types of Active Filters / First-Order Filters / The Biquadratic Function / Butterworth Filters / Transfer Function Realization / Low-Pass Filters / High-Pass Filters / Band-Pass Filters / Band-Reject Filter / All-Pass Filters / Switched- Capacitor Filters / Filter Design Guidelines

13. Oscillators
Principles of Oscillators / Audio- Frequency Oscillators / Radio Frequency Oscillators / Crystal Oscillators / Active-Filter Tuned Oscillators / Design of Oscillators

14. Operational Amplifiers

15. Introduction to Digital Electronics

16. Integrated Analog Circuits and Applications

Appendix A: Introduction to OrCAD
Appendix B: Review of Basic Circuits
Appendix C: Low Frequency Hybrid BJT Model
Appendix D: Ebers-Moll Model of Bipolar Junction Transistors
Appendix E: Passive Components
Appendix F: Design Problems

Image Processing, Analysis, and Machine Vision

Fourth Edition
Milan Sonka, University of Iowa
Vaclav Hlavac, Czech Technical University-Prague
Roger Boyle, Prifysgol Aberystwyth, Aberystwyth

870 pages. Casebound. 8 x 9-1/4. 1-Color. ©2015.

Also Available in AISE
AISE Image Processing Analysis

This new edition of Image Processing, Analysis, and Machine Vision is a robust text providing deep and wide coverage of the full range of topics encountered in the field of image processing and machine vision. As a result, it can serve undergraduates, graduates, researchers, and professionals looking for a readable reference. The book’s encyclopedic coverage of topics is wide, and allows it to be used in more than one course, for both image processing and machine vision classes. While students do not need to have taken advanced mathematics to understand basic concepts, making this a good choice for undergraduates, more advanced readers can take advantage of the rigorous mathematical coverage that the text provides. This text is distinguished by its easy-to-understand algorithm descriptions of difficult concepts, and a wealth of carefully selected problems and examples.

New to This Edition
• The “Problems and Exercises” section in each chapter has been updated and moved back into the core book, instead of only being available in the MATLAB® Companion workbook.
• Many sections have been rewritten or reintroduced with 15% newly written material presenting state-of-the-art methods and techniques that have already proven their importance in the field.
• Includes many of the rapid developments in the field, including new topics: Radon transform, unified approach to image/template matching, efficient object skeletonization (MB and MB2 algorithms), nearest neighbor classification including BBF/FLANN, random forests, Markov random fields, Gaussian mixture models–expectation maximization, scale invariant feature transform (SIFT), recent 3D image analysis/vision development, texture description using local binary patterns, and several point tracking approaches for motion analysis.
• Chapter 12 has been entirely rewritten, presenting all new content on the reconstruction from 3D.
• Approaches to 3D vision have been heavily revised.
• Now with a 16-page 4-color insert.
• Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Key Features
• Each chapter is supported by an extensive list of references and exercises.
• A selection of algorithms is summarized and presented formally in a manner that will aid implementation.
• Reflects the authors’ experience in teaching one and two semester undergraduate courses in Digital Image Processing, Digital Image Analysis, Image Understanding, Medical Imaging, Machine Vision, Pattern Recognition, and Intelligent Robotics at their respective institutions.
• Each chapter further includes a concise summary section.

Also Available
Instructor’s Solution Manual

Contents
1. Introduction
2. The Image, Its Representations and Properties
3. The Image, Its Mathematical and Physical Background
4. Data Structures for Image Analysis
5. Image Pre-Processing
6. Segmentation I
7. Segmentation II
8. Shape Representation and Description
9. Object Recognition
10. Image Understanding
11. 3D Geometry, Correspondence, 3D from Intensities
12. Use of 3D vision
13. Mathematical Morphology
14. Image Data Compression
15. Texture
16. Motion Analysis

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Image Processing, Analysis and Machine Vision: A MATLAB® Companion
Tomas Svoboda, Czech Technical University-Prague
Jan Kybic, Czech Technical University-Prague
Vaclav Hlavac, Czech Technical University-Prague

This new MATLAB® exercise book is intended to be an aid for both students and teachers. Students can learn from the short answer questions, formulated problems, and programmed examples, while teachers will find the book useful for preparing examples for lectures and assignments. Co-authored by Vaclav Hlavac, one of the authors of Image Processing, Analysis, and Machine Vision, this book can be used as a supplement to the text by Sonka, Hlavac, and Boyle, but it is not restricted to that text alone. The exercises prove useful in all areas where students require hands-on practice with MATLAB®.

Contents
Part 1 - Image Fundamentals
1. Introduction to Image Engineering
2. Image Acquisition
3. Image Geometry
Part 2 - Image Processing
4. Image Transforms
5. Image Enhancement
6. Image Restoration
7. Image Reconstruction from Projection
8. Image Coding
Part 3 - Image Analysis
9. Image Segmentation
10. Object Representation and Description
11. Feature Measurement and Error Analysis
12. Texture Analysis
13. Shape Analysis
Part 4 - Image Understanding
14. Stereo Vision
15. 3-D Shape Information Recovery
16. Matching and Understanding
17. Multi-Sensor Image Fusion
18. Content-Based Image Retrieval

Image Engineering
Yujin Zhang, Tsinghua University

One of the fastest growing disciplines, Image Engineering is a broad subject encompassing computer science, electrical and electronic engineering, mathematics, physics, physiology, and psychology. This comprehensive book attempts to introduce the basic concepts, theories, methodologies, and techniques of image engineering. At the same time, it also furnishes a wide-ranging survey of up-to-date topics and state-of-the-art methods in image engineering.

Key Features:
• This book consists of four parts dealing respectively with image fundamentals, image processing, image analysis, and image understanding.
• Numerous figures, tables, examples, and problems are given in this book to help the students understand the subject. Also, more than 300 key references are given at the end of the book.
• Suitable for courses in image engineering, computer science, electrical and electronic engineering, image-pattern recognition, information processing, and intelligent information systems.
• Can also be of use to scientists and engineers doing research and development related to image engineering.

Contents
9S12, this book describes both the general processes and the specific details involved in microcomputer simulation. In particular, detailed case studies are used to illustrate fundamental concepts, and laboratory assignments are provided.

Introduction to Embedded Systems Interfacing to the Freescale 9S12
Jonathan W. Valvano, University of Texas at Austin

This book employs a bottom-up educational approach, with an overall educational objective of helping students to discover how the computer interacts with its environment through learning basic computer architecture, assembly language programming, as well as through an introduction to interfacing. Developed around the Freescale 9S12, this book describes both the general processes and the specific details involved in microcomputer simulation. In particular, detailed case studies are used to illustrate fundamental concepts, and laboratory assignments are provided.

Key Features:
Valvano uses action components for a "learn-by-doing" educational approach. Such action components include:
• Checkpoints: Short questions meant as an immediate feedback mechanism for the reader to evaluate his or her level of comprehension. These can be found throughout the book and should be performed while reading the chapter. Answers to checkpoints are given in Appendix 4.
• Examples: Design examples are included within each chapter for the purpose of applying the knowledge presented in that chapter to solve a specific problem.
• Homework problems: Found at the end of each chapter and are intended to evaluate the reader’s understanding of specific topics introduced in the chapter.
• Tutorials: Each tutorial includes a sequence of actions (specific things for the reader to do) and a list of questions. Tutorials are meant to be performed without supervision, and should be performed after reading the chapter, but before attempting the labs or homework. Answers to the tutorial questions are also given in Appendix 4.
• Laboratory assignments: These can be found at the end of each chapter. Each laboratory solution can first be built and tested using the TExaS simulator, then downloaded and run on an actual 9S12. Only by performing the laboratory assignments can the reader truly assimilate the hardware and software concepts introduced in this book. Laboratories are meant to be performed under the supervision of an instructor, and involve the classic engineering processes of design, construction, debugging, and evaluation.
• Additional Labs and tutorials can be found at the accompanying website.

Ancillaries
Instructor's Solutions Manual
Also Available
Introduction to Embedded Systems Interfacing to the Freescale 9S12
Spanish Version

Contents
1. Introduction to Embedded Microcomputer Systems
   Overview / Attitude / Basic Components of an Embedded System / Flowcharts and Structured Programming / Product Development Cycle / Successive Refinement / Quality Programming / Debugging Theory / Tutorial / Getting Started
2. Introduction to Assembly Language Programming
   Basic Approach to Assembly Programming on the 9S12 / Simple Addressing Modes / Memory Transfer Operations / Memory Allocation / Subroutines / Input/Output / Tutorial 2: Running with TExaS
3. Information
   Hexadecimal Conversion / Boolean Information / 8-Bit Numbers / Character Information

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Embedded Microcomputer Systems Real Time Interfacing

Third Edition
Jonathan W. Valvano, University of Texas at Austin


Embedded Microcomputer Systems: Real Time Interfacing provides an in-depth discussion of the design of real-time embedded systems using 9S12 microcontrollers. This book covers the hardware aspects of interfacing, advanced software topics (including interrupts), and a systems approach to typical embedded applications. The balanced, in-depth treatment of both hardware and software issues important in real-time embedded systems design differentiates this text from other microcomputer systems books. It features a wealth of detailed case studies that demonstrate basic concepts in the context of actual working examples of systems. It also features a unique simulation software package on the bound-in CD-ROM (called Test Execute and Simulate, or TExaS), for short, that provides a self-contained software environment for designing, writing, implementing, and testing both the hardware and software components of embedded systems.

New to This Edition
- Content on the now obsolete 6811 microcontroller has been removed.
- Includes numerous new design examples.
- Many new exercises have been added which are divided into “Simple Answer,” “Detailed Design,” and “Lab Assignments” sections.
- Additional content in the sections on real-time operating systems (Chapter 5) and file systems (Chapter 10).
- Brand new sections on: requirements documents, MOS circuits, low power design, transmission lines, parallel programming, recursion, logic analyzers, modular programming, synchronization using semaphores, pseudo vectors, time jitter, I2C, motor electromagnetic, brushless DC motor, programming flash memory, audio circuits, PWM DAC, wireless systems, and FFT.

Key Features
- Emphasizes the importance of combining concepts and examples as an effective method of educating student engineers.
- Presents a complete bottom-up approach to embedded systems.
- Rich with detailed case studies that illustrate the basic concepts in the context of actual working embedded systems applications.
- Numerous “Checkpoint” questions interspersed throughout the text test conceptual understanding as students read. The answers are provided at the end of the book for self evaluation.
- Unique pedagogical features, such as “Common Error”, “Observation,” and “Programming Tip,” that enable easy implementation of the concepts learned in problems and in labs.
- Simulation software package included on bound-in CD-ROM (Test Execute and Simulate, or TExaS) provides a self-contained software environment for designing, writing, implementing, and testing both the hardware and software components of embedded systems.

Ancillaries
- Instructor’s Solutions Manual
- Also Available
  Embedded Microcomputer Systems Real-Time Interfacing

Contents

1. Microcomputer Based Systems
- Computer Architecture / Embedded Computer Systems / The Design Process / Digital Logic and Open Collector / Digital Representation of Numbers / Common Architecture of the 9S12 / 9S12 Architecture Details / Phase-Lock Loop (PLL) / Parallel I/O Ports / Choosing a Microcontroller

2. Design of Software Development

3. Interfacing Methods
- Introduction / Key Wake-Up / Blind Cycle Counting / Synchronization / Gadjfly or Busy-Wait Synchronization / Parallel I/O Interface Examples / Serial Communications Interface (SCI) Device Driver / Parallel Port LCD Interface with the HD44780 Controller

4. Interrupt Synchronization
- What are Interrupts? / Reentrancy and Critical Sections / First-In-First-Out Queue / General Features of Interrupts on the 9S12 / Interrupt Vectors and Priority / External Interrupt Design Approach / Polled vs. Vectored Interrupts / Pseudo-Interrupt Vectors / Key Wake-Up Interrupt Examples / Power System Interface Using XIRQ Synchronization / Interrupt Polling Using Linked Lists / Interrupt Priority / Round-Robin Polling / Periodic Interrupts / Low Power Design

5. Real-Time Operating Systems
- Introduction / Round-Robin Scheduler / Semaphores / Thread Synchronization and Communication / Fixed Scheduling / OS Considerations for I/O Devices

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6. Timing Generation and Measurements
Input Capture / Output Compare / Frequency Measurement / Conversion Between Frequency and Period / Pulse Accumulator / Pulse-Width Modulation on the MC9S12C32

7. Serial I/O Devices

8. Parallel Port Interfaces
Input Switches and Keyboards / Output LEDs / Liquid Crystal Displays / Transistors Used for Computer-Controlled Current Switches / Computer-Controlled relays, Solenoids, and DC Motors / Stepper Motors / Servo Motors

9. Memory Interfacing
Introduction / Address Decoding / General Memory Bus Timing / External Bus Timing / General Approach to Interfacing / 9512 Paged Memory / Programming Flash EEPROM / Dynamic RAM (DRAM)

10. High Speed I/O Interfacing
The Need For Speed / High-Speed I/O Applications / General Approaches to High-Speed Interfaces / Fundamental Approach to DMA / LCD Graphics / Secure Digital Card Interface / File System Management

11. Analog Interfacing
Resistors and Capacitors / Operational Amplifiers (Op Amps) / Analog Filters / Digital-to-Analog Converters / Analog-to-Digital Converters / Sample and Hold / BIFET Analog Multiplexer / ADC System / Power / Multiple-Access Circular Queue / Internal ADCs

12. Data Acquisition Systems
Introduction / Transducers / DAS Design / Analysis of Noise / Data Acquisition Case Studies

13. Microcomputer-Based Control Systems
Introduction to Digital Control Systems / Open-Loop Control Systems / Simple Closed-Loop Control Systems / PID Controllers / Fuzzy Logic Control

14. Simple Networks
Introduction / Communication Systems Based on the SCI Serial Port / Design and Implementation of a Controller Area Network (CAN) / Wireless Communication / Modern Communications

15. Digital Filters
Basic Principles / Simple Digital Filter Examples / Impulse Response / High-Q 60-Hz Digital Notch Filter / Effect of Time Jitter on Digital Filters / Discrete Fourier Transform / FIR Filter Design / Direct-Form Implementations
Embedded Systems & Robots: Projects Using the 8051 Microcontroller

Subrata Ghoshal, International Institute of Information and Technology-Pune


Embedded Systems & Robots: Projects Using the 8051 Microcontroller is meant to serve as a reference book on real-time embedded system design and the applications of the 8051 microcontroller for undergraduate as well as postgraduate students of computer science, information technology, electronics, instrumentation, mechatronics, and other related disciplines. The book will also prove useful to general readers who wish to understand and fabricate simple working models of robots.

