

## BOOK REVIEWS

### Micromechanisms of Plasticity and Fracture

Reviewed by Dr. B. Anne Fields, Rockville, MD.

**REFERENCE:** Lewis, M. H. and Taplin, D. M. R., Eds., *Micromechanisms of Plasticity and Fracture*, SM Publications, University of Waterloo Press, Waterloo, Ontario, Canada, ISBN: 0-88898-045-0, hardcover, \$30.00, 368 pp.

This book is a collection of ten review papers covering aspects of the micromechanisms of strength and fracture in metