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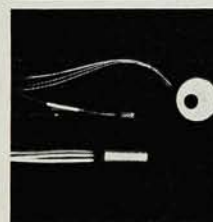
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A First Course in the Mathematical Foundations of Thermodynamics

David R. Owen
134 pp. Springer-Verlag, New York, 1984.
\$26.00

Thermodynamics cuts across more disciplines than any subject except mathematics. One consequence of this is that the study of classical and modern thermodynamics is fragmented into poorly communicating and occasionally hostile camps. One camp of modern thermodynamics, which emerged from the study of nonlinear deformations of continuous media, has developed a new mathematical approach to the foundations of thermodynamics. David Owen, an applied mathematician who does research in the application of thermodynamics to elastic and plastic media, has written an excellent introduction to this development.

This book is part of the Springer-Verlag series of undergraduate texts in mathematics. As might be expected, the text concentrates on the mathematical development of the theory without much discussion of the physical meaning of the material. The book is divided into four parts. The first part uses homogeneous fluids to introduce the ideas that are developed in the remainder of the book; the next two parts present the first and second laws of thermodynamics; and the final part describes some applications.

Owen develops the first and second laws of thermodynamics in a different manner from most standard textbooks. In standard presentations, the first law is presented as the extension of conservation of energy from mechanical to nonmechanical processes. Heat is then introduced as the energy that enters a system to make up the difference between the internal energy and the work done on the system. Owen introduces heat, along with work, as a primitive notion, and derives the existence of the internal energy potential. A similar approach is found in Joseph H. Keenan's *Thermodynamics*. Owen's abstract introduction of the second law is based on the interesting work of James Serrin and provides a lucid exposition of the central ideas of Serrin's approach to the foundations of thermodynamics.

The last two chapters of the book provide applications to thermoelasticity and to homogeneous bodies with viscosity. In particular, they show how thermodynamics places limitations on the properties of materials. It is at this point that the efforts expended on the earlier chapters pay a nice dividend: This point is generally discussed in most texts under the heading of stability, but Owen's treatment is far

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The author has been successful in attaining his goal of making this book accessible to junior-level students who have completed the standard introductory calculus sequence. The text is a model of sound pedagogy, developing concepts in a repetitive fashion, starting with the ideal gas, progressing to more general and more abstract principles, and concluding with applications. At the back of the book there are a few problems for each chapter. However, I cannot recommend this as a text for an undergraduate course in introductory thermodynamics. I think such courses should contain more physics and give students a view of the vast scope of thermodynamics. I do emphatically recommend this book to all serious students and teachers of thermodynamics.

MORTON H. RUBIN
University of Maryland
Baltimore County

new books

Theory and Mathematical Physics

Supersymmetry and Supergravity, Nonperturbative QCD. Proc. Winter School, Mahabaleshwar, India, January 1984. P. Roy, V. Singh, eds. 389 pp. Springer-Verlag, New York, 1984. \$18.00

Computer Studies of Phase Transitions and Critical Phenomena. O. G. Mouritsen. 200 pp. Springer-Verlag, New York, 1984. \$24.50. *Monograph*

Introduction to Gauge Field Theories. M. Chaichian, N. F. Nelipa. 332 pp. Springer-Verlag, New York, 1984. \$39.50. *Monograph*

Stochastic Methods and Computer Techniques in Quantum Dynamics. H. Mitter, L. P. Graz, eds. 452 pp. Springer-Verlag, New York, 1984. \$42.90. *Compendium*

Sensitivity of Functionals with Applications to Engineering Sciences. *Lecture Notes in Mathematics.* Proc. Special Session AMS Spring Meeting, New York, May 1983. 130 pp. Springer-Verlag, New York, 1984. \$7.50

Electrodynamics of Continuous Media. Course of Theoretical Physics. Vol. 8. Second Edition. L. D. Landau, E. M. Lifshitz. 460 pp. Pergamon, New York, 1984. \$25.00. *Text*

Fields and Waves in Communication Electronics. Second Edition. S. Ramo, J. R. Whinnery, T. van Duzer. 817 pp. Wiley, New York, 1984. *Intermediate text*

Gravitation, Geometry and Relativistic Physics. Proc. "Journées Relativistes," Aussois, France, May 1984. 336 pp. Springer-Verlag, New York, 1984. \$16.00. *Compendium*

Classical, Discrete Spin Models: Symmetry, Duality and Renormalization. *Lecture Notes in Physics.* H. Moraal. 251 pp.

Springer-Verlag, New York, 1984. \$11.00. *Monograph*

Coulomb Liquids. N. H. March, M. P. Tosi. 351 pp. Academic, New York, 1984. \$59.00. *Monograph*

Gauge Theory of Elementary Particle Physics. T. P. Cheng, L.-F. Li. 536 pp. Oxford, U.P., New York, 1984. \$39.00. *Graduate text*

Resonances—Models and Phenomena. *Lecture Notes in Physics 211.* Proc. Workshop, Centre for Interdisciplinary Research, Bielefeld University, Bielefeld, Germany, April 1984. S. Albeverio, L. S. Ferreira, L. Streit, eds. 359 pp. Springer-Verlag, New York, 1984. \$18.00

The Mathematical Theory of Turbulence. M. M. Stanišić. 429 pp. Springer-Verlag, New York, 1984. \$29.00. *Monograph*

Cellular Structures in Instabilities. Proc. Meeting, Gif-sur-Yvette, France, June 1983. J. E. Wesfreid, S. Zaleski, eds. 389 pp. Springer-Verlag, New York, 1984. \$18.00

Thermodynamics and Statistical Physics

Rational Thermodynamics. Second Edition. C. Truesdell. 578 pp. Springer-Verlag, New York, 1984. \$69.00. *Compendium*

Steam Tables. Thermodynamic and Transport Properties and Computer Programs for Vapor and Liquid States of Water in SI Units. L. Haar, J. S. Gallagher, G. S. Kell. 320 pp. Hemisphere, New York, 1984. \$34.50 cloth; \$14.95 paper

Energy and Environment

Environmental Radioactivity. Proc. 19th Ann. Meeting, April 1983. 284 pp. National Council on Radiation Protection and Measurements, Bethesda, Md., 1983. \$17.00

Energy and Problems of a Technical Society. J. J. Kraushaar, R. A. Ristinen. 513 pp. Wiley, New York, 1984. \$24.95. *Introductory text*

Energy Policy in America Since 1945: A Study of Business-Government Relations. R. H. K. Vietor. pp. 363. Cambridge U.P., New York, 1984. \$29.95

Fusion Energy. R. A. Gross. 328 pp. Wiley, New York, 1984. \$41.95. *Text*

Radioactivity in the Environment: Sources, Distribution, and Surveillance. R. L. Kathren. 397 pp. Harwood, New York, 1984. \$66.00. *Text*

Student Texts and Popularizations

Science Update. H. Messel, ed. 326 pp. Pergamon, New York, 1984. \$18.00. *Lay readers*

Orbits For Amateurs with a Microcomputer. D. Tattersfield. 171 pp. Wiley, New York, 1984. \$29.95

The Creation of Matter: The Universe From Beginning to End. H. Fritzsch. 307 pp. Basic, New York, 1984. \$19.95. *Lay readers*