



# Engineering Mechanics: Statics and Dynamics (3rd Edition)

By Anthony Bedford, Wallace T. Fowler

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**Engineering Mechanics: Statics and Dynamics (3rd Edition)** By Anthony Bedford, Wallace T. Fowler

This book presents the foundations and applications of statics by emphasizing the importance of visual analysis of topics—especially through the use of free body diagrams. It also promotes a problem-solving approach to solving examples through its strategy, solution, and discussion format. The authors further include design and computational examples that help integrate these ABET 2000 requirements. Features strong coverage of FBDs and free-body and kinetic diagrams. Chapter topics include: Vectors; Forces; Systems of Forces and Moments; Objects in Equilibrium; Structures In Equilibrium; Centroids and Centers of Mass; Moments of Inertia; Friction; Internal Forces and Moments; Virtual Work and Potential Energy; Motion of a Point; Force, Mass, and Acceleration; Energy Methods; Momentum Methods; Planar Kinematics of Rigid Bodies; Planar Dynamics of Rigid Bodies; Energy and Momentum in Rigid Body Dynamics; Three-Dimensional Kinematics and Dynamics of Rigid Bodies; Vibration. For professionals in mechanical, civil, aeronautical, or engineering mechanics fields.

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### **Bibliography**

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## **Editorial Review**

### **From the Back Cover**

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### **About the Author**

**Anthony Bedford** is Professor of Aerospace Engineering and Engineering Mechanics at the University of Texas at Austin. He received his B.S. degree at the University of Texas at Austin, his M.S. degree at the California Institute of Technology, and his Ph.D. degree at Rice University in 1967. He has industrial experience at Douglas Aircraft Company and at TRW, where he did structural dynamics and trajectory analyses for the Apollo program. He has been on the faculty of the University of Texas at Austin since 1968. He is a member of the University of Texas Academy of Distinguished Teachers and has received several teaching awards over the years.

Dr. Bedford's main professional activity has been education and research in engineering mechanics. He has been principal investigator on grants from the National Science Foundation and the Office of Naval Research, and from 1973 until 1983 was a consultant to Sandia National Laboratories, Albuquerque, New Mexico. His other books include *Hamilton's Principle in Continuum Mechanics*, *Introduction to Elastic Wave Propagation* (with D.S. Drumheller), and *Mechanics of Materials* (with K.M. Liechti).

**Wallace T. Fowler** holds the Paul D. and Betty Robertson Meek Professorship in Engineering in the Department of Aerospace Engineering and Engineering Mechanics at the University of Texas at Austin. Dr. Fowler received his B.A., M.S., and Ph.D. degrees at the University of Texas at Austin, and has been on the faculty there since 1965. During Fall 1976, he was on the staff of the United States Air Force Test Pilot School, Edwards Air Force Base, California, and in 1981-1982 he was a visiting professor at the United States Air Force Academy. Since 1991 he has been Associate Director of the Texas Space Grant Consortium.

Dr. Fowler's areas of teaching and research are dynamics, orbital mechanics, anti spacecraft mission design. He is author or coauthor of technical papers on trajectory optimization, attitude dynamics, and space mission planning and has also published papers on the theory and practice of engineering teaching. He has received numerous teaching awards including the Chancellor's Council Outstanding Teaching Award, the General Dynamics Teaching Excellence Award, the Halliburton Education Foundation Award of Excellence, the ASEE Fred Merryfield Design Award, and the AIAA-ASEE Distinguished Aerospace Educator Award. He is a member of the Academy of Distinguished Teachers at the University of Texas at Austin. He is a licensed professional engineer, a member of several technical societies, and a Fellow of both the American Institute

of Aeronautics and Astronautics and the American Society for Engineering Education. In 2000-2001, he served as president of the American Society for Engineering Education.

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Our original objective in writing this book was to present the foundations and applications of dynamics as we do in the classroom. We used many sequences of figures, emulating the gradual development of a figure by a teacher explaining a concept. We stressed the importance of visual analysis in gaining understanding, especially through the use of free-body diagrams. Because inspiration is so conducive to learning, we based many of our examples and problems on a variety of modern engineering applications. With encouragement and help from many students and fellow teachers who have used the book, we continue and expand upon these themes in this edition.

