ed the formidable task of writing a graduate text covering the physics of magnetically confined plasmas in its entirety, covering such diverse topics as magnetohydrodynamic equilibrium and stability, microinstabilities, heating and diagnostics. Although necessarily superficial in places, he successfully gives a broad overview of the subject.

This edition represents an English translation of the Japanese original, first published in 1976. Although the translation was performed by the author, he has not used this opportunity to revise and update the 1976 edition. This is particularly unfortunate in those cases in which the accepted wisdom of 1976 has been overturned in the intervening four years—a long time in this rapidly developing field. Typically, this is due to the inapplicability of approximations, such as those used in the derivation of the critical shear for stability of collisionless drift waves in slab geometry and in the critical poloidal β for existence of tokamak equilibrium. Thus, caution must be urged in using such expressions. Also, such recent developments as the theory of ballooning modes in toroidal geometry are not treated.

By adopting a rather terse style, the author has managed to compile a large compendium of useful formulas applicable (with the caveat above) to systems of sufficient complexity to be of interest as prospective fusion devices—tokamaks, stellarators, mirrors, and so on. This pursuit of relevance is rare in an introductory text book and is to be applauded. The other side of the coin, however, is that Miyamoto may have failed to discuss basic principles sufficiently to make the work accessible to students. The author also omits a critical discussion of the domain of the applicability of the approximations and techniques used. For instance, when magnetic surfaces in nonaxisymmetric systems are introduced by the method of averaging, there is no discussion of the fact that surfaces may not exist in the strict sense, nor of the consequences of stochastic field line wandering in the event of surface breakup.

The English is reasonable, though not impeccable, and the number of misprints is not exceptionally high. I found the use of nested parentheses, undifferentiated by size or shape, a feature that made the equations difficult to read. Another habit I found confusing was the systematic omission of the dot between the ∇ operator and the vector in divergences. This is particularly unfortunate as the author occasionally uses dyadic notation.

In summary, I feel that this book will make an excellent reference work, but that it may not prove totally satisfactory as an introductory text. Unfortunately, although there are several good textbooks at a more elementary level, the only comparable text is *MHD Instabilities* by Glenn Bateman, which has a much narrower focus.

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Thermodynamics of Irreversible Processes

B. H. Lavenda
182 pp. Halsted (Wiley), New York, 1978. $27.50

This is a scholarly work, and the author, an erudite theoretical physicist, has read widely and deeply. It is not a textbook. You won't want to pick it up to find out what "irreversible thermodynamics" is all about. If you do, you won't even find out to what physical systems it might be relevant. This book is for the specialist. It may be viewed as a sequel to P. Glansdorff and Ilya Prigogine's *Thermodynamic Theory of Structure, Stability, and Fluctuations* (Wiley-Interscience, New York, 1971). Bernard H. Lavenda, the author, is a product of Prigogine's Brussels school, and he has adopted its style. The Preface sets the tone: "This book is formalistic rather than applicative in character." It sets its goal as making "a definitive statement in regard to the present-day status of linear and nonlinear thermodynamics." This includes resolving "the ambiguity in the meanings of 'dissipation' and 'irreversibility'," as well as in the term "nonlinear" in thermodynamics. Indeed, Chapters 5 through 9—half of the book—deal largely with nonlinear systems and how their thermodynamics differs from the linear. The task of the reviewer here is surely not to criticize the goal. The task is rather to express an opinion on whether the work is correct, whether it is readable and whether it is important.

A quote from the last chapter, "Continuum Thermodynamics," may give a feeling for style and substance:

The reduced power equation then takes the form (Lavenda, 1974)

$$\pi = \frac{1}{\rho} \nabla\cdot(\mathbf{J}_S - \mathbf{J}_D) + \dot{\eta} - 2\phi, \qquad \dot{\theta} = 0,\ \dot{\mathsf{F}} = \mathbf{0} \tag{9.2.20}$$

Where we have defined the dissipative flux vector $\mathbf{J}_D$ as

$$\mathbf{J}_D = -\frac{1}{\theta} \mathbf{C}^{(i)} \mathbf{J}_i \tag{9.2.21}$$

Noting (9.1.9), (9.1.15) and (9.2.3), we can also write the power flux $(\mathbf{J}_s - \mathbf{J}_D)$ as

$$\theta(\mathbf{J}_S - \mathbf{J}_D) = \rho_i \epsilon_i u_i - \mathbf{t}_{(i)} \mathbf{u}_i = \mathbf{J}_E \tag{9.2.22}$$

