

to a time before the development of structured constructs for loop control banished the GOTO from modern programming practice. Some of the tutorial materials dealing with specific software packages read as if they are actually laboratory handouts and as such should probably have been included as appendix material, if at all. Referring to "giga" as a "billion" (page 355) is OK for material limited to distribution in the US, but not for worldwide distribution. Stating that protons and neutrons are "elementary" particles (page 668) in the same sense that the electron is is bothersome. Similarly, stellar "color" is related to the temperature of a star, not its brightness (page 306). The use of 'he' to refer to the reader should have been avoided. Distractions like these should have been caught by the editors or reviewers prior to publication.

This book can be considered for use as a text in a laboratory-based course in computational science, but its selection would be dictated by whether or not the specific hardware and application software discussed provides the necessary fit with the course. If selected, its use would have to be supplemented appropriately with questions, exercises and projects developed by the instructor or, in part, obtained from the authors.

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Mechanics of Materials

David Roylance
Wiley, New York, 1996. 315 pp.
\$75.95 hc ISBN 0-471-59399-0

Mechanics of Materials

Roy R. Craig Jr
Wiley, New York, 1996. 752 pp.
\$92.95 hc ISBN 0-471-50284-7

The title "Mechanics of Materials" has been used to describe books on beam theory and books bridging materials science (the development of new materials) and mechanics (as applied to solving structure and infrastructure problems). David Roylance's *Mechanics of Materials* covers beam theory, failure theories and fracture, while Roy Craig's book of the same title covers beam theory in depth.

Roylance's book is well written and well organized, and it contributes a nice overview of the field. Its focus, on tying mechanical behavior to microstructure, is the appropriate approach for this subject; its introduction of finite elements, strain gauges, moiré patterns and photo-stress is also appro-

priate. Experimental and computational techniques should be included with the analytical approach to the mechanics of materials; unfortunately, I found the mathematics here to be presented rather than developed; the book contains so much material in so abbreviated a manner as to lose substance.

Roylance's book is not suitable as an undergraduate text for teaching beam theory, nor is it suitable for a course in mechanical behavior of materials that would be taught from a book like Norman Dowling's *Mechanical Behavior of Materials* (Prentice Hall, 1993). It might, however, be suitable for a senior-year elective course in mechanics.

In general, the mathematics and techniques used in Roylance's text are relatively advanced and not sufficiently well developed to teach them to undergraduates. For example, Roylance introduces and then derives the biharmonic equation in just a few pages; cylindrical and elliptical coordinates and complex variable techniques and Airy's stress function are similarly introduced in a few pages. Such brief presentations of advanced material are insufficient for the student to gain an understanding of the underlying physics. I agree that it is good to expose students to advanced techniques, however, the techniques must be carefully developed in an undergraduate text or the students will simply be lost. By comparison, the development in this book is even more brief than that in Lawrence Malvern's *Continuum Mechanics* (Prentice Hall, 1969). I would consider using Roylance's book for a senior elective after a student has taken beam theory and a course that covers the material in Dowling's book.

Roy Craig's *Mechanics of Materials*, by contrast, covers a section of the core of the undergraduate curriculum in mechanical, civil and aerospace engineering. The subject of the text is of fundamental importance in these disciplines, and a textbook of this caliber is certainly needed.

As a field, the mechanics of materials (also called mechanics of deformable bodies or strength of materials) is a mature subject, and thus no ground-breaking advances are expected. However, Craig's book does represent a contribution to undergraduate teaching. Stephen Timoshenko and James Gere's *Mechanics of Materials* (PWS Publishing, 1990) was a very good book in this area. Craig's treatment is similar in format to theirs, but much improved.

When undergraduates step into this subject area, they are getting their first exposure to techniques of mechanical analysis and design. The figures

throughout Craig's text are not the typical schematic idealized problems. Rather, they present mechanical parts of engineering structures and machines. Many other excellent pictures are used to illustrate the techniques of experimental mechanics, which is extremely useful to an instructor in motivating the students.

The organization of the material in Craig's text lends itself well to teaching. The section on stress and strain builds systematically all the way up to the generalized Hooke's law for isotropic materials. The discussion of special cases then follows naturally (uniaxial, multiaxial, torsional and so on). The chapter on stress and strain transformations is particularly nice. Several motivating examples lead up to the development of Mohr's circles, but Craig does not stop here. Principal values and directions are presented, and the general approach using direction cosines is used. The chapter ends with application of the transformation laws to strain gauges. (Contrary to popular belief, the finite-element method has not eliminated the need for and use of wire/foil strain gauges.)

The final chapter, on failure theories, is too brief to do anything but mention that they exist. This is the subject of other books, Dowling's *Mechanical Behavior of Materials* for example, or such more advanced books as Jean P. Lemaitre and Jean-Louis Chaboche's *Mechanics of Solid Materials*, (Cambridge U. P., 1994), which are beyond the scope of an undergraduate course. This chapter could have been left out without detracting from the book.

Roy Craig is well known and respected by the structural mechanics community and has already written one successful textbook, *Structural Dynamics—An Introduction to Computer Methods* (Wiley, 1981) in a related field. It has been a pleasure to review his latest book.

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Lasers and Electro-Optics: Fundamentals and Engineering

Christopher C. Davis
Cambridge U. P., New York, 1996.
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(0-521-48403-0 pb)

Christopher Davis's *Lasers and Electro-Optics* is a comprehensive undergraduate text that provides a broad but detailed introduction to the basic physics and applied underpinnings of