BOOK REVIEW


Continuum Mechanics via Problems and Exercises, edited by Margarita E. Eglit and Dewey H. Hodges collects the experience in the teaching of Continuum Mechanics acquired over the years by the professors of the Department of Hydrodynamics of M.V. Lomonosov Moscow State University. The authors intend to cover wide domains of both Solid and Fluid Mechanics, starting from basic concepts to advanced issues. It results in an original textbook where Continuum Mechanics is addressed through exercises and problems. These exercises and problems are preceded by the minimal theoretical background required to solve them. Thanks to this method and to a concise style the authors succeed in approaching Continuum Mechanics as a whole in two volumes of about only two hundred pages each and devoted respectively to the problems and to their solutions.

No doubt that such a concise presentation of Continuum Mechanics through problems and exercises is one of the achievements of the book. Although it deserves to be recognised, it is not without any counterpart. On one hand, the authors provide a clear presentation of the general structure of Continuum Mechanics through short summaries which therefore appear as the theoretical backbone of the book. These summaries will be very useful for the reader, especially for undergraduate as well as graduate students. On the other hand, in order to preserve the conciseness of the theoretical part, the authors have sometimes been obliged to introduce key points of Continuum Mechanics through exercises. For instance, the presentation of the boundary layer theory or the turbulent flow theory in only half a page is questionable, particularly in a book where the limit between exercises and theory represents the implicit line drawn by the authors between what they judge to be fundamental and less fundamental. Concerning some key points, many students will need further basic reading.

Before starting with Continuum Mechanics concepts, the authors propose a useful introduction to tensorial algebra, including basic concepts required to handle tensor functions and calculations in curvilinear coordinate systems. The presentation of dimensional analysis and of the Π-theorem in the last chapter is equally welcome.

Continuum Thermodynamics is presented in detail. The general concepts are applied to Fluid Mechanics and to the elastic solid. A specific section is even devoted to the case of media with internal angular momentum. In contrast, no energy approach is proposed for inelastic solids. Plastic or viscous behaviours are actually considered rather briefly and, curiously, there is no mention on fracture mechanics. Inversely, owing to the apparent basic purpose of the book and its conciseness, it seems inopportune with respect to the previous lacks to have spared some pages to the introduction of relativistic kinematics.

From a pedagogical viewpoint, advanced issues like magneto- and electro-hydrodynamics, nonlinear elasticity at large strains are interesting to discover via exercises. It is however again questionable whether this approach is the best appropriate to students who have not been initiated to these subjects before.

Covering the major areas of Fluid and Solid Mechanics, and illustrating them by many exercises, Continuum Mechanics via Problems and Exercises is certainly a valuable tool for students as well as for their professors, in spite of some debatable and surprising choices.

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