mathematical bifurcation theory associated with names such as Hopf, Leray-Schauder, and Liapunov-Schmidt. The author in his many publications has made important contributions in each of these areas, but his work is more usually associated with (*ii*) and (*iii*) and a similar statement applies to this monograph.

An introductory section and first two chapters on "Global Stability and Uniqueness" and "Instability and Bifurcation" gives an excellent discussion of the basic ideas of stability, global stability and energy methods, linear stability (referred to here as the spectral problem of linear theory), the theory for subcritical and supercritical bifurcation, and the stability of bifurcating solutions. Engineers may find the mathematics somewhat sophisticated. But the patient reader will be rewarded by a deeper and broader understanding of the concepts, mathematics, and problems of stability and instability. In these chapters, and indeed throughout the book, Professor Joseph makes an effort to set the mathematical analysis in the framework of relevant experiments and our limited knowledge of transition from laminar to turbulent flow. Each chapter concludes with a section of notes. The notes for Chapter II on Instability and Bifurcation form an attractive summary of major work in areas (*ii*) and (*iii*) just noted of the last 20 years and the current state of the art.

Following the introductory first two chapters are chapters on Poiseuille Flow: The Form of the Distrubance Whose Energy Increases Initially at the Largest Value fo ν (25 pages); Friction Factor Response Curves for Flow Through Annular Ducts (39 pages); Global Stability of Couette Flow Between Rotating Cylinders (27 pages); Global Stability of Spiral Couette-Poiseuille Flows (43 pages); and Global Stability of the Flow Between Concentric Rotating Cylinders (18 pages). As the chapter titles indicate, the emphasis is on energy methods leading to global stability results.

In addition, there are five appendices (48 pages) which primarily deal with mathematical details such as properties of almost-periodic functions, variational methods and problems, and oscillation kernels. A short, but incomplete, Appendix on the stability of nearly parallel flows is included. The collection of approximately 300 references with cross reference to the section(s) where the reference is cited is very helpful. But there are serious omissions, which again reflect the special interest of the author; for example, references to the important work of Gaster on the relation of temporal and spatial disturbances for the Orr/Sommerfeld equation and on nearly parallel flows are not included.

An unusual feature of this monograph is the inclusion of a large number of exercises. Some of these explain, using simple models, many of the basic ideas, and others expand on the text. A selection from the exercises could almost form a supplemental minicourse in nonlinear hydrodynamic stability—ideal for the new thesis student. The author is to be congratulated for his patience and ingenuity in planning and developing these exercises.

In a brief review it is not possible to discuss or even summarize the many results that are given in this book. With the caution that the work reflects Professor Joseph's special interest in energy methods and global stability, there are a considerable number of results to read and to study. But from my point of view, the special feature of this book is the unique blending of formal, sophisticated mathematics with understanding of the physical problems. Professor Joseph has made an important contribution to the literature on the stability of fluid motions.

But I must conclude with one complaint, one that I suspect is shared by others. Granted that these are inflationary times, and granted that the cost of paper and composition has increased rapidly; but why was it necessary to publish this work in two volumes of less than 300 pages each, with each volume costing $39.80? The total cost of $79.60 for the two volumes takes this important work out of the reach of most graduate students and will make others hesitate in its purchase.

Constitutive Equations in Plasticity. Edited by A. S. Argon. M.I.T. Press, Cambridge, Mass., 1976. 591 Pages. Price $19.95.

REVIEWED BY C. S. HARTLEY[3]

This book is a compilation of invited, previously unpublished papers by various authors on the general subject of constitutive equations used in calculating material behavior. The emphasis of the work is on the physical basis of constitutive equations, and several efforts are made to formulate constitutive laws which contain terms related to the structure of the material. The 15 chapters in the book can be divided into four general areas. The first five chapters are concerned with theoretical aspects of constitutive equations, in particular, the thermodynamic and physical bases for such equations. Chapters 6–8 are concerned with description of dislocation structures after various types of deformation, Chapters 9–13 treat techniques for constructing analytical models of the changes in structure under various deformation conditions and for various types of materials, and Chapters 14 and 15 are concerned with the application of models to computer codes which calculate large-scale deformation behavior. A listing of the chapters with authors is given as follows:

Chapter 1—"Physical Basis of Constitutive Equations for Inelastic Deformation" by A. S. Argon; Chapter 2—"Continuum Mechanics and Thermodynamics of Plasticity in Relation to Microscale Deformation Mechanisms" by J. R. Rice; Chapter 3—"Constitutive Relations for Slip the Kinetics of Inelastic Deformation Above 0°K" by U. F. Kocks, M. F. Ashby, and H. J. Frost; Chapter 5—"Phenomenological Theory: A Guide to Constitutive Relations and Fundamental Deformation Properties" by E. W. Hart, C. Y. Li, H. Yamada, and G. L. Wire; Chapter 6—"Description of the Dislocation Structure After Unidirectional Deformation at Low Temperatures" by H. Mughrabi; Chapter 7—"Description of the Work-Hardened Structure at Low Temperature in Cyclic Deformation" by J. C. Grosskreutz, and H. Mughrabi; Chapter 8—"Dislocation Structures in Deformation at Elevated Temperatures" by H. M. Miekk-oja and V. K. Lindroos; Chapter 9—"Modeling of Changes of Dislocation Structures in Monotonically Deformed Single Phase Crystals" by J. Zarka; Chapter 10—"Modeling Structural Changes in Deformed Dispersion Strengthened Crystals" by L. M. Brown, and W. M. Stobbs; Chapter 11—"Development of Deformation Textures" by G. Y. Chin; Chapter 12—"Modeling of Changes of Dislocation Structure in Cyclically Deformed Crystals" by P. Newmann; Chapter 13—"Modeling of Changes of Strain Rate and Dislocation Structure During High Temperature Creep" by B. Ilschner; Chapter 14—"Microstructure Based Modeling of Constitutive Behavior for Engineering Applications" by J. H. Gittus; Chapter 15—"The Fuel Element Life Code, an Ultimate Application of Constitutive Equations to a High Technology Problem" by R. W. Weeks, V. Z. Jankus, and R. B. Poeppel.

The point of view taken in this work, that constitutive equations must have physical bases which are related to measurable structural parameters, is a refreshing and promising departure from the purely phenomenological treatments characteristic of most theories of plasticity. This book takes an important step forward in bringing together various points of view about plasticity of metals. This collection is recommended to any serious student of plastic behavior of materials.

Mechanics of Continuous Media. By S. C. Hunter. Halsted Press, A Division of John Wiley & Sons, Inc., 605 Third Ave., New York. N.Y. 10016. 1977. Pages 567. Price $37.50.

REVIEWED BY A. C. PIPKIN[4]

This is an excellent introductory text. Although it gives a modern

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