The book highlights the need for accurate scheduling in real-time systems and indicates the related solution-techniques through assembly language programming. It contains discussions on the importance of data structures in real-time scheduling and interfacing issues of sensors such as SONAR, infrared, LDR, and tactile sensors. The book provides complete fabrication blue-prints of several robot examples, including line-follower robot, maze-solving robot, obstruction-detecting robot, shadow-activated robot, learning robot, and humanoid robot. The text uses simple and lucid language for easy understanding of the concepts involved. A large number of illustrations (in color where required) have been incorporated to enhance understanding of relevant technical details. All circuits shown in the book have been tested. Review exercises, including objective-type questions, have been provided at the end of every chapter to test the students’ understanding of the topics discussed.

Key Features
- Delineates 11 do-it-yourself projects using the 8051 microcontroller with complete hardware circuit details and software listings.
- Follows a step-by-step approach for understanding the design concepts of real-time embedded systems.
- Contains over 350 diagrams, photographs, and tables for quick, clear, and easy understanding.
- Includes 16 color plates to enhance display of selected figures and photographs.

Contents
1. Real-Time Embedded Systems and Robots
2. My First Embedded System
3. My First Robot
4. A Robot That Learns
5. Designing an Intelligent Clock
6. Advanced Digital Clock: Stopwatch & Alarm Settings
7. Industrial Infrared Counter
8. Line-Follower Robot
9. Maze-Solving Robot
10. Obstruction-Detecting Robot
11. Robotic Gripper and Arm
12. Humanoid Robot
Chip Design for Submicron VLSI: CMOS Layout and Simulation

John P. Uyemura, Georgia Institute of Technology


This book teaches the principles of physical design, layout, and simulation of CMOS integrated circuits. It is written around a very powerful CAD program called Microwind that is available on the accompanying CD-ROM. Featuring a friendly interface, Microwind is both educational and useful for designing CMOS chips. When coupled with its companion program on the CD-ROM, DSCH, Microwind provides an automated design environment where one can design a logic schematic and translate it into a CMOS circuit with a few easy steps. Throughout, the book centers on physical design as a central theme.

Key Features
- Microwind code is fast and students can simulate a circuit using a BSIM4 MOSFET model. The 2-dimensional viewer displays the patterned layering along any selected line. The 3-dimensional simulator draws a 3D perspective view of the chip as it is fabricated.
- Illustrates how material layers are patterned to create a CMOS integrated circuit in the first part of the book with Microwind. The discussion covers the basics of the CMOS fabrication sequence and how it relates to using a layout editor.
- Covers the electrical characteristics of MOSFETs as they relate to the layout. Simple analytic expressions are compared to SPICE models in Microwind.
- Provides CMOS logic circuits and chip design problems in the main portion of the book.
- Includes a wealth of examples to help students master the material.

Ancillaries

Contents
1. Installing the Microwind Software
   Getting Started / Exploring Microwind
2. Views of a Chip
   The Design Hierarchy / Integrated Circuit Layers / Photolithography and Patterning / Planarization / Electrical Characteristics / Silicon Characteristics / Overview of Layout Design
3. CMOS Technology
   Meet the MOSFETs / CMOS Fabrication / Submicron CMOS Processes / Process Technologies in Microwind / Masks and Layout / The Microwind MOS Generator / Chapter Summary and Roadmap
4. Using a Layout Editor
   Lambda-Based Layout / Rectangles and Polygons / The MOS Generator Revisited
5. CMOS Design Rules
   Types of Rules / The SCMOS Design Rule Set / FET Layout
6. MOSFETs
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7. MOSFET Modeling with SPICE
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8. CMOS Logic Gates
   The Inverter / NAND and NOR Gates / Complex Logic Gates / The Microwind Compile Command / Tri-State Circuits / Large FETs / Transmission Gates and Pass Control
9. Standard Cell Design
   Cell Hierarchies / Cell Libraries / Library Entries / Cell Shapes and Floor Planning
10. Storage Elements
    SR Latch / Bit-level Register / D-type Flip Flop / Dynamic DFF / The Static RAM Cell
11. Dynamic Logic Circuits
    Basic Dynamic Logic Gates / Domino Logic / Self-Resetting Logic / Dynamic Memories
12. Interconnects
    Modeling an Isolated Line / Long Interconnects / Crosstalk Capacitances / Interconnect Wiring Tools / General Routing Techniques
13. System Layout
    Power Supply Distribution / Pad Generation / Input and Output Circuits / The Logo Generator
14. SOI Technology
    Modern SOI CMOS / Why SOI? / Problems with SOI / SOI in Microwind
15. Digital System Design
    A First Look / Editing Features / Creating a Logic Schematic / Simulating a Logic Design / Creating a Macro Symbol / Creating A Verilog Listing / The DSCH-Microwind Design Flow / Using a Design Toolset / MOSFETs in DSCH
16. Digital System Design
    A 4-bit Binary Adder / Carry Lookahead Adder / Pipeline Register / Divide-by-N Circuit / Binary Counter
17. Capacitors and Inductors
    Integrated Capacitors / Integrated Inductors
18. Analog MOS Circuits
    Simple Amplifiers / MOSFETs / Resistors / Signal Wiring

Appendix 1 - Microwind Command Summary
Appendix 2 - Microwind CMOS Technology Files

Power Systems/Electric Machines

www.cengage.com/engineering
points raised.
• Six design projects are included in the text, all of which meet ABET requirements.

Ancillaries
Instructor's Solutions Manual
SI Version Instructor's Solutions Manual

Also Available
Power System Analysis & Design, Third Edition
Complex Chinese Version
Spanish Version

Contents
1. Introduction
2. Fundamentals
   Case Study: Making Microgrids Work / Phasors / Instantaneous Power in Single-Phase AC Circuits / Complex Power / Network Equations / Balanced Three-Phase Circuits / Power in Balanced Three-Phase Circuits / Advantages of Balanced Three-Phase vs. Single-Phase Systems
3. Power Transformers
   Case Study: PJM Manages Aging Transformer Fleet / The Ideal Transformer / Equivalent Circuits for Practical Transformers / The Per-Unit System / Three-Phase Transformer Connections and Phase Shift / Per-Unit Equivalent Circuits of Balanced Three-Phase Two-Winding Transformers / Three-Winding Transformers / Autotransformers / Transformers with Off-Nominal Turns Ratios
4. Transmission-Line Parameters
   Case Study: Transmission Line Conductor Design Comes of Age / Case Study: Six Utilities Share Their Perspectives on Insulators / Transmission Line Design Considerations / Resistance / Conductance / Inductance: Solid Cylindrical Conductor / Inductance: Single-Phase Two Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing / Inductance: Composite Conductors, Unequal Phase Spacing, Bundled Conductors / Series Impedances: Three-Phase Line with Neutral Conductors and Earth Return / Electric Field and Voltage: Solid Cylindrical Conductor / Capacitance: Single-Phase Two Wire Line and Three-Phase Three-Wire Line with Equal Phase Spacing / Capacitance: Stranded Conductors, Unequal Phase Spacing, Bundled Conductors / Shunt Admittances: Lines with Neutral Conductors and Earth Return / Electric Field Strength at Conductor Surfaces and at Ground Level / Parallel Circuit Three-Phase Lines
5. Transmission Lines: Steady-State Operation
   Case Study: The ABCs of HVDC Transmission Technologies / Medium and Short Line Approximations / Transmission-Line Differential Equations / Equivalent π Circuit / Lossless Lines / Maximum Power Flow / Line Loadability / Reactive Compensation Techniques
6. Power Flows
7. Symmetrical Faults
8. Symmetrical Components
   Case Study: Circuit Breakers Go High Voltage / Definition of Symmetrical Components / Sequence Networks of Impedance Loads / Sequence Networks of Series Impedances / Sequence Networks of Three-Phase Lines / Sequence Networks of Rotating Machines / Per-Unit Sequence Models of Three-Phase Two-Winding Transformers / Per-Unit Sequence Models of Three-Phase Three-Winding Transformers / Power in Sequence Networks
9. Unsymmetrical Faults
10. System Protection
11. Transient Stability
12. Power System Controls
    Case Study: Overcoming Restoration Challenges Associated with Major Power System Disturbances / Generator-Voltage Control / Turbine-Governor Control / Load-Frequency Control / Economic Dispatch / Optimal Power Flow
13. Transmission Lines: Transient Operation
    Case Study: VarISTAR® Type AZE Surge Arresters / Case Study: Change in the Air / Traveling Waves on Single-Phase Lossless Lines / Boundary Conditions for Single-Phase Lossless Lines / Bewley Lattice Diagram / Discrete-Time Models of Single-Phase Lossless Lines and Lumped RLC Elements / Lossy Lines / Multiconductor Lines / Power System Overvoltages / Insulation Coordination
14. Power Distribution
    Case Study: The Path of the Smart Grid / Primary Distribution / Secondary Distribution / Transformers in Distribution Systems / Shunt Capacitors in Distribution Systems / Distribution Software / Distribution Reliability / Distribution Automation / Smart Grids
Contents
Part 1 - Fundamentals of Electric Power Networks
1. General Methods for Network Analysis
2. Network Matrices of Power Systems
3. Sparse Techniques in Network Computations
4. Updated Solutions of Network Equations
5. Network Transformation, Reduction, and Equivalence
6. Piecewise Solutions of Large Scale Power Systems

Part 2 - Power Flow and Fault Analysis
7. Mathematical Models of Power Flow Calculations and Basic Solution Methods
8. Special Solution Methods to Power Flow Equation
9. Special Problems in Power Flow Calculation
10. Expansion for Power Flow Calculation Problem
11. The Method of Symmetrical Components and Sequence Networks
12. Computer Methods for Fault Analysis

Appendix 1 - Inversion of Block Matrices and Inverse Matrix Modification Lemma
Appendix 2 - IEEE 14-Bus and 30-Bus Test Systems

Fundamentals of Electric Drives
Mohamed El-Sharkawi, University of Washington


This text presents the fundamental concepts underlying electric machines, power electronics, and electric drives at the undergraduate level. Most existing books on electric drives concentrate either on converters and waveform analysis (ignoring mechanical load dynamics), or on motor characteristics (giving short shrift to analysis of converters and controllers). This book provides a complete overview of the subject, at the right level for EE students. The book takes readers through the analysis and design of a complete electric drives system, including coverage of mechanical loads, motors, converters, sensing, and controllers. In addition to serving as a text, this book serves as a useful and practical reference for professional electric drives engineers.

Key Features
- Broad, flexible presentation of topics supports either a stand-alone course in Electric Drives, or a broader survey of Energy Systems, at a level appropriate for undergraduates.
- Presents methods required to achieve speed control, position control, braking and holding of a variety of electric drives systems.
- Covers steady-state and dynamic analysis of electric drives systems.
- Presents the effect of the mechanical load inherent characteristic with respect to speed changes.
- Covers the topic of trajectory control, when starting and braking times must be controlled. This topic is especially important in high performance applications such as robotics and guided manipulations.
- The author uses his industry experience to develop real world examples and problems.
- Bound-in disk contains multimedia software that illustrates concepts of key drive systems, plus MATLAB® simulations that help students understand the process of designing electric drives.

Contents
1. Elements of Electric Drive Systems
2. Introduction to Solid State Devices
3. Introduction to Solid State Switching Circuits
4. Joint Speed-Torque Characteristics of Electric Motors and Mechanical Loads
5. Speed-Torque Characteristics of Electric Motors
6. Speed Control of Direct Current Motors
7. Speed Control of Induction Motors
8. Braking of Electric Motors
9. Braking of DC Motors
10. Braking of Induction Motors
11. Transient Time of Electric Drives System Index

Electric Machines: Principles, Applications, and Control Schematics
Second Edition
Dino Zorbas, McGill University


Also Available in AISE
AISE Electric Machines

Designed to serve as a textbook for a single semester undergraduate course on electric machines or electromechanical energy conversion devices, Electric Machines strikes a balance between theoretical coverage, clear explanations, and practical applications, presenting real-world applications of concepts without compromising rigor or continuity of the text. Zorbas guides the student through every topic, showing how the concepts can be applied to everyday decisions and use. The theory is well matched with invaluable industry insight. The book enables students to master the language of plant and electrical engineers, while improving their understanding of a machine’s start operation, control, and protection. The accompanying website provides additional content for each chapter, manufacturing data, and additional problems for students and instructors. Examples clarify theoretical concepts and analyze real-world problems. Most problems reflect actual industrial situations. Each example is followed by a practice exercise and answer so students be assured of comprehension.

