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REVIEW

Mechanics of Continuous Media. By S. C. HUNTER. Halsted Press, 1977. 567 pp. £15 (hardback) or £6.90 (paperback).

Continuum mechanics is studied both in mathematics and in engineering. It comprises the scientific phenomena which occur in the mechanics of continuous media, the postulated physical laws and the mathematical techniques needed to understand the phenomena in terms of the laws. The subject is so vast that any book attempting a broad treatment is inevitably a selection, not just from the whole, but from those parts with which the author is familiar.

The first five chapters of the book treat strain and stress. Along with the physical concepts, the mathematical concept of Cartesian tensors is introduced. This is typical of the author's approach throughout. He introduces the mathematics when needed. The following three chapters introduce the constitutive equations for various fluids and thermoelastic (which includes elastic) solids. Chapters 9–14 each treat a range of boundary-value problems in a particular branch of continuum mechanics: in turn Reiner–Rivlin fluids, the Navier–Stokes equations, inviscid hydrodynamics, potential flow, the acoustic approximation for compressible flow and linear elasticity. The prime mathematical concern in these chapters is the solution of partial differential equations; techniques explained and used include separation of variables, transforms, including Fourier methods, similarity transformations and complex-variable methods. The final two chapters are devoted to linear viscoelasticity and plasticity.

The range and limitation of the author's approach can be illustrated by looking at one chapter in detail, namely chapter 14, entitled 'The theory of classical linear elasticity for isotropic solids'. The governing equations and boundary conditions, derived earlier, are linearized and the significance of the linearization discussed. After finding the relations between the elastic constants, the author treats exactly six static problems (the prism under gravity, bending of beams, the spherical and cylindrical pressure vessels, rotating shafts and torsion of a cylinder), and then considers Euler–Bernoulli beam theory, which is approximate but of great practical importance. The elastodynamics section solves the isentropic governing equations using the Helmholtz resolution of a vector, treats torsional waves in a cylinder and Rayleigh waves exactly and then longitudinal and flexural waves in a rod approximately.

In the space of sixty pages a coherent selection has been given of topics which would form part of a first course on elasticity theory. But it is only part. If the reader wishes to study elasticity in more detail, he must go to one of the standard books on the subject, references to which are given in this text. In particular, the author does not make clear that the isentropic approximation in elastodynamics is valid at low but not at high frequencies.

The author states that one of the purposes of the book is to make clear to the student those ideas common to all of continuum mechanics and not just specific to one branch. This reviewer feels that this purpose has been achieved and that the author's selection of topics with their relative weighting is defensible. Numerous examples, some worked in the text and others with answers in an appendix, are given.

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