This permits us to write the reduced power equation (9.2.20) in the more lucid form

$$\pi - \frac{1}{\rho} \nabla\cdot\mathbf{J}_E = \dot{\eta} - 2\phi \tag{9.2.23}$$

This is the expression for the thermodynamic principle of the balance of power for the continua under isothermal and isochoric conditions. Expressed in words (9.2.23) states that the absorbed power less energy which flows across the surface of the system appears as the time-rate-of-change of the entropy less the energy which is dissipated in the system.

The reader who can not insert the missing temperature factor spontaneously will have trouble with the rest of the book too.

The early chapters review the Onsager reciprocal relations, including the attack on them by Bernard D. Coleman and Clifford Truesdell. Is the ultimate resolution of the (semantic?) conflict to be found here (page 34)? Writing *homogeneous* instead of *isotropic* doesn't help. Adherents of the school of "rational thermodynamics" would answer no, although their subject gets a whole chapter. Contrasting it with the "Generalized Thermodynamics" (chapter 4) of the Prigogine school is useful, and such a discussion is probably not found elsewhere. The early history of reciprocal relations should surely have cited K. G. Denbigh's little book, *The Thermodynamics of the Steady State* (Methuen, London, 1951). Actually, Denbigh is more successful in imparting physical intuition—the kind that enabled Lord Kelvin to relate the Seebeck and Peltier coefficients eighty years before Onsager.

When a reviewer snipes, a natural question is, how generously does the author cite the reviewer's own work? Here the author gets orchids. He is very generous throughout in giving credit to the two 1953 Onsager and Machlup papers (Phys. Rev. **91**, 1505 and 1512, 1953).

The meat of the book is, of course, the nonlinear thermodynamics. Here the author integrates his own contributions and adds new connections. It took me a while to realize that "half-degrees of freedom" (page 86) are Hendrik B. G. Casimir's α-type variables, and "single degrees of freedom" are the β-type. The next stumbling block was (page 100) the distinction between free and constrained variational principles. Here Lavenda faults Onsager for concluding "that defects that alter the heat flow can only decrease the entropy production under stationary flow conditions, or cause no change." Surely a "crack in the crystal" can decrease the entropy production! What is being held constant in the variation?