New to This Edition
- New chapter on Electrical Safety and Energy Conservation.
- Additions and updates to sections on: power factor concepts in linear and non-linear loads, harmonics, super-capacitors, magnetic levitation, digital measuring instruments and wiring diagrams, optical measuring devices, special types of transformers, wind power generators, speed control of 3-phase induction motors (Star-Delta starters, speed controllers using IGBT and soft starters), programmable logic controllers (PLC’s), and unbalanced operation of 3-phase systems.

Key Features
- Reviews important concepts of phasor theory.
- Inclusion of control schematics.
- Clear and precise descriptions.
- Many application-based examples.
- Great balance between high quality theoretical coverage, easy explanations, and practical application examples.
- Chapters include what you will learn, conclusions, review questions, and problem sets.
- Includes a review of important mathematical relationships as well as manufacturers’ data for the discussion on three-phase synchronous machines.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Ancillaries
Instructor’s Solution Manual
MindTap

Contents
1. Basic Electromagnetic Concepts

2. Transformers
   Single-Phase Transformers / Three-Phase, Two-Winding Transformers / Autotransformers / Parallel Operation of Transformers / Instrument Transformers and Wiring Diagrams / Transformer’s Name-Plate Data

3. Three-Phase Induction Machines
   Three-Phase Induction Motors / Industrial Considerations / Measurement of Equivalent-Circuit Parameters / Asynchronous Generators / Controls

4. Single-Phase Motors
   Revolving Fields / Equivalent Circuit / Torque Developed / Methods of Starting Single-Phase Induction Motors / Magnetic Fields at Starting / Types of 1-Φ Motors

5. Synchronous Machines
   Three-Phase Cylindrical Rotor Machines: Motors / Three-Phase Cylindrical Rotor Machines: Generators / Salient-Pole Synchronous Machines

6. DC Machines
   Steady-State Analysis / Modern Methods of Speed Control

7. Control Schematics
   Basic Devices and Symbols / The Concept of Protection / Actual Control Schematics

8. Electrical Safety and Reduction in Energy Consumption
   Electrical Safety / Reduction in Energy Consumption

Appendix A: Three-Phase Systems
Appendix B: Per-Unit System
Appendix C: Laplace Transforms
Appendix D: Solid State Devices
Appendix E: Basic Economic Considerations
Appendix F: Photovoltaics
Appendix G: Tables
Appendix H: Bibliography

Electric Machines
Mulukutla S. Sarma, Northeastern University
Mukesh Kumar Pathak, IIT Roorkee


Electric Machines is designed to serve as a textbook for a course on electrical machines for undergraduate students of engineering. It provides an insight into the fundamentals of the theory and performance of electric machines. The book includes comprehensive discussions on phasor diagrams and their applications in the study of electric machines. Beginning with topics such as three-phase circuits, transformers, and machine windings, the book goes on to cover induction machines, synchronous machines, and direct current machines, and their transient and dynamic characteristics. Discussions on magnetic aspects of electric machines, principles of electromechanical energy conversion, and power semiconductor-controlled devices make the book a complete text for undergraduate students.

Written in an easy-to-understand manner, the book presents the relevant topics in a systematic and lucid manner. Solved examples have been interspersed throughout the text to illustrate problem-solving methodologies. A large number of unsolved problems have been included to test the students’ understanding of the concepts discussed.

Key Features
- Reviews important concepts of phasor diagrams, electromagnetic field theory, and electromechanical energy conversion.
- Includes discussions on power semiconductor-controlled drives.
- Discusses steady-state theory and performance of various types of machines.
- Incorporates pedagogical features such as illustrations, photographs, solved examples, and end-of-chapter exercises.

Contents
Part I: Introduction
1. A Review of Phasor Diagrams
2. Three-Phase Circuits
3. The Magnetic Aspect
4. Transformers
5. Principles of Electromechanical Energy Conversion
6. Machine Windings

Part II: Steady-State Theory and Performance
7. Induction Machines
8. Synchronous Machines
9. Direct-Current Machines

Part III: Transients and Dynamics
10. Transients and Dynamics of AC Machines
11. Direct Current Machine Dynamics
12. Power Semiconductor-Controlled Drives

Introduction to Wireless and Mobile Systems
Third Edition
Dharma P. Agrawal, University of Cincinnati
Qing-An Zeng, University of Cincinnati


This text explains the general principles of how wireless systems work, how mobility is supported, what the underlying infrastructure is, and what interactions are needed among different functional components. Designed as a textbook appropriate for undergraduate or graduate courses in Computer Science (CS), Computer Engineering (CE), and Electrical Engineering (EE), Introduction to Wireless and Mobile Systems focuses on qualitative descriptions and the realistic explanations of relationships between wireless systems and performance parameters. Rather than offering a thorough history behind the development of wireless technologies or an exhaustive list of work being carried out, the authors help CS, CE, and EE students learn this exciting technology through relevant examples, such as understanding how a cell phone starts working as soon as they get out of an airplane.

New to This Edition
- Experiments have been added to the end of each chapter for exploring the use of hardware and/or simulators.
- Challenging open-ended experimental questions have been added to many chapters.
- Expanded coverage of Sensor Networks and associated issues.
- Expanded coverage of IEEE 802.11 protocols and its variants.

Key Features
- Provides a clear understanding of how the mobility of cell phones is supported.
- Includes only the necessary mathematical formulations so students can appreciate their usefulness in numerous wireless and mobile system applications, without being overwhelmed by mathematical detail.
- Offers detailed discussions on how ad hoc and sensor networks are finding increasing use in military and commercial applications.
• Discusses how the introduction of the Bluetooth standard has revolutionized the field with easy replacement of connectors.
• Covers recent advances in the last chapter with an emphasis on the research work being carried out in wireless and mobile computing areas.
• Encourages students to use one of the simulators (ns-2, OPNET, or other stable simulators) to get a feel for the overall system complexity.
• Offers a list of class-tested laboratory experiments that could be used for projects in various chapters.

Ancillaries
Instructor’s Solutions Manual

Also Available
Introduction to Wireless and Mobile Systems

Contents
1. Introduction
2. Probability, Statistics, and Traffic Theories
   Introduction / Basic Probability and Statistics Theories / Traffic Theory / Basic Queuing Systems
3. Mobile Radio Propagation
4. Channel Coding and Error Control
   Introduction / Linear Block Codes / Cyclic Codes / Cyclic Redundancy Check (CRC) / Convolutional Codes / Interleaver / Turbo Codes / ARQ Techniques / Summary / References / Experiments
5. Cellular Concept
   Introduction / Cell Area / Signal Strength and Cell Parameters / Capacity of a Cell / Frequency Reuse / How to Form a Cluster / Cochannel Interference / Summary / Experiments
6. Multiple Radio Access
   Introduction / Multiple Radio Access Protocols / Contention-Based Protocols
7. Multiple Division Techniques for Traffic Channels
   Introduction / Concepts and Models for Multiple Divisions / Modulation Techniques
8. Traffic Channel Allocation
   Introduction / Static Allocation Versus Dynamic Allocation / Fixed Channel Allocation (FCA) / Dynamic Channel Allocation (DCA) / Hybrid Channel Allocation (HCA) / Allocation in Specialized System Structure / System Modeling
9. Network Protocols
10. Mobile Communication Systems
    Introduction / Cellular System Infrastructure / Registration / Handoff Parameters and Underlying Support / Roaming Support / Multicasting / Security and Privacy / Firewalls and System Security
11. Existing Wireless Systems
    Introduction / AMPS / IS-41 / GSM / PCS / IS-95 / IMT-2000
12. Satellite Systems
13. Ad Hoc Networks
    Introduction / Characteristics of MANETs / Applications / Routing / Table-Driven Routing Protocols / Source-Initiated On-Demand Routing / Hybrid Protocols / Vehicular Area Network (VANET) / Security Issues in Mobile Ad Hoc Networks (MANETs) / Network Simulators
14. Sensor Networks
15. Wireless LANs, MANs, and PANs
    Introduction / Wireless Local Area Networks (WLANs) / Enhancement for IEEE 802.11 WLANs / Wireless Metropolitan Area Networks (WMANs) using WiMAX and Mesh Networks / Mesh Networks / Wireless Personal Area Networks (WPANs) / ZigBee
16. Recent Advances

Acronyms
Appendix A – Erlang B Table
Appendix B – Simulation Projects
Materials Science and Engineering Properties

First Edition
Charles Gilmore, George Washington University

752 pages. Casebound. 8 x 10.4-Color. ©2015.

Also Available in SI Units

Materials Science and Engineering Properties is primarily directed to mechanical, civil, and aerospace engineering students. Although the book focuses on material sciences and mechanical properties of materials, it also includes a chapter on materials selection, making it extremely useful to civil engineers. The textbook provides students with a materials science and engineering background that offers a sufficient scientific basis that engineering properties of materials can be clearly understood. The textbook uses an integrated approach to treating the engineering properties of ceramics, metals, and polymers. In addition to the introductory chapters on materials science, there are chapters on mechanical properties, properties of engineering materials, the effects of temperature and time on mechanical properties, electrochemical effects on materials including corrosion, electroprocessing, batteries, and fuel cells, fracture and fatigue, composite materials, experimental methods in material science. In addition, the accompanying website contains the derivations of equations and advanced subjects related to the textbook as well as additional chapters on electrical, magnetic, and photonic properties of materials.

Key Features
- The only introductory textbook that unifies materials science and engineering subjects using energy and entropy.
- Reinforcement of basic concepts, such as chemical bonding, by showing how physical properties of materials are related to the atomic electron structure, chemical bonding, defects in the material, and microstructure.
- Analytical techniques used in this course, such as energy minimization and the application of probability, carry over into the study of other engineering systems.
- Integrated treatment of metals, ceramics, and polymers. Discussion of material properties that students regularly observe. Strength of nanostructured materials covered under strong solids.
- End-of-chapter material includes concept questions, Engineer in Training type questions, and homework problems and when appropriate design problems.
- Pedagogical elements include worked-out examples in each section, chapter goals, introductory chapter sections on what is important, and chapter summaries.
- Four-color figures and photographs give students a visual understanding of materials science in addition to an analytical one.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.
- Free companion website includes: advanced subjects, derivations of equations, chapters on electrical, magnetic, and photonic properties of materials; and links to videos produced by the National Science Foundation.

Contents
1. Introduction
2. Atoms, Chemical Bonding, Material Structure, and Physical Properties
3. The Structure of Real Materials
4. Temperature Effects on Atom Arrangements and Atom Motion
5. Phase Transformations and Phase Diagrams
6. Introduction to Mechanical Properties
7. Making Strong Materials
8. Engineering Materials
9. Time, Temperature, and Mechanical Properties
10. Oxidation, Degradation, Corrosion, Electroprocessing, Batteries, and Fuel Cells
11. Fracture and Fatigue
12. Composite Materials
13. Materials Processing
14. Material Selection
15. Experimental Methods
16. Electrical Properties of Materials
17. Magnetic Materials
18. Photonic Materials

Also Available
SI Version MindTap

SI Version Instructor’s Solution Manual

SI Version MindLink

New to This Edition
- New content has been added to the text including:
  - Enhanced crystallography descriptions and sections about the allotropes of carbon
  - Nanoindentation; mechanical properties of bulk metallic glasses
  - Mechanical behavior at small length scales
  - Integrated circuit manufacturing thin film deposition
- New problems have been added to the end of each chapter, as well as new special sections at the conclusion of each chapter that require the use of Knovel® online reference tool for Materials Science (www.knovel.com).

Key Features
- Chapter Openings introduce the student to relevant topics and ideas covered in that chapter.
- Have You Ever Wondered? questions designed to pique the interest of the reader relate the material covered in the chapter to its real world application.
- Considerably more focused on core Materials Science.
MATERIALS SCIENCE

- Includes end-of-chapter design problems and chapter summaries.
- A glossary of key words and definitions can be found at the end of each chapter.
- Instructor Supplements include a Solutions Manual that provides complete solutions to selected problems, annotated PowerPoint slides, as well as a bank of all images from the text.