## Examples that Teach

The Strategy/Solution/Discussion framework employed in most of our examples is designed to emphasize the critical importance of good problem-solving skills. Our objective is to teach students how to approach problems and critically judge the results.

## Engineering Design

We include simple design considerations in many examples and problems without compromising emphasis on fundamental mechanics. Design problems are marked with a **D** icon. Optional examples titled "Application to Engineering" provide more detailed discussions of the uses of dynamics in engineering design.

## Computational Mechanics

Some instructors prefer to teach engineering dynamics without requiring the use of a computer. Others use the subject as an opportunity to introduce students to the use of computers in engineering, having them either write their own programs in a lower level language or use higher level problem-solving software. Our book is suitable for each of these approaches. We provide optional, self-contained "Computational Mechanics" sections with examples and problems designed for solution by a programmable calculator or computer. In addition, tutorials on using Mathcad® and MATLAB® in engineering mechanics are available from our text's website. See Supplements (page xv) for a further description.

## Consistent Use of Color

To help students recognize and interpret elements of figures, we use consistent identifying colors.

## New to the Third Edition

Positive responses from users and reviewers have led us to retain the basic organization, content, and features of the first edition. During our preparation of this edition, we examined how we presented each concept, example, figure, summary statement, and problem. Where necessary, we made changes, additions, or deletions to simplify and clarify the presentation. In response to requests, we made the following notable changes:

- Problems that contain elements of engineering design have been marked with a new **D** icon.
- We have added new examples where users indicated more were needed. Many of the new examples continue our emphasis on realistic and motivational applications and engineering design.
- We provide over 300 new and revised problems, including the conversion of some problems from U.S. Customary to SI units. As with the examples, many of the new problems continue our focus on applications of dynamics within the context of engineering practice.
- New sets of **Study Questions** appear after most sections to help students check their retention of key concepts.
- Each example is clearly labeled for its teaching purpose.
- We have redesigned the text and also added photographs throughout to help students relate the text to actual applications and situations.
- An extensive new supplement program includes web-based assessment software, visualization software, and much more. See the Supplements description for complete information.
- At the suggestion of reviewers, we have improved the organization of Chapter 20 by introducing Euler's equations earlier and moving the material on moments and products of inertia to an appendix at the end of the chapter.

## Commitment to Students and Instructors

In revising the textbook and solutions manual, we have taken precautions to ensure accuracy to the best of our ability. We have each solved the new problems in an effort to be sure that their answers are correct and that they are of an appropriate level of difficulty. Karim Nohra of the University of South Florida also checked the text, examples, problems and solutions manual. Any errors that remain are the responsibility of the authors. We welcome communication from students and instructors concerning errors or areas for improvement. Our mailing address is Department of Aerospace Engineering and Engineering Mechanics, University of Texas at Austin, Austin, Texas 78712. Our electronic mail address is [abedford@mail.utexas.edu](mailto:abedford@mail.utexas.edu).

## Supplements

### Student Supplements

**Web Assessment Software** lets students solve problems from the text with randomized variables so each student solves a slightly different problem. After students have submitted their answers, they receive the correct answers and, if necessary, can continue to attempt similar problems until they are successful. By integrating with an optional course management system, professors can have student results recorded electronically. Students may also print random problem sets for submission and traditional grading. Contact your Prentice Hall representative for more information and for instructor's passwords. This site is password protected—student passwords appear in each text's accompanying Dynamics Study Pack.

**Study Packs** is designed to give students the tools to improve their study skills. ***Study Packs are bundled at no additional cost with every Third Edition*** sold in bookstores. It consists of three study components—a free body-diagram workbook, a Visualization CD based on Working Model Software, and an access code to a website with 500 sample Statics and Dynamics problems and solutions.

- **Free-Body Diagram Workbook** prepared by Peter Schiavone of the University of Alberta. This workbook begins with a tutorial on free body diagrams and then includes 50 practice problems of progressing difficulty with complete solutions. Further "strategies and tips" help students understand how to use the diagrams in solving the accompanying problems.