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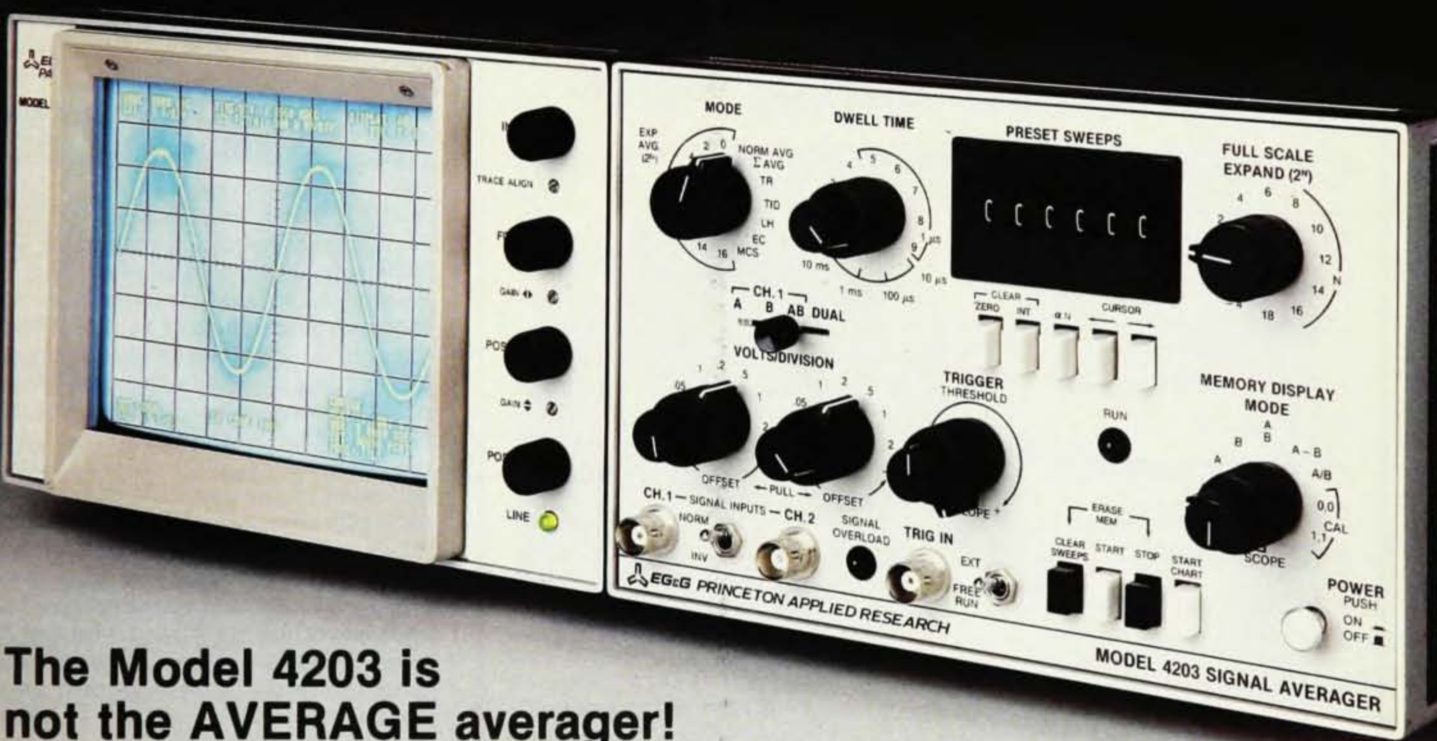

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One of my pet projects has been the attempt (unsuccessful to date) to invent a variational principle for limit cycles—the nonlinear extension of the steady-state concept—particularly in the context of oscillatory chemical reactions. Lavenda seems also to be groping in this direction. He had not got there when he finished the book. At this point, it appears most likely that the kind of thermodynamic guidelines the book develops will be useful in that endeavor. The question, "Is this an important book?" may well be answered only in the light of any future discoveries it catalyzes.

STEFAN MACHLUP
Case Western Reserve University

book notes

The Structure of Matter. R. M. Turnbull. 277 pp. Blackie, Glasgow, UK, 1979. $17.95 (paperback)

"This book is an endeavour to present a concise account of atomic, nuclear and elementary particle physics . . . in the hope that students in the early years of an undergraduate course may gain a glimpse of developments and ideas in current research," states Robert M. Turnbull in the Preface of *The Structure of Matter.* The author, who is senior lecturer in the development of natural philosophy, University of Glasgow, seems to have fulfilled his intentions. The early chapters focus on particle–wave duality and other basic concepts. A five-chapter look at the extranuclear structure of atoms and a similar section on the atomic nucleus follow. Turnbull devotes final three chapters to elementary particles. The approach is essentially conceptual with the more difficult mathematics deferred to later sections. Each chapter finishes with a bibliography listing suggested further readings and original papers. A short appendix of problems and answers is included.

McGraw-Hill Modern Scientists and Engineers, Vols. 1, 2 and 3. S. P. Parker, ed. 465, 449 and 452 pp. McGraw-Hill, New York 1980. $110.00 for the set.

Modern Scientists and Engineers is a revised and enlarged version of the 1966 reference book, *Modern Men of Science.* The new three-volume set contains biographies of some 1100 international scientists and engineers selected from those who received major scientific awards and prizes since the 1920's. Since more than 90 percent of the articles are autobiographical the portrayal of the scientific endeavor is decidedly personal. The text was compiled and edited by the staff of the *McGraw-Hill Encyclopedia of Science and Technology* and provides cross references both to scientific topics and to other scientists. Almost every biographical essay is accompanied by a sketched portrait. —SCA

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Theory & Applications of Electron Spin Resonance. W. Gordy. 635 pp. Wiley-Interscience, New York, 1980. $39.95

Optics and Acoustics

Inelastic Light Scattering (Proc. of a seminar, Santa Monica, Cal., January 1979). E.