Ancillaries
Instructor's Solutions Manual
SI Version Instructor's Solutions Manual

Also Available
The Science & Engineering of Materials, Sixth Edition
Spanish Version
The Science & Engineering of Materials, Fifth Edition
Thai Version
Korean Version

Contents
1. Introduction to Materials Science and Engineering
What is Materials Science and Engineering? / Classification of Materials / Functional Classification of Materials / Classification of Materials Based on Structure / Environmental and Other Effects / Materials Design and Selection
2. Atomic Structure
The Structure of Materials: Technological Relevance / The Structure of the Atom / The Electronic Structure of the Atom / The Periodic Table / Atomic Bonding / Binding Energy and Intermolecular Spacing / The Many Forms of Carbon
3. Atomic and Ionic Arrangements
Short-Range Order versus Long-Range Order / Amorphous Materials / Lattice, Basis, Unit Cells, and Crystal Structures / Allotropic or Polymorphic Transformations / Points, Directions, and Planes in the Unit Cell / Interstitial Sites / Crystal Structures of Ionic Materials / Covalent Structures / Diffraction Techniques for Crystal Structure Analysis
4. Imperfections in the Atomic and Ionic Arrangements
Point Defects / Other Point Defects / Dislocations / Significance of Dislocations / Schmid's Law / Influence of Crystal Structure / Surface Defects / Importance of Defects
5. Atom and Ion Movements in Materials
Applications of Diffusion / Stability of Atoms and Ions / Mechanisms for Diffusion / Activation Energy for Diffusion / Rate of Diffusion (Fick's First Law) / Factors Affecting Diffusion / Permeability of Polymers / Composition Profile (Fick's Second Law) / Diffusion and Materials Processing
6. Mechanical Properties: Part One
Technological Significance / Terminology for Mechanical Properties / The Tensile Test: Use of the Stress-Strain Diagram / Properties Obtained from the Tensile Test / True Stress and True Strain / The Bend Test for Brittle Materials / Hardness of Materials / Nanoindentation / Strain Rate Effects and Impact Behavior / Properties Obtained from the Impact Test / Bulk Metallic Glasses and Their Mechanical Behavior / Mechanical Behavior at Small Length Scales
7. Mechanical Properties: Part Two
8. Strain Hardening and Annealing
9. Principles of Solidification
Technological Significance / Nucleation / Applications of Controlled Nucleation / Growth Mechanisms / Solidification Time and Dendrite Size / Cooling Curves / Cast Structure / Solidification Defects / Casting Processes for Manufacturing Components / Continuous Casting and Ingot Casting / Directional Solidification (DS), Single Crystal Growth, and Epitaxial Growth / Solidification of Polymers and Inorganic Glasses / Joining of Metallic Materials
10. Solid Solutions and Phase Equilibrium
Phases and the Phase Diagram / Solubility and Solid Solutions / Conditions for Unlimited Solid Solubility / Solid-Solution Strengthening / Isostructural Phase Diagrams / Relationship Between Phase Diagram and Solidification of a Solid-Solution Alloy / Nonequilibrium Solidification and Segregation
11. Dispersion Strengthening and Eutectic Phase Diagrams
Principles and Examples of Dispersion Strengthening / Intermetallic Compounds / Phase Diagrams Containing Three-Phase Reactions / The Eutectic Phase Diagram / Strength of Eutectic Alloys / Eutectics and Materials Processing / Nonequilibrium Freezing in the Eutectic System / Nanowires and the Eutectic Phase Diagram
12. Dispersion Strengthening by Phase Transformations and Heat Treatment
Nucleation and Growth in Solid-State Reactions / Alloys Strengthened by Exceeding the Solubility Limit / Age or Precipitation Hardening / Applications of Age-Hardened Alloys / Microstructural Evolution in Age or Precipitation Hardening / Effects of Aging Temperature and Time / Requirements for Age Hardening / Use of Age-Hardenable Alloys at High Temperatures / The Eutectoid Reaction / Controlling the Eutectoid Reaction / The Martensitic Reaction and Tempering / The Shape-Memory Alloys (SMAs)
13. Heat Treatment of Steels and Cast Irons
Designations and Classification of Steels / Simple Heat Treatments / Isothermal Heat Treatments / Quench and Tempering / Treatments / Effect of Alloying Elements / Application of Hardenability / Specialty Steels / Surface Treatments / Weldability of Steel / Stainless Steels / Cast Irons
14. Nonferrous Alloys
Aluminum Alloys / Magnesium and Beryllium Alloys / Copper Alloys / Nickel and Cobalt Alloys / Titanium Alloys / Refractory and Precious Metals
15. Ceramic Materials
Applications of Ceramics / Properties of Ceramics / Synthesis and Processing of Ceramic Powders / Characteristics of Sintered Ceramics / Inorganic Glasses / Glass-Ceramics / Processing and Applications of Clay Products / Refractories / Other Ceramic Materials
16. Polymers
Classification of Polymers / Addition and Condensation Polymerization / Degree of Polymerization / Typical Thermoplastics / Structure-Property Relationships in Thermoplastics / Effect of Temperature on Thermoplastics / Mechanical Properties of Thermoplastics / Elastomers (Rubbers) / Thermosetting Polymers / Adhesives / Polymer Processing and Recycling
17. Composites: Teamwork and Synergy in Materials
Dispersion-Strengthened Composites / Particulate Composites / Fiber-Reinforced Composites / Characteristics of Fiber-Reinforced Composites / Manufacturing Fibers and Composites / Fiber-Reinforced Systems and Applications / Laminar Composite Materials / Examples and Applications of Laminar Composites / Sandwich Structures
18. Construction Materials
The Structure of Wood / Moisture Content and Density of Wood / Mechanical Properties of Wood / Expansion and Contraction of Wood / Plywood / Concrete Materials / Properties of Concrete / Reinforced and Prestressed Concrete / Asphalt
19. Electronic Materials
Ohm's Law and Electrical Conductivity / Band Structures of Solids / Conductivity of Metals and Alloys / Semiconductors / Applications of Semiconductors / General Overview of Integrated Circuit Processing / Deposition of Thin Films / Conductivity in Other Materials / Insulators and Dielectric Properties / Polarization in Dielectrics / Electrostriction, Piezoelectricity, and Ferroelectricity
20. Magnetic Materials

www.cengage.com/engineering
21. Photonic Materials
The Electromagnetic Spectrum / Refraction, Reflection, Absorption, and Transmission / Selective Absorption, Transmission, or Reflection / Examples and Use of Emission Phenomena / Fiber-Optic Communication System

22. Thermal Properties of Materials
Heat Capacity and Specific Heat / Thermal Expansion / Thermal Conductivity / Thermal Shock

23. Corrosion and Wear
Chemical Corrosion / Electrochemical Corrosion / The Electrode Potential in Electrochemical Cells / The Corrosion Current and Polarization / Types of Electrochemical Corrosion / Protection Against Electrochemical Corrosion / Microbial Degradation and Biodegradable Polymers / Oxidation and Other Gas Reactions / Wear and Erosion

Appendix A: Selected Physical Properties of Metals
Appendix B: The Atomic and Ionic Radii of Selected Elements
Answers to Selected Problems

New to This Edition
- A new chapter on corrosion and wear has been added, extend the traditional Materials Science curriculum.
- Chapter learning objectives have been added to the beginning of each chapter to aid in the learning and retention of chapter content as well as to assist instructors with assessment instruments.
- Extended discussion of crystallography.
- New material on the allotropes of carbon added to the discussion on atomic structure.
- New current research topics and applications such as nonoxidation, mechanical behavior of metallic glasses, and mechanical behavior at small length scales.
- New material on the vapor-liquid-solid mechanism of nanowire growth.
- Problems have been added to the end of each chapter, some of which require students to use Knovel^ online reference tool for Materials Science.
- Glossary items now in 2nd color for easier navigation.

Key Features
- Uses an integrated approach to Materials Science and Engineering throughout.
- Content is in line with the latest advances in the field allowing students and faculty to make use of the ideas and issues that are of current interest.
- Students can relate the content to the products and technologies they have experience with through the real-world examples used throughout.
- Each chapter contains a “Have You Ever Wondered?” set of questions designed to pique the interest of students and set the framework for the material to be covered in that chapter.

Ancillaries
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Also Available
Essentials of Materials Science & Engineering, First Edition
Portuguese Version
Complex Chinese Version

Contents
1. Introduction to Materials Science and Engineering
   What is Materials Science and Engineering? / Classification of Materials / Functional Classification of Materials / Classification of Materials Based on Structure / Environmental and Other Effects / Materials Design and Selection
2. Atomic Structure
   The Structure of Materials: Technological Relevance / The Structure of the Atom / The Electronic Structure of the Atom / The Periodic Table

3. Atomic and Ionic Arrangements
   Short-Range Order versus Long-Range Order / Amorphous Materials / Lattice, Basis, Unit Cells, and Crystal Structures / Allotropic or Polymorphic Transformations / Points, Directions, and Planes in the Unit Cell / Interstitial Sites / Crystal Structures of Ionic Materials / Covalent Structures / Diffraction Techniques for Crystal Structure Analysis

4. Imperfections in the Atomic and Ionic Arrangements
   Point Defects / Other Point Defects / Dislocations / Significance of Dislocations / Schmid’s Law / Influence of Crystal Structure / Surface Defects / Importance of Defects

5. Atom and Ion Movements in Materials
   Applications of Diffusion / Stability of Atoms and Ions / Mechanisms for Diffusion / Activation Energy for Diffusion / Rate of Diffusion / Fick’s First Law / Factors Affecting Diffusion / Permeability of Polymers / Composition Profile (Fick’s Second Law)

6. Mechanical Properties: Part One
   Technological Significance / Terminology for Mechanical Properties / The Tensile Test: Use of the Stress-Strain Diagram / Properties Obtained from the Tensile Test / True Stress and True Strain / The Bend Test for Brittle Materials / Hardness of Materials / Nanoindentation / Strain Rate Effects and Impact Behavior / Properties Obtained from the Impact Test / Bulk Metallic Glasses and Their Mechanical Behavior / Mechanical Behavior at Small Length Scales

7. Mechanical Properties: Part Two
   Fracture Mechanics / The Importance of Fracture Mechanics / Microstructural Features of Fracture in Metallic Materials / Microstructural Features of Fracture in Ceramics and Glasses / Weibull Statistics for Failure Strength / Analytic / Fatigue / Results of the Fatigue Test / Application of Fatigue Testing / Creep, Stress Rupture, and Stress Corrosion / Evaluation of Creep Behavior / Use of Creep Data

8.8. Strain Hardening and Annealing

9. Principles of Solidification
   Technological Significance / Nucleation / Applications of Controlled Nucleation / Growth Mechanisms / Solidification Time and Dendrite Size / Cooling Curves / Cast Structure / Solidification Defects / Casting Processes for Manufacturing Components / Solidification of Polymers and Inorganic Glasses / Joining of Metallic Materials

10. Solid Solutions and Phase Equilibrium
    Phase and the Phase Diagram / Solubility and Solid Solutions / Conditions for Unlimited Solid Solubility / Solid-Solution Strengthening / Isomorphous Phase Diagrams / Solidification
11. Dispersion Strengthening and Eutectic Phase Diagrams
   - Principles and Examples of Dispersion Strengthening / Intermetallic Compounds
   - Phase Diagrams Containing Three-Phase Reactions / The Eutectic Phase Diagram
   - Strength of Eutectic Alloys / Eutectics and Materials Processing / Nonequilibrium Solidification / Segregation
   - Freezing in the Eutectic System / Nanowires and the Eutectic Phase Diagram

12. Dispersion Strengthening by Phase Transformations and Heat Treatment
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Appendices
An Introduction to Mechanical Engineering
Third Edition
Jonathan Wickert, Iowa State University
Kemper Lewis, University at Buffalo • SUNY


Also Available in SI Units

An Introduction to Mechanical Engineering introduces students to the ever-emerging field of mechanical engineering, giving an appreciation for how engineers design the hardware that builds and improves societies all around the world. Intended for students in their first or second year of a typical college or university program in mechanical engineering or a closely related field, the text balances the treatments of technical problem-solving skills, design, engineering analysis, and modern technology.

New to This Edition
• 60% more homework problems.
  • New section on written and graphical communications.
  • New introduction to Newton’s Laws of Motion.
  • New design applications are developed in each chapter through the homework problems, case studies, and/or example problems, allowing students to learn how their engineering science knowledge gets transformed into engineered systems using design principles.
  • Many new and updated “Focus On” features, highlighting emerging trends and technologies in mechanical engineering, expose students to modern and recent global technologies, products, and events, and learn how engineers impact them.
  • Increased emphasis on the development of innovative solutions to technical challenges that address global, social, environmental, and economic issues.
  • Includes many new global, environmental, and social applications including: the NAE Grand Challenges; the Deepwater Oil Spill; clean energy vehicles; sustainable cities; advanced materials; global energy consumption; sports technology; design, policy, and innovation; and renewable energy.
  • New Cengage Learning Global Engineering CourseMate brings course concepts to life with interactive learning, study, and exam preparation tools that support the printed textbook. Watch student comprehension soar as your class works with the printed textbook and the textbook-specific website. Global Engineering CourseMate goes beyond the book to deliver what you need!

Key Features
• Addresses the questions “who are mechanical engineers” and “what do they do?”
• Explores innovative design experiences, problem-solving skills, basic engineering analysis, and case studies.
• Emphasizes design projects, and exposes students to computer-aided engineering, principles of engineering science, and mechanical engineering hardware.
• Includes a number of vignettes and case studies to demonstrate the realism of the material.
• “Focus on …” boxes in each chapter are used to highlight interesting topics and other emerging concepts in mechanical engineering, broadening the textbook’s coverage without detracting from its flow.
• Presents engineering as a visual and graphical activity by placing particular emphasis on the quality and breadth of the nearly three hundred photographs and illustrations. This text leverages realism to motivate students through interesting examples that offer a glimpse of what they will be able to study in later courses and, subsequently, practice in their own careers.

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SI Version Instructor’s Solutions Manual
Global Engineering CourseMate
Global Engineering CourseMate – SI Version
Cengage Learning’s Engineering CourseMate brings course concepts to life with interactive learning, study, and exam preparation tools that support the printed textbook. Visit www.cengage.com/coursermate for more details.