- **Working Model CDs** contain pre-set simulations of Statics & Dynamics examples in the text that include questions for further exploration. Simulations are powered by the Working Model Engine and were created with actual artwork from the text to enhance their correlation with the text.
- **Password-Protected Website** contains 500 sample Statics and Dynamics problems for students to study. Problems are keyed to each chapter of the text and contain complete solutions. All problems are supplemental and do not appear in the Third Edition. Student passwords are printed on the inside cover of the Free-Body Diagram Workbook. To access this site, students should go to <http://www.prenhall.com/bedford> and follow the on-line directions to register.

The Study Packs are available as a stand-alone item. Order Study Packs with the ISBN 0-13-061574-9, and Dynamics Study Packs with ISBN 0-13-093235-3.

**MATLAB®/Mathcad® Tutorials.** These tutorials showing how to use computational software in engineering mechanics. Each tutorial discusses a basic mechanics concept, and then shows how to solve a specific problem related to this concept using MATLAB/Mathcad. There are twenty tutorials each for MATLAB and Mathcad, and are available in PDF format from the password-protected area of the Bedford website. Passwords appear in each student study pack. Worksheets were developed by Ronald Larsen and Stephen Hunt of Montana State University-Bozeman.

**Website**—<http://www.prenhall.com/bedford> contains multiple-choice and True/False quizzes keyed to each chapter in the book developed by Karim Nohra of the University of South Florida. Web Assessment, MATLAB/Mathcad tutorials, and Study Pack questions and solutions are all available at the password protected part of this website. Passwords for the protected portion are printed in the Dynamics Study Pack.

**ESource ACCESS.** Students can obtain a password to access an over 5000-page on-line database of Introductory Engineering titles. Topics in the database include mathematics review, MATLAB, Mathcad, Excel, programming languages, engineering design, and many more. This database is fully searchable and available 24 hours a day from the web. To learn more, visit <http://www.prenhall.com/esource>. Contact either your sales representative or [engineering@prenhall.com](mailto:engineering@prenhall.com) for pricing and bundling options.

**ADAMS Simulations for Dynamics**—Mechanical Dynamics, Inc. has created over 100 simulations of problems from *Dynamics* using their ADAMS simulation/prototyping software. Professors and students can simulate and observe the effects of changing parameters in systems and gain deeper insight into their behavior. Simulations also come with an accompanying avi "movie" file. Files are located at the password protected part of the website—students use their study pack passwords, and professors should contact their rep for professor access. Qualified adopters may also be able to obtain free site licenses. Contact [university@adams.com](mailto:university@adams.com) for more information.

## Instructor Supplements

**Instructor's Solutions Manual and Presentation CD.** These supplements, available only to instructors, contain complete solutions to all of the problems and several sample syllabi. Each solution comes with problem statement as well as associated artwork. The accompanying CD contains PowerPoint slides of art from examples and text passages, as well as pdf files of all the art from the book and solutions files.

**Course Management.** Prentice Hall will be supporting Bedford/Fowler with several course management options. Contact your sales representative or [engineering@prenhall.com](mailto:engineering@prenhall.com) for complete information including prices and availability, dates as well as how to use course management with our web assessment software.

## Users Review

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#### Peggy Hahne:

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#### Susan Velez:

The experience that you get from Engineering Mechanics: Statics and Dynamics (3rd Edition) may be the more deep you excavating the information that hide inside words the more you get serious about reading it. It does not mean that this book is hard to understand but Engineering Mechanics: Statics and Dynamics (3rd Edition) giving you joy feeling of reading. The author conveys their point in particular way that can be understood simply by anyone who read this because the author of this reserve is well-known enough. That book also makes your current vocabulary increase well. Therefore it is easy to understand then can go along with you, both in printed or e-book style are available. We recommend you for having that Engineering Mechanics: Statics and Dynamics (3rd Edition) instantly.

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#### Irving Carlin:

As a pupil exactly feel bored to reading. If their teacher expected them to go to the library or make summary for some reserve, they are complained. Just minor students that has reading's internal or real their interest. They just do what the educator want, like asked to the library. They go to there but nothing reading very seriously. Any students feel that reading is not important, boring along with can't see colorful pictures on there. Yeah, it is being complicated. Book is very important for yourself. As we know that on this time, many ways to get whatever we really wish for. Likewise word says, ways to reach Chinese's country.

Therefore , this Engineering Mechanics: Statics and Dynamics (3rd Edition) can make you truly feel more interested to read.

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