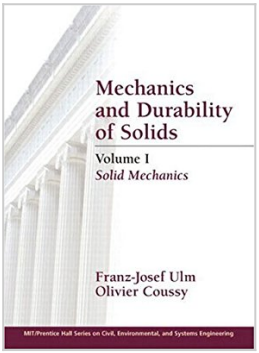

Mechanics and Durability of Solids, Volume I

By Franz-Josef Ulm, Olivier Coussy

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For first courses in Continuum Mechanics and senior undergraduate or introductory graduate-level Constitutive Modeling courses.Using a fresh, modern approach to the mechanics of materials, this book focuses on a unified mechanistic approach that uses energy concepts for modeling a large range of engineering material behavior. In the presentation, 1D-Think models lead to the development of various fundamentals of continuum mechanics, such as deformation and strain, momentum balance, stress and stress states, thermoelasticity and elasticity bounds, plasticity and yield design. The bases for a common language among core disciplines in engineering sciences are developed in a mathematical manner.

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Mechanics and Durability of Solids, Volume I By Franz-Josef Ulm, Olivier Coussy Bibliography

- Rank: #3661014 in Books
- Brand: Brand: Prentice Hall
- Published on: 2002-07-30
- Original language: English
- Number of items: 1
- Dimensions: 9.63" h x .88" w x 7.38" l,
- Binding: Hardcover
- 408 pages

Editorial Review

From the Back Cover

Intended for a first course in continuum mechanics and constitutive modeling at the senior undergraduate and the introductory graduate level, the focus of this book is on a unified "mechanistic" approach that uses energy concepts for modeling a large range of engineering material behavior. In the presentation, 1D-Think models lead to the development of various fundamentals of continuum mechanics, such as deformation and strain, momentum balance, stress and stress states, thermoelasticity and elasticity bounds, plasticity, and yield design. Along these lines, the bases for a common language among core disciplines in engineering sciences are developed, in a mathematical, yet eloquent manner. The textbook evolved from lecture notes of a one-semester course developed by the authors at the Massachusetts Institute of Technology, as well as in France, Germany, and Brazil.

Key Features of the Book

- Parts I and II introduce the two pillars of continuum mechanics, strain and stresses, with a focus on geometrical and physical interpretation, starting with the finite deformation theory.
- Part III is dedicated to non-dissipative material behavior, with a focus on thermoelasticity and variational methods in elasticity, as well as to its application in heterogeneous material systems.
- Part IV starts with 1D-plasticity, introducing ideal plasticity, hardening plasticity, and associated energy transformations. It is within the energy approach that the 1D-Think models are extended to 3D, introducing the notion of associated and non-associated plasticity. Finally, the concept of plastic collapse is introduced, leading to the development of the upper- and lower-bound theorems of limit analysis, which form the basis of modern yield design for engineering structures and material systems.
- The mathematical developments in each chapter are illustrated through a set of accompanying blackboard exercises of the subject matter, a Training Set for recitation, followed by a broad spectrum of worked exercises suitable for homework, classroom assignments, quizzes, or take-home examinations.

This textbook is the first of two volumes dealing with Mechanics and Durability of Solids. It provides an introduction to continuum mechanics and material modeling of engineering materials based on first energy principles. The second volume extends the approach to fracture and durability mechanics of solids. The overall theme of both volumes is a unified `mechanistic' approach that uses energy concepts for modeling a large range of engineering material behavior, while generating the basis of a common language with other core disciplines in engineering sciences.

The first volume is composed of four parts: (I) Deformation and Strain; (II) Momentum Balance, Stress and Stress States; (III) Elasticity and Elasticity Bounds; (IV) Plasticity and Yield Design. Parts I and 11 introduce the two pillars of continuum mechanics and focus on geometrical and physical interpretation of strain and stresses, starting with the finite deformation theory, which is consistently linearized. Part III is dedicated to non-dissipative material behavior, with a focus on thermoelasticity and variational methods in elasticity and its application to heterogeneous material systems. Part IV starts with 1D plasticity, introducing ideal plasticity, hardening plasticity, and associated energy transformations. It is within the energy approach that the 1D Think models are extended to three dimensions, introducing the notion of associated and non-

associated plasticity. Finally, the plastic collapse is introduced, leading to the development of the upper and lower bound theorem of limit analysis as bounds of the maximum admissible dissipation at plastic collapse of material systems and structures.

From the onset, our approach to writing this textbook was nourished by the multicultural flavor of our educational backgrounds: the pragmatism of the traditional German Engineering Mechanics education and the modern mathematical eloquence of "La Mecanique Rationelle." In such an endeavor, the need for a common language is critical. We developed this language over the years with our students on blackboards through 1D Think Models in France, Germany, Brazil, and finally at M.I.T. The outcome of this cultural adventure is this textbook; it is situated at the interface of Applied Mechanics and Engineering Mechanics.

The first ideas about writing this textbook go back to France, where we taught Continuum Mechanics together to undergraduate students in a joint program of L'Ecole Normale Superieure de Cachan and Universite de Marne-LaVallee. But it was M.I.T. that gave us the occasion to develop a spoken language into lecture notes for undergraduate and graduate students. Still, some of the Problem Sets in this textbook have a much longer history, rooted in the teaching of "La Mecanique Rationelle" by the most gifted educators, who instilled in us the beauty of Mechanics: Jean Mandel, Paul Germain, Jean Salencon, Yves Bamberger, Bernard HaJphen; and with our colleagues and friends: Patrick de Buhan, Luc Dormieux, and many more. By recycling some of the Problem Sets from our drawers into this textbook, we trust that we remain true to our roots.

We wish to thank Professor Stein Sture of the University of Colorado at Boulder and Professor John Rudnicki of Nortwestern University for their assistance in reviewing the textbook.

We trust that this textbook will be a source of imagination.

FRANZ-JOSEF ULM
Cambridge, Massachusetts

OLIVIER COUSSY
Paris, France

Users Review

From reader reviews:

Jay Burke:

Why don't make it to become your habit? Right now, try to prepare your time to do the important take action, like looking for your favorite book and reading a book. Beside you can solve your problem; you can add your knowledge by the e-book entitled Mechanics and Durability of Solids, Volume I. Try to face the book Mechanics and Durability of Solids, Volume I as your close friend. It means that it can to become your friend when you feel alone and beside that of course make you smarter than ever before. Yeah, it is very fortuned for you. The book makes you considerably more confidence because you can know anything by the book. So , we should make new experience and also knowledge with this book.

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