Also Available
An Introduction to Mechanical Engineering
First Edition, Korean Version
An Introduction to Mechanical Engineering

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8. Motion and Power Transmission

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Mechanics of Materials

Eighth Edition
James M. Gere, Stanford University
Barry J. Goodno, Georgia Institute of Technology

1130 pages. Casebound. 8 x 10. 4-Color. ©2013. 

Also Available in SI Units

The eighth edition of Mechanics of Materials continues its tradition as one of the leading texts on the market. With its hallmark clarity and accuracy, this text develops student understanding along with analytical and problem-solving skills. The main topics include analysis and design of structural members subjected to tension, compression, torsion, bending, and more. The book includes more material than can be taught in a single course giving instructors the opportunity to select the topics they wish to cover, while leaving any remaining material as a valuable student reference.

Key Features
- 4-color format provides better visualization of graphs and worked-out problems.
- Clarity and Accuracy: Considerable effort was spent in designing, checking, and proofreading the text and figures.
- Problems: The text offers more than 1000 problems for homework assignments and classroom discussions. The exercises are arranged in order of difficulty and placed at the end of the chapter making them easy to find without breaking up the subject matter.
- Examples: Numerous examples illustrate the theoretical concepts and show how those concepts may be used in practical situations. In some cases, photographs have been added showing actual engineering structures or components to reinforce the tie between theory and application.
- Both the International System of Units (SI) and the U.S. Customary System (USCS) are used in the examples and problems allowing students to gain proficiency using both.

Ancillaries
Instructor’s Solutions Manual
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Also Available
Mechanics of Materials, Seventh Edition
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Mechanics of Materials
Second Edition
Andrew Pytel, Pennsylvania State University
Jaan Kiusalaas, Pennsylvania State University
554 pages. Casebound. 8 x 10. 2-Color. ©2012.

The second edition of Mechanics of Materials by Pytel and Kiusalaas is a concise examination of the fundamentals of Mechanics of Materials. The book maintains the hallmark organization of the previous edition, as well as the time-tested problem solving methodology that incorporates outlines of procedures and numerous sample problems to help ease students through the transition from theory to problem analysis. Emphasis is placed on giving students the introduction to the field that they need, along with the problem-solving skills that will help them in their subsequent studies. This is demonstrated in the text by the presentation of fundamental principles before the introduction of advanced/ special topics.

New to This Edition:
• Now includes the analysis of the torsion of rectangular bars, discussing an important applied problem within engineering design.
• Expanded article on reinforced concrete beams now includes Ultimate Moment Analysis based upon the most recent code of the American Concrete Institute (ACI).
• Revised article on the design of intermediate columns now includes the most recent specifications of the American Institute of Steel Construction (AISC).
• Increased amount of figures to accompany homework problems.
• New and revised sample and homework problems.
• First edition Study Guide material now available online – complementary for students.

Key Features:
• Offers concise coverage of all of the required material for a Mechanics of Materials course.
• Covers fundamental concepts – clearly and simply – without clouding students’ understanding with details about special cases.
• Advanced topics are found in later chapters and are not interwoven into the early chapters on the basic theory, allowing the core material to be efficiently taught without skipping over topics within chapters.
• The general transformation equation for stress (including Mohr’s Circle) are deferred until Chapter 8, after students have gained experience with the basics of axial, torsional, and bending loads.
• In the derivation of formulas, the authors emphasize the physical situation before implementing mathematics to model the problem.
• Free-body diagrams are used throughout the text to identify unknown quantities and to recognize the number of independent equations.
• Virtually, every article is immediately illustrated by sample problems and homework problems that illustrate the principles and the problem-solving procedure introduced in the article.
• End-of-chapter homework exercises serve as a review of the material covered in the chapter.
• Design-oriented computer problems are included at the end of most chapters, intended to be solved using computer languages such as MathCAD and/or MATLAB®.
• The text contains an equal number of problems using SI and US Customary Units.
• Basic equations are summarized inside the back cover of the textbook for easy access.

Ancillaries:
Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Also Available:

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Engineering Mechanics: Statics

Computational Edition

Robert Soutas-Little, Michigan State University
Daniel J. Inman, Virginia Polytechnic University
Daniel S. Balint, Imperial College London


Also Available in SI Units

Engineering Mechanics: Dynamics

Computational Edition
Robert Soutas-Little, Michigan State University
Daniel J. Inman, Virginia Polytechnic University
Daniel S. Balint, Imperial College London


Also Available in SI Units

Focusing on the conceptual understanding of mechanics, these exciting new texts address developments in the methods of analyzing mechanics problems. They fully incorporate the highly sophisticated computational software packages currently available to students. The texts provide transition material to higher level courses, as well as a wealth of problems to foster understanding. All sample problems and the use of computational software (MathCAD®, MATLAB®, Mathematica® and Maple®) are presented in four separate manuals (one for each software program). Each manual explains how to use the software package to solve the example problems in the books.

Key Features:

- Separate manuals for MATLAB®, MathCAD®, Maple®, and Mathematica® present details on each computational software package and how it can be used in the solution of problems in either Statics or Dynamics.
- Homework problems are marked in such a manner that the instructor and student will know if a particular problem can and in some cases must be solved with the aid of software, or if it could be easily solved “by hand.”
- Computational methods were separated in the text so that they can be omitted if the instructor chooses. These methods would still be available as a reference for the student for later courses.
An Introduction to Planar Dynamics

Third Edition
Chen Guang, Nanyang Technological University - Singapore
Yap Fook Fah, Nanyang Technological University - Singapore


This book is intended for students taking a fundamental course in Engineering Mechanics. The material in this book is tailored in a concise manner for teaching the major concepts of Dynamics in one semester. Students cover the fundamental principles of Dynamics through the study of planar motion of particles and rigid bodies. Throughout the book, vectors are used as a basic mathematical tool. The authors believe that basic training in vector analysis will be of great help in giving students an in-depth understanding of the concepts and principles in Planar Dynamics.

Key Features
- Important underlying concepts, such as moving reference frames and relative motion, are consistently used throughout the text. There is a close connection between the study of particles and rigid bodies.
- A consistent vector approach to establishing principles and solving problems is followed.
- Emphasis is placed on the concept of relative motion—based on the principle of velocity/acceleration combination—bringing out the physical relevance of the terms in the velocity/acceleration equation.
- From rectilinear, circular motion to curvilinear motion, a straightforward way to study the combination of motion in different coordinate systems. From translation, rotation to general motion, an easy-to-follow approach to deriving/explaining the governing equations of motion of rigid body.
- A hierarchy of the principles and equations in Kinematics and Kinetics gives students a good overall picture of the knowledge structure.
- Each chapter has a summary to highlight the contents, followed by guidelines for problem solving.

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Finite Element Analysis

A Primer
S. M. Musa
A. V. Kulkarni
V. K. Havanur

300 pages. Casebound. 7 x 9. ©2014.

Today, the finite element method (FEM) has become a common tool for solving engineering problems in many industries for the obvious reasons of its versatility and affordability. This book contains materials applied to mechanical engineering, civil engineering, electrical engineering, and physics. It is written primarily for students in engineering, civil engineering, electrical engineering, and physics. It contains many 1D and 2D problems solved by the analytical method, by FEM using hand calculations, and by using ANSYS®, COMSOL®, and MATLAB® software. Results of all the methods have been compared.

Key Features
- Includes a comparison of solutions to the problems obtained by the analytical method, FEM hand calculations, and the software method
- Includes over 35 solved problems using software applications such as MATLAB, COMSOL, and ANSYS
- Accompanied by a DVD with applications and figures from the text
- Careful, balanced presentation of theory and applications

Contents
A First Course in the Finite Element Method

**Fifth Edition**
Daryl L. Logan, University of Wisconsin–Platteville


**Also Available in SI Units**

**New to This Edition**
- Now includes examples from other fields in order to demonstrate that FEM can be used to solve problems from a variety of engineering and mathematical physics areas.
- Chapter objective sections have been added to each chapter as a strategy to increase understanding and retention of the material.
- Short-answer type problems have been added to the end of each chapter to invoke the use of the creative thought process in understanding the principles of the Finite Element Method.
- End of chapter summaries and key equations sections have been added to each chapter for easy review.
- Additional plate bending real-world examples and problems have been included in order to enhance student understanding.
- Now in 2-color format for enhanced clarity and understanding of figures and tables.
- Increased amount of illustrations of 3D applications and solutions in stress and heat transfer analysis.
- Notation has been revised for consistency throughout.

**Key Features**
- Topics progress from basic to advanced, making the text suitable for a one or two-course sequence.
- Mathematics is presented in a simple and straightforward manner making this text accessible and easily understood.
- Each chapter is structured in a similar format. General principles are presented for each topic, followed by traditional applications of these principles, which are in turn followed by computer applications where relevant.
- The principle of minimum potential energy and Galerkin’s residual method are introduced at various stages as required to develop the equations needed for analysis.
- Appendices include basic matrix algebra (used throughout the text), solutions methods for simultaneous equations, equations from elasticity theory, equivalent nodal forces, the principle of virtual work, and properties of structural steel and aluminum shapes.
- Many worked examples appear throughout the text. These examples are solved “longhand” to illustrate how essential concepts are applied.
- Includes a 4-color insert that provides a clear visual application of FEM.

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A First Course in the Finite Element Method Using Algor™
Second Edition
Daryl L. Logan, University of Wisconsin-Platteville

Daryl Logan’s clear and easy-to-understand text provides a thorough treatment of the finite element method and how to apply it to solve practical physical problems in engineering. Concepts are presented simply, making it understandable for students of all levels of experience.

Key Features
- Integrates Algor Release 12.
- The book proceeds from basic to advanced topics and can be suitably used in a one or two-course sequence.
- Each chapter is structured in a similar format. General principles are presented for each topic, followed by traditional applications of these principles, which are in turn followed by computer applications where relevant.
- The principle of minimum potential energy and Galerkin’s residual method are introduced at various stages as required to develop the equations needed for analysis.
- Appendices include basic matrix algebra (used throughout the text), solutions methods for simultaneous equations, basic theory of elasticity, equivalent nodal forces, the principle of virtual work, and the Basics of Algor™.
- Contains several worked examples that appear throughout the text. These examples are solved by hand to illustrate how essential concepts are applied.

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Answers to Selected Problems
Thermal Sciences: An Introduction to Thermodynamics, Fluid Mechanics, and Heat Transfer

Merle C. Potter, Michigan State University
Elaine P. Scott, Virginia Tech


This book allows a school to use a common text for two key subjects, thermodynamics and fluid mechanics, with a short introduction to heat transfer. Taking a well-balanced approach, the authors clearly demonstrate the connections among the three interrelated subjects. Due to the consistent terminology and continuity, students will find it easier to learn the three subjects. Instructors will also find it easier to refer to material covered earlier (e.g. thermodynamic laws as applied in fluid mechanics and heat transfer). The book provides the appropriate amount of material for non-mechanical engineering students. Addressing various levels of difficulty, the authors provide a wealth of examples and exercises, including synthesis problems and design problems.

Key Features
- Uses an easy-to-read style that makes it simple for students to understand the material.
- Assists in the effective teaching and learning of engineering design, which often involves application of all three subjects to a particular design project.
- Includes examples that clarify all of the important concepts with hundreds of homework problems for effective learning of these concepts, including FE/EIT-type problems.
- Incorporates helpful learning features, such as chapter outlines and summaries, margin notes, nomenclature lists, and more.

Contents

PART I: THERMODYNAMICS
1. Concepts, Definitions, and Basic Principles
   Thermodynamic Systems and Control Volumes / Macroscopic Description / Properties and State of a System / Equilibrium Processes and Cycles / Units / Density, Specific Volume, Specific Weight / Pressure / Temperature / Energy
2. Properties of Pure Substances
   The p-T-v Surface / The Liquid-Vapor Region / Steam Tables / Equations of State / Equations of State for a Nonideal Gas
3. Work and Heat
   Introduction / Definition of Work / Quasiequilibrium Work Due to a Moving Boundary / Nonequilibrium Work / Other Work Modes / Heat Transfer
4. The First Law of Thermodynamics
5. The Second Law of Thermodynamics
6. Power and Refrigeration vapor Cycles
   The Rankine Cycle / Rankine Cycle Efficiency / The Reheat Cycle / The Regenerative Cycle / Effect of Losses on Power Cycle Efficiency / The Vapor Refrigeration Cycle / The Heat Pump
7. Power and Refrigeration Gas Cycles
8. Psychrometrics
   Gas-Vapor Mixtures / Adiabatic Saturation and Wet-Bulb Temperatures / The Psychrometric Chart / Air-Conditioning Processes
9. Combustion

Also Available
Thermodynamics, Fluid Mechanics, and Heat Transfer

First Edition
Kenneth A. Kroos, Villanova University
Merle C. Potter, Michigan State University

624 pages. Casebound. 8 x 10. 2-Color. ©2015.

Also Available in SI Units

Thermodynamics for Engineers focuses on...
outcome-based learning, which has been identified by ABET as an essential aspect of engineering curricula. Learning outcomes are listed at the start of each chapter and identified as completed at relevant places in the text, followed by a summary at the end of each chapter. Authors Kenneth Kroos and Merle Potter bring decades of teaching experience to a clear writing style that describes key concepts without straying from the course. The language of thermodynamics is explained in careful detail so that students can quickly understand the concepts presented and the analysis techniques used. Extensive use of practical examples demonstrates the proper set-up and solution of problems. These skills are then further developed using a wide variety of homework problems. Some homework problems are presented with an increased degree of complexity to allow the instructor to challenge the more accomplished.

Key Features
- The mathematics (calculus) needed has been kept to a minimum so that all students can follow the developments.
- Learning outcomes are listed at the start of each chapter and identified as completed at relevant places in the text, followed by a summary at the end of each chapter.
- Includes short concept quizzes at the completion of each outcome to test the students.
- Real-world parallels are drawn at appropriate places to help students relate to abstract concepts.
- Equal emphasis is laid on qualitative and quantitative coverage, theory and application, and core concepts and current trends.
- Solved examples illustrate clear problem solving methodology and focus on real-world applications of thermodynamics concepts.
- Sustainability and Bio-related themes make the text more relevant to today’s students.
- FE Type problems are included at the end of each chapter, to help students prepare for certification exams and aid instructors with short quizzes.
- End-of-Chapter exercises will serve to check the students’ understanding and provide instructors with an extensive set of homework and exam questions.
- Mini-exams for students and Sample Exams for Instructors are available through the companion website.
- Available with MindTap and MindLink! MindTap and MindLink connects MindTap and other online activities to all major Learning Management Systems.

Ancillaries
Instructor’s Solution Manual
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Contents
PART I. CONCEPTS AND BASIC LAWS
1. Basic Concepts and Systems of Units
   Introduction / Dimensions and Units / Properties, Processes, and Equilibrium / Pressure / Temperature / Energy
2. Properties of Pure Substances
   Phases of a Substance / Internal Energy and Enthalpy / Refrigerants / Ideal-Gas Law / Real Gas Equations of State / Internal Energy and Enthalpy of Ideal Gases / Specific Heats of Liquids and Solids
3. The First Law for Systems
4. The First Law Applied to Control Volumes
   The Conservation of Mass for Control Volumes / The First Law for Control Volumes / Unsteady Flow / Devices Combined into Cycles
5. The Second Law of Thermodynamics
6. Entropy
   Inequality of Clauses / Entropy / Entropy Change in Substances for Systems / Entropy Changes for a Control Volume / Isentropic Efficiency / Exergy (Availability) and Irreversibility
7. Thermodynamic Relations
   The Maxwell Relations / The Clapeyron Equation / Relationships for Internal Energy, Enthalpy, Entropy, and Specific Heats / The Joule-Thompson Coefficient / Real-Gas Effects

PART II. APPLICATIONS
8. The Rankine Power Cycle
   Energy Sustainability / The Rankine Cycle / Modified Rankine Cycles / Cogeneration Cycles / Losses in Power Plants
9. Gas Power Cycles
10. Refrigeration Cycles
    The Vapor Compression-Refrigeration Cycle / Cascade Refrigeration Systems / Absorption Refrigeration / Gas Refrigeration Systems
11. Mixtures and Psychrometrics
    Gas Mixtures / Air-Vapor Mixtures and Psychrometry / Air-Conditioning Processes
12. Combustion
    Introduction / Combustion Reactions / The Enthalpy of Formation and the Enthalpy of Combustion / Flame Temperature / Equilibrium Reactions

PART III. CONTEMPORARY TOPICS
13. Alternative Energy Conversion
14. Thermodynamics of Living Organisms

Fluid Mechanics

Design of Fluid Thermal Systems

Fourth Edition

Design of Fluid Thermal Systems

Also Available in SI Units

This book is designed to serve senior-level engineering students taking a capstone design course in fluid and thermal systems design. It is built from the ground up with the needs and interests of practicing engineers in mind, emphasizing practical applications. The book begins with a discussion of design methodology, including the process of bidding to obtain a project and project management techniques. The text continues with an introductory overview of fluid thermal systems (a pump and pumping system, a household air conditioner, a baseboard heater, a water slide, and a vacuum cleaner are among the examples given) and a review of the properties of fluids and the equations of fluid mechanics. The text then offers an in-depth discussion of piping systems, including the economics of pipe size selection. Pumps (including net positive suction head considerations) and piping systems are examined, providing the reader with the ability to design an entire system for moving fluids that is efficient and cost-effective. Next, the book provides a review of basic heat transfer principles, and the analysis of heat exchangers, including double-pipe, shell-and-tube, plate-and-frame, and cross-flow heat exchange systems.
exchangers. Design considerations for these exchangers are also discussed. The text concludes with a chapter of term projects that may be undertaken by teams of students.

**New to This Edition**
- New section added on the concepts of optimization.
- New information on the system approach versus the individual approach to modeling a fluid thermal system.
- Newly created chapter (5) including new information on measurements, pipe networks, water hammer, and thermal stresses.
- Additional information on plate-and-frame and cross-flow heat exchangers.
- Many new projects have been added as well as an organizational table.
- Many example and practice problems have been added to each chapter.
- A great number of design problems have been added at appropriate places in the text.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment materials online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

**Key Features:**
- Built from the ground up geared towards the needs and interests of practicing engineers.
- Heavy emphasis is placed on practical applications.
- Reader gains the ability to design an entire system for moving fluids that is efficient and cost-effective.
- Provides a review of basic heat transfer principles and the analysis of heat exchangers.
- Chapters conclude with a summary, problems, and a Show and Tell section where students are asked to provide very brief presentations on selected topics.
- Includes group problems and discussion problems in various chapters.
- Term projects that may be undertaken by teams of students are provided within the concluding chapter.

**Ancillaries**
- Instructor’s Solution Manual
- SI Version Instructor’s Solution Manual
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  SI Version MindTap

**Contents**
1. **Introduction**
   - The Design Process / The Bid Process / Approaches to Engineering Design / Design Project Example / Project Management / Dimensions and Units
2. **Fluid Properties and Basic Equations**
3. **Piping Systems I**
   - Pipe and Tubing Standards / Equivalent Diameter for Noncircular Ducts / Equation of Motion for Flow in a Duct / Friction Factor and Pipe Roughness / Minor Losses / Series Piping Systems / Flow Through Noncircular Cross Sections
4. **Piping Systems II**
   - The Optimization Process / Economic Pipe Diameter / Equivalent Length of Fittings / Graphical Symbols for Piping Systems / System Behavior / Measurement of Flow Rate in Closed Conduits / Support Systems for Pipes
5. **Selected Topics in Fluid Mechanics**
   - Flow in Pipe Networks / Pipes in Parallel / Measurement of Flow Rate in Closed Conduits / The Unsteady Draining Tank Problem
6. **Pumps and Piping Systems**
   - Types of Pumps / Pump Testing Methods / Cavitation and Net Positive Suction Head / Dimensional Analysis of Pumps / Specific Speed and Pump Types / Piping System Design Practices / Fans and Fan Performance
7. **Some Heat Transfer Fundamentals**
8. **Double-Pipe Heat Exchangers**
   - The Double-Pipe Heat Exchanger / Analysis of Double-Pipe Heat Exchangers / Effectiveness-NTU Analysis / Double-Pipe Heat Exchanger Design Considerations
9. **Shell-and-Tube Heat Exchangers**
11. **Project Descriptions**
1. Basic Considerations


2. Fluid Statics

Pressure at a Point / Pressure Variation / Fluids at Rest / Linearly Accelerating Containers / Rotating Containers

3. Introduction to Fluids in Motion

Description of Fluid Motion / Classification of Fluid Flows / The Bernoulli Equation

4. The Integral Forms of the Fundamental Laws

The Three Basic Laws / System-to-Control Volume Transformation / Conservation of Mass / Energy Equation / Momentum Equation / Moment-of-Momentum Equation

5. The Differential Forms of the Fundamental Laws


6. Dimensional Analysis and Similitude

Dimensional Analysis / Similitude / Normalized Differential Equations

7. Internal Flows

Entrance Flow and Developed Flow / Laminar Flow in a Pipe / Laminar Flow between Parallel Plates / Laminar Flow between Rotating Cylinders / Turbulent Flow in a Pipe / Uniform Turbulent Flow in Open Channels

8. External Flows

Separation / Flow Around Immersed Bodies / Lift and Drag on Airfoils / Potential-Flow Theory / Boundary-Layer Theory

9. Compressible Flow


10. Flow in Open Channels


11. Flows in Piping Systems

Losses in Piping Systems / Simple Pipe Systems / Analysis of Pipe Networks / Unsteady Flow in Pipelines

12. Turbomachinery

Turbopumps / Dimensional Analysis and Similitude for Turbomachinery / Use of Turbopumps in Piping Systems / Turbines

13. Measurements in Fluid Mechanics

Measurement of Local Flow Parameters / Flow Rate Measurement / Flow Visualization / Data Acquisition and Analysis

14. Computational Fluid Dynamics

Examples of Finite-Difference Methods / Stability, Convergence, and Errors / Solution of Couette Flow / Solution of Two-Dimensional Steady-State Potential Flow / Appendix A. Units and Conversions and Vector Relationships

Appendix B. Fluid Properties

Appendix C. Properties of Areas and Volumes

Appendix D. Compressible-Flow Tables for Air

Appendix E. Numerical Solutions for Chapter 10

Appendix F. Numerical Solutions for Chapter 11

Bibliography

References

General Interest

Answers to Selected Problems
New “Concepts and Analyses to be Learned” sections at the beginning of each chapter.

New figures, tables, and examples throughout, to help clarify textual material for students.

Now included in the Instructor’s solutions manual is a set of closed-book-test problems that ask a student to demonstrate his or her ability to understand the new concepts related to a specific area.

Clarifying statements have been added throughout for further development and enhanced student understanding.

Additional homework problems that deal directly with topics of current interest, such as the space program and renewable energy.

Key Features

• Addresses the rapid and pervasive changes in technology, applications, analysis tools, and the economy, and their relation to the principles of heat transfer.

• Presents an appreciation for both the physics and the elegance of simple mathematics in addressing complex phenomena, while emphasizing the importance of analysis by means of computers.

• Uses open-ended problems to illustrate practical applications of heat transfer with problem statements similar to those faced by practicing engineers.

• Teaches methods for approaching real, world problems, such as describing problems in your own words, providing schematic descriptions, indicating known and unknown variables, making judicious engineering decisions on the approach of a solution, etc.

Ancillaries

Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Also Available
Principles of Heat Transfer, 7th Edition
Spanish Version

Contents

1. Basic Modes of Heat Transfer

2. Heat Conduction
   The Conduction Equation / Steady Heat Conduction in Simple Geometries / Extended Surfaces / Multidimensional Steady Conduction / Transient Heat Conduction / Charts for Transient Heat Conduction

3. Numerical Analysis of Heat Conduction
   One-Dimensional Steady Conduction / One-Dimensional Unsteady Conduction / Two-Dimensional Unsteady and Steady Conduction / Cylindrical Coordinates / Irregular Boundaries

4. Analysis of Convection Heat Transfer
   Convection Heat Transfer / Boundary Layer Fundamentals / Conservation Equations of Mass, Momentum, and Energy for Laminar Flow over a Flat Plate / Dimensionless Boundary Layer Equations and Similarity

Parameters / Evaluation of Convection Heat Transfer Coefficients / Dimensional Analysis / Analytic Solution for Laminar Boundary Layer Flow Over a Flat Plate / Approximate Integral Boundary Layer Analysis / Analogy Between Momentum and Heat Transfer in Turbulent Flow over a Flat Surface / Reynolds Analogy for Turbulent Flow over Plane Surfaces / Mixed Boundary Layer / Special Boundary Conditions and High-Speed Flow

5. Natural Convection
   Similarity Parameters for Natural Convection / Empirical Correlation for Various Shapes / Rotating Cylinders, Disks, and Spheres / Combined Forced and Natural Convection / Finned Surfaces

6. Forced Convection Inside Tubes and Ducts

7. Forced Convection Over Exterior Surfaces
   Flow over Bluff Bodies / Cylinders, Spheres, and Other Bluff Shapes / Packed Beds / Tube Bundles in Cross-Flow / Finned Tube Bundles in Cross-Flow / Free Jets

8. Heat Exchangers
   Basic Types of Heat Exchangers / Overall Heat Transfer Coefficient / Log Mean Temperature Difference / Heat Exchanger Effectiveness / Heat Transfer Enhancement / Microscale Heat Exchangers

9. Heat Transfer by Radiation
   Thermal Radiation / Blackbody Radiation / Radiation Properties / The Radiation Shape Factor / Enclosures with Black Surfaces / Enclosures with Gray Surfaces / Matrix Inversion / Radiation Properties of Gases and Vapors / Radiation Combined with Convection and Conduction

10. Heat Transfer with Phase Change
    Introduction to Boiling / Pool Boiling / Boiling in Forced Convection / Condensation / Condenser Design / Heat Pipes / Freezing and Melting

Appendix 1. The International Systems of Units
Appendix 2. Tables
Appendix 3. Tridiagonal Matrix Computer Program
Appendix 4. Computer Codes for Heat Transfer
Appendix 5. The Heat Transfer Literature

Kinematics of Mechanisms and Machines: Kinematics, Dynamics, and Synthesis

First Edition
Michael M. Stanisic, University of Notre Dame

Also Available in SI Units

Mechanisms and Machines is designed to serve as a core textbook for the mechanisms and machines course, targeting junior level mechanical engineering students. The book is written with the aim of providing a complete, yet concise, text that can be covered in a single-semester course. The primary goal of the text is to introduce students to the synthesis and analysis of planar mechanisms and machines using a method well suited to computer programming, known as the Vector Loop Method. Author Michael Stanisic’s approach of teaching synthesis first and then going into analysis will enable students to actually grasp the mathematics behind mechanism design. The book uses the Vector Loop Method and kinematic coefficients throughout, and exhibits a seamless continuity in presentation that is a rare find in engineering texts. The multitude of examples in the book covers a large variety of problems and delineates an excellent problem solving methodology.

Key Features

• A large number of automotive-based examples are included in the text: a highly engaging feature for students!

• This is the only text that consistently uses the Vector Loop Method throughout.

• Subject matter is presented entirely in terms of kinematic coefficients, including geartrains, mechanical advantage, limit positions and dead positions.

• The final two chapters deal with mechanism synthesis and stand apart from the first seven chapters which focus on analysis.

• Various chapters end with exercises, programming problems, design problems, and relevant appendices where applicable.

• Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic
reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindTap connects MindTap and other online activities to all major Learning Management Systems.

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Also Available

Contents
1. Introduction
   Joints / Skeleton Diagrams / Mechanisms and Machines / Gruenler’s Criterion and Degrees of Freedom / Mobility / Grashof’s Criterion / Exercises

2. Kinematic Analysis Part I: Vector Loop Method
   Kinematic Analysis and the Vector Loop Method / Hints for Choosing Vectors / Closed-Form Solutions to the Position Equations / Numerical Solutions to Position Equations via Newton’s Method / The Motion of Points of Interest / Exercises / Programming Problems / Appendix I: Derivation of the Double Angle Formulas / Appendix II: Derivation of the Tangent of the Half Angle Formulas / Appendix III: MATLAB Code Used in Example 2.10 Demonstrating Newton’s Method

3. Kinematic Analysis Part II: Rolling Contacts
   Externally Contacting Rolling Bodies / Internally Contacting Rolling Bodies / One Body with a Flat Surface / Assembly Configuration / Geartrains / Exercises / Appendix I: The Involute Tooth Profile

4. Kinematic Analysis Part III: Kinematic Coefficients
   Time-Based Velocity and Acceleration Analysis of the Four Bar Mechanism / Kinematic Coefficients / Finding Dead Points Using Kinematic Coefficients / Finding Limit Positions Using Kinematic Coefficients / Kinematic Coefficients of Points of Interest / Kinematic Coefficients of Geartrains / Exercises / Programming Problems

5. Machine Dynamics Part I: The Inverse Dynamics Problem
   Review of Planar Kinetics / Three-Dimensional Aspects in the Force Analysis of Planar Machines / Static Force Analysis and Inertia Force Analysis / Force Analysis of Rolling Contacts / Exercises / Appendix I: Kinematic Analysis for Examples in Section 5.1 (Example 5.2) and Section 7.2 / Appendix II: Computing the Accelerations of the Mass Centers of the Composite Shapes in the Example Discussed in Section 5.2.6

6. Machine Dynamics Part II: Joint Friction
   Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint / Friction in a Pin Joint / Friction in a Pin-in-a-Slot Joint / Friction in a Straight Sliding Joint /
Fundamentals of Mechatronics

First Edition
Musa Jouaneh, University of Rhode Island


The objective of Fundamentals of Mechatronics is to cover both hardware and software aspects of mechatronics systems in a single text, giving a complete treatment to the subject matter. The text focuses on application considerations and relevant practical issues that arise in the selection and design of mechatronics components and systems. The text uses several programming languages to illustrate the key topics. Different programming platforms are presented to give instructors the choice to select the programming language most suited to their course objectives. A separate laboratory book, with additional language most suited to their course objectives, is available to instructors the choice to select the programming platforms are presented to give students guided, hands-on experience with mechatronics lab exercises designed to give students guided, hands-on experience with the concepts covered in the text.

Key Features
- Includes coverage of the essential topics in mechatronics including analog and digital circuits, basic electronics, microcontrollers, data acquisition and interfacing, control software, sensors and actuators, and feedback control.
- Emphasis is placed on structured software development. Software concepts are applicable for both microcontrollers and PC-based systems.
- Discusses software topics such as timing, task states, graphical user interfaces, and real-time operating systems that are needed to implement control of mechatronics systems. Software code examples are presented in C, MATLAB®, and Visual Basic Express.
- Coverage of PIC microcontrollers as well as the interfacing of microcontrollers/PCs and mechatronic components using techniques such as asynchronous serial, synchronous serial, USB, and Ethernet interfacing.
- A companion laboratory book containing mechatronics lab exercises designed to give students guided, hands-on experience with application of the concepts covered in the text.

Contains illustrative real-world examples and case studies, as well as descriptions of several simple-to-build experimental systems.

Example problems, concept questions, problems, and basic laboratory exercises can be found in most chapters.

Instructor’s Solution Manual, Annotated PowerPoints, and Lecture Builder PowerPoints can be found on the accompanying Instructor Companion website.

Ancillaries

Best Buy Package
Fundamentals of Mechatronics + Laboratory Exercises in Mechatronics
SI Version - Fundamentals of Mechatronics + Laboratory Exercises in Mechatronics

Contents
1. Introduction to Mechatronics
Examples of Mechatronic Systems / Overview of Text

2. Analog Circuits and Components

3. Semiconductor Electronic Devices and Digital Circuits
Diodes / Thyristors / Bipolar Junction Transistor / Metal Oxide Semiconductor Field Effect Transistor / Combinational Logic Circuits / Sequential Logic Circuits / Circuit Families / Digital Devices / H-Bridge Drives

4. Microcontrollers
Numbering Systems / Microprocessors and Microcontrollers / PIC Microcontroller / Programming the PIC Microcontroller / C-Language Programming / PIC MCU Devices and Features / Interrupts / Assembly Language Programming

5. Data Acquisition and Microcontroller/PC Interfacing
Sampling Theory / Analog to Digital Converter / Digital to Analog Converter / Parallel Port / Data Acquisition Board Programming / USART Serial Port / Serial Peripheral Interface / Inter-Integrated Circuit Interface / USB Communication / Network Connection

6. Control Software

7. Sensors

8. Actuators
DC Motors / AC Motors / Stepper Motors / Other Motor Types / Actuator Selection

9. Feedback Control

10. Mechatronics Projects
Stepper-Motor Driven Rotary Table / A Paper Dispensing System That Uses a Roller / Driven by a Position Controlled DC Motor / A Temperature-Controlled Heating System That Uses a Heating Coil, a Copper Plat, and a Temperature Sensor

Appendix A: Visual Basic Express
Appendix B: System Response
Appendix C: MATLAB Simulation of Dynamic Systems
Appendix D: 7-Bit ASCII Code

Industrial Automation and Robotics
An Introduction
A.K. Gupta
S.K. Arora


The purpose of this book is to present an introduction to the multidisciplinary field of automation and robotics for industrial applications. The book initially covers the important concepts of hydraulics and pneumatics and how they are used for automation in an industrial setting. It then moves to a discussion of circuits and using them in hydraulic, pneumatic, and fluidic design. The latter part of the book deals with electric and electronic controls in automation and final chapters are devoted to robotics, robotic programming, and applications of robotics in industry. A companion disc is included with applications and videos.

Key Features
- Begins with introductory concepts on automation, hydraulics, and pneumatics
- Covers sensors, PLC’s, microprocessors, transfer devices and feeders, robotic sensors, robotic grippers, and robot programming
Appendix A. Cable Connectors

Suggested Projects

Lab 14. Feedback Control
Lab 13. Stepper Motors
Lab 12. Sensors and Lab Exercises
Transition Diagrams
Lab 9. PIC MCU – Serial Interfacing
Lab 8. PIC MCU – A/D and PWM
Lab 7. PIC MCU – Basic
Lab 6. Digital Circuit Components
Lab 5. Relays and H-Bridge
Lab 4. BJT and MOSFET Transistors
Lab 3. Diodes and LEDs
Lab 2. Op-Amps
Lab 1. Basic Measurements

Also Available in SI Units
SI Version Instructor’s Solutions Manual
SI Version Instructor’s Solutions Manual

Contents

Mechatronics System Design

Second Edition
Devdas Shetty, University of Hartford
Richard A. Kolk, Pace Controls, Philadelphia, PA


Also Available in SI Units

This text by Shetty and Kolk, blends the pertinent aspects of mechatronics—system modeling, simulation, sensors, actuation, real time computer interfacing, and control—into a single unified result suitable for use in the college-level mechatronic curriculum. Students are introduced to all the topics needed to develop a good understanding of the basic principles used in mechatronics technology, through the use of examples, problems and case studies, all of which can be quickly and affordably assembled and investigated in laboratory settings. Core aspects are combined with practical industrial applications and are presented in an optimal way for understanding. The book features extensive coverage of the modeling and simulation of physical systems made possible by block-diagrams, the modified analogy approach to modeling, and state-of-the art visual simulation software. A collection of case studies drawn from a variety of industries (complete with parts, lists, setup, and instructions) are used to support the authors’ applied, design-oriented approach. Readers of this text will be equipped with all the tools necessary to plan, test, and implement a well designed mechatronic system.

New to this Edition
• Simulation and Real-Time Interfacing using National Instrument’s LabView has been used in addition to VisSim.
• Numerous design examples and end-of-chapter problems have been added to help students understand the basic mechatronics methodology.
• A simple motion control example, which is carried out over the 8 chapters, allows coverage of the different elements of mechatronics systems progressively.
• Current trends in mechatronics and smart manufacturing are presented in the first chapter.
• Illustration of block diagram approach and emphasis on the comprehensive use of mathematical analysis, simulation, modeling, control, and real time interfacing in implementing case studies.
• Expanded coverage of sensors, real time interfacing, multiple input and multiple output systems.

Key Features
• Includes an overview and explanation of mechatronics from a model-based perspective.
• Uses a Modified Analogy Approach for creating dynamical models of physical systems.
• Presents a thorough discussion of classical control with the incorporation of real-world constraints.
• Gives a discussion of analog and digital hardware components for real-time computer interfacing.
• Incorporates a collection of case studies, complete with parts list, suitable for laboratory exercises.
• Includes a summary of recent advances in the mechatronics field and future trends.

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Contents
1. Mechatronics System Design
What is Mechatronics? / Integrated Design Issues in Mechatronics / The Mechatronics Design Process / Mechatronics Key Elements / Applications in Mechatronics

2. Modeling and Simulation of Physical Systems
Operator Notation and Transfer Functions / Block Diagrams, Manipulations, and Simulation / Block Diagram Modeling—Direct Method / Block Diagram Modeling—Analogy Approach / Electrical Systems / Mechanical Translational Systems / Mechanical Rotational Systems / Electrical-Mechanical Coupling / Fluid Systems

3. Sensors and Transducers

4. Actuating Devices
Direct Current Motors / Permanent Magnet Stepper Motor / Fluid Power Actuation / Fluid Power Design Elements / Piezoelectric Actuators

5. System Control – Logic Methods
Number Systems in Mechatronics / Binary Logic / Karnaugh Map Minimization / Programmable Logic Controllers

6. Signals, Systems, and Controls
Introduction to Signals, Systems, and Controls / Laplace Transform Solution of Ordinary Differential Equations / System Representation / Linearization of Nonlinear Systems / Time Delays / Measures of System Performance /
As engineering systems become more increasingly interdisciplinary, knowledge of both mechanical and electrical systems has become an asset within the field of engineering. All engineers should have general facility with modeling of dynamic systems and determining their response, and it is the objective of this book to provide a framework for that understanding. The study material is presented in four distinct parts: the mathematical modeling of dynamic systems; the mathematical solution of the differential equations and integro differential equations obtained during the modeling process; the response of dynamic systems; and an introduction to feedback control systems and their analysis. An appendix is provided with a short introduction to SIMULINK®, a MATLAB® based graphical tool. SIMULINK®, a MATLAB® based simulation and modeling tool, is discussed in a graphical tool. SIMULINK®, a MATLAB® based simulation and modeling tool, is discussed in a graphical tool.

**Key Features**
- Each chapter concludes with a detailed summary as well as problems for students.
- Further examples are provided for most chapters where necessary.
- Instructor’s Solutions Manual is available, providing completely worked-out solutions to problems.
- M-Files available for download online.
- PowerPoints available for download online.

**Ancillaries**

**Contents**
1. Introduction

---

**Root Locus / Bode Plots / Controller Design Using Pole Placement Method**

7. **Signal Conditioning and Real Time Interfacing**
   Introduction / Elements of a Data Acquisition and Control System / Transducers and Signal Conditioning / Devices for Data Conversion / Data Conversion Process / Application Software

8. **Case Studies**
   Comprehensive Case Studies / Data Acquisition Case Studies / Data Acquisition and Control Case Studies

**Appendix 1. Data Acquisition Cards**
**Appendix 2. Strain Gauge Experiment**

---

**RF Module**
**The Three Stub Tuner**
Roger Pryor, PhD

150 pages. Casebound. 8 x 9 1/4. ©2014.

Designed for engineers from the fields of mechanical, electrical and civil disciplines, this book presents the reader with a solved problem that utilizes the RF Module. This model is based on RF multiphysics modeling and employs the use of physics first principles for the solution of this difficult problem. It introduces the user to the advanced numerical analysis modeling techniques employed in the COMSOL Multiphysics software Version 4.x. Includes a DVD with models and code.

**Contents**
1. Modeling Methodology Using COMSOL 4.2
   Applicable RF Theory. 3. Designing the Three-Stub Tuner Model. 4. Building the Three-Stub Tuner Model. 5. Three-Stub Tuner Model Results. 6. Three-Stub Tuner Model VSWR Calculations. 7. Conclusions. Index.

---

**System Dynamics and Response**
S. Graham Kelly, University of Akron

608 pages. Casebound. 8 x 9 1/4. 1-Color. ©2007.

Also available in SI Units

As engineering systems become more increasingly interdisciplinary, knowledge of both mechanical and electrical systems has become an asset within the field of engineering. All engineers should have general facility with modeling of dynamic systems and determining their response, and it is the objective of this book to provide a framework for that understanding. The study material is presented in four distinct parts: the mathematical modeling of dynamic systems; the mathematical solution of the differential equations and integro differential equations obtained during the modeling process; the response of dynamic systems; and an introduction to feedback control systems and their analysis. An appendix is provided with a short introduction to SIMULINK®, a MATLAB® based simulation and modeling tool, is discussed in a graphical tool. SIMULINK®, a MATLAB® based simulation and modeling tool, is discussed in a graphical tool.

**Highlights**
- Further Examples / Summary / Mathematical Modeling of Electrical Systems / Other Chapter Highlights

**Fluid, Thermal, and Chemical Systems**

**Laplace Transforms**

**Mechanical Systems**

---
6. Transient Analysis and Time Domain Response

7. Frequency Response
   - Undamped Second-Order Systems / Sinusoidal Transfer Function / Graphical Representation of the Frequency Response / Frequency Response Curves / Bode Diagrams / Construction and Asymptotes / Products of Transfer Functions / Bode Diagrams for Common Transfer Functions / Bode Diagram Parameters / Nyquist Diagrams / Use of MATLAB® to Develop Bode Plots and Nyquist Diagrams / First-Order Systems / Second-Order Systems / One-Degree-of-Freedom Mechanical System / Motion Input / Filters / Higher Order Systems / Dynamic Vibration Absorbers / Higher Order Filters / Response Due to Periodic Input

8. Feedback Control Systems

9. State-Space Methods
   - An Example in the State-Space / General State-Space Modeling / Basic Concepts / Multi Degree-of-Freedom Mechanical Systems / State-Space Solutions for Free Response / Laplace Transform Solution / Exponential Solution / General Description of Free Response / State-Space Analysis of Response due to Inputs / Laplace Transform Solution / Numerical Solutions / Use of MATLAB® Program ode45.m / Relationship Between Transfer Functions and State-Space Models / MATLAB® and SIMULINK® modeling in the State-Space / MATLAB® / SIMULINK® / Nonlinear Systems and Systems with Variable Coefficients

Appendix A – Complex Algebra
Appendix B – Matrix Algebra
Appendix C – MATLAB®
Appendix D – Construction of Root-Locus Diagrams

System Dynamics & Control
Eronini I. Umez-Eronini, Morgan State University

This applied and comprehensive book combines topical coverage of both System Dynamics and Automatic Controls in one text, resulting in a pedagogically sound presentation of both subjects that can be used in this standard two-course sequence. It is thorough and complete, with, according to one reviewer, a “tremendous number of interesting practice problems covering a broad range of areas, giving the instructor significant choice and flexibility” in teaching the material. The book also has a wealth of worked-out, real-world examples, with every step clearly shown and explained. Cumulative examples that build through succeeding chapters demonstrate the stages of system modeling, from initial steps—which include the important but often omitted physical modeling process—through mathematical analysis to design realization. The result is a new and unified presentation of system dynamics and control, founded on a wide range of systems (mechanical, electrical, electromechanical—including MEMS, fluid, thermal, and chemical), with a common state-space approach.

Key Features
- Excellent, worked-out real-world examples for physical and system modeling.
- Coverage of system dynamics and automatic controls are combined in one text.
- Includes a wealth of interesting practice problems from a wide range of disciplines, including mechanical, electrical, electromechanical, fluid, thermal, and chemical engineering.
- Incorporates the use of computer software throughout, with downloadable files (complete MATLAB® m-files and MathCAD® mcd files for all problems, figures and examples in the book) available online.
- Covers both classical and modern state-space control (see Part 3).
- Unusually complete coverage of automatic controls, including digital control systems. The book can be used without supplements for most undergraduate courses, and serve as a useful reference for both students and practicing engineers.

Contents
Part I: Physical Modeling and Construction
1. Introduction
2. Specification of Dynamic Systems and Behavior
3. Engineering System Models in State Space
4. Other System Models in State Space
5. Generalized System Models and Analogs

Part II: Model Solution
6. Response of Lumped-Parameter Systems
7. Solution of Higher-Order Scalar Systems
8. Further Solution by Transformation
9. Representation of System Dynamics
10. Stability of Dynamic Systems

Part III: System Design
11. Introducing Automatic Control Systems Design
12. Design in the Frequency Domain
13. Multi-Loop and Other Control Configurations
14. Discrete-Time Control Systems
15. Realization of Microcomputer Control Systems

Appendices
A: Selected Constants; Properties and Conversion Factors
B: Some Elements of Linear Algebra
C: Answers to Selected (*) Problems

www.cengage.com/engineering
Numerous pedagogical features have been included in the text in order to aid the student with comprehension and retention. These include the development of three benchmark problems that are revisited in each chapter, creating a coherent chain linking all chapters in the book. Also included are learning outcomes, summaries of key concepts including important equations and formulae, fully-solved examples with an emphasis on real-world examples, as well as an extensive exercise set including objective-type questions.

**Key Features**
- Includes introductory chapters on continuous systems, nonlinear systems, and the finite element method.
- Provides flexibility for instructors in application of the free-body diagram method to derive differential equations for one-degree-of-freedom systems.
- Include a chapter specifically on two-degree-of-freedom systems for those instructors who do not wish to teach the linear algebra necessary to discuss multi-degree-of-freedom systems in general.
- Simulation examples using MATLAB® and SIMULINK® are integrated with book.

**Ancillaries**
* Instructor's Solutions Manual
  SI Version Instructor's Solutions Manual

**Contents**
1. Introduction
   - The Study of Vibrations / Mathematical Modeling / Generalized Coordinates / Classification of Vibration / Dimensional Analysis / Simple Harmonic Motion / Review of Dynamics
2. Modeling of SDOF Systems
   - Springs / Springs in Combination / Other Sources of Potential Energy / Viscous Damping / Energy Dissipated By Viscous Damping / Inertia Elements / External Sources / Free-Body Diagram Method / Static Deflections and Gravity / Small Angle or Displacement Assumption / Equivalent Systems Method
3. Free Vibrations of SDOF Systems
   - Standard Form of Differential Equation / Free Vibrations of an Undamped System / Underdamped Free Vibrations / Critically Damped Free Vibrations / Overdamped Free Vibrations / Coulomb Damping / Hysteretic Damping / Other Forms of Damping
4. Harmonic Excitation of SDOF Systems
5. Transient Vibrations of One-Degree-of-Freedom Systems
   - Derivation of Convolution Integral / Response Due to a General Excitation / Excitations Whose Forms Change at Discrete Times / Transient Motion Due to Base Excitation / Laplace Transform Solutions / Transfer Functions / Numerical Methods / Shock Spectrum / Vibration Isolation for Short Duration Pulses
6. Two Degree-of-Freedom Systems
7. Modeling of MDOF Systems
8. Free Vibrations of MDOF Systems
   - Normal-Mode Solution / Natural Frequencies and Mode Shapes / General Solution / Special Cases / Energy Scalar Products / Properties of Natural Frequencies and Mode Shapes / Normalized Mode Shapes / Rayleigh's Quotient / Principal Coordinates / Determination of Natural Frequencies and Mode Shapes / Proportional Damping / General Viscous Damping
9. Forced Vibrations of MDOF Systems
   - Harmonic Excitations / Laplace Transform Solutions / Modal Analysis for Undamped Systems and Systems with Proportional Damping / Modal Analysis for Systems with General Damping / Numerical Solutions
10. Vibrations of Continuous Systems
11. Finite Element Method
    - Assumed Modes Method / General Method / The Bar Element / Beam Element / Global Matrices
12. Nonlinear Vibrations
    - Sources of Nonlinearity / Qualitative Analysis of Nonlinear Systems / Quantitative Method of Analysis / Free Vibrations of SDOF Systems / Forced Vibrations of SDOF Systems with Cubic Nonlinearities / MDOF Systems / Continuous Systems / Chaos
13. Random Vibrations
    - Behavior of a Random Variable / Functions of a Random Variable / Joint Probability Distributions / Fourier Transforms / Power Spectral Density / Mean Square Value of the Response

Appendix A. Unit Impulse Function and Unit Step Function
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Appendix D. Deflections of Beams Subject to Concentrated Loads
Appendix E. Integrals Used in Random Vibrations
Appendix F. Vibrations

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3. Single Degree-of-Freedom Systems:
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   Force-Balance and Moment-Balance Methods / Natural Frequency and Damping Factor /
   Governing Equations for Different Types of Damping / Governing Equations for Different
   Types of Applied Forces and Moments / Lagrange’s Equations
4. Single Degree-of-Freedom System:
   Solution for Response and Free-Response Characteristics
   General Solution / Free Responses of Undamped and Damped Systems / Stability of
   Systems with Nonlinear Elements
5. Single Degree-of-Freedom Systems
   Subjected to Periodic Excitations
   Response to Harmonic Excitation / Frequency-Response Function / Systems with Rotating
   Unbalanced Mass / System with Base Excitation / Acceleration Measurement: Accelerometer
   / Vibration Isolation / Energy Dissipation and Equivalent Damping / Response to Periodic
   Excitation / Influence of Nonlinear Stiffness on Forced Response
   Subjected to Transient Forces
   Response to Impulse Excitation / Response to Step Input / Response to Ramp Input /
   Spectral Energy of the Response / Response to Rectangular Pulse Excitation / Response to
   Half-Sine Wave Pulse / Impact Testing
7. Multiple Degree-of-Freedom Systems:
   Governing Equations and Characteristics of Free Oscillations
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   Supports / Stability
8. Multiple Degree-of-Freedom Systems:
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   Formulation / Laplace Transform Approach / Transfer Functions and Frequency-Response
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9. Vibration of Beams
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Appendix B - Fourier Series
Appendix C - Decibel Scale
Appendix D - Solutions to Ordinary Differential Equations
Appendix E - Matrices
Appendix F - Complex Numbers and Variables
Appendix G - Natural Frequencies and Mode Shapes of Bars, Shafts, and Strings
Chemical Engineering/Thermodynamics

Fundamentals of Chemical Engineering Thermodynamics

First Edition
Kevin D. Dahm, Rowan University
Donald P. Visco, Jr., University of Akron

792 pages. Casebound. 8 x 10.2-Color. ©2015.

Also Available in SI Units

This brand new book makes the abstract subject of chemical engineering thermodynamics more accessible for undergraduate students. By presenting the subject matter through a problem-solving inductive (from specific to general) learning approach, the practical and relatable content is extremely approachable and easier to comprehend. Suitable for either a one-semester course or two-semester sequence, the book covers thermodynamics in a complete and mathematically rigorous manner with an emphasis on solving practical engineering problems. The approach stresses problem solving and draws from “best practice” engineering teaching strategies. This book is aimed at providing the “fundamentals” of chemical engineering thermodynamics to undergraduate students. Each chapter begins with a motivational example that is investigated in context to that topic. This framing of the material is helpful to all readers, particularly to global learners who require “big picture” insights, and hands-on learners who struggle with abstractions. Each worked example is fully annotated with sketches and explanations of the thought process behind the solved problems as well as the practical significance of the material. Common errors are presented and explained in margin notes. Extensive margin notes add to the book’s accessibility as well as presenting opportunities for investigation.

Key Features
- The text expertly combines inductive and deductive teaching, invoking each style where appropriate, enabling students to better grasp concepts and apply them with greater ease.
- Simplified writing style while retaining rigor. The authors write in a conversational style that is easily understood by students and keeps the material from becoming dry or intimidating without compromising the mathematical rigor of the content.
- Real-world example-based approach, enabling students to better grasp the abstract concepts involved in thermodynamics and aiding instructors in better communicating core thermodynamics concepts needed in future engineering courses.
- Learning Objectives begin each chapter, and chapter summaries include definitions of key terms and highlight key concepts.
- Detailed derivations of key concepts and fundamental equations include all steps to ensure that students are clear on the approach.
- Available with MindTap and MindLink! MindTap is a personalized online learning program allowing students to make notes, highlight text, and save bookmarks in an electronic reader. Students can complete homework and assessment material online, while allowing instructors to customize the online course and track student progress. MindLink connects MindTap and other online activities to all major Learning Management Systems.

Ancillaries
Instructors Solution Manual
SI Version Instructors Solution Manual
MindTap
SI Version MindTap

Contents
1. Introduction
The Role of Thermodynamics in Chemical Engineering / Motivational Example: The Conversion of Fuel into Electricity / Systems and Processes / The Forms of Energy
2. The Physical Properties of Pure Compounds
Motivational Example: Practical Design Decisions in the Rankine Cycle / Physical Properties of Pure Chemical Compounds / Thermodynamic Models of Physical Properties
3. Material and Energy Balances
4. Entropy
Motivational Example: Turbines / Reversible Processes / Mathematical Definition of Entropy / The Entropy Balance
5. Thermodynamic Processes and Cycles
Motivational Example: Chemical Process Design / Real Heat Engines / Refrigeration - The Vapor Compression Cycle / Liquefaction
6. Thermodynamic Models of Real, Pure Compounds
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7. Equations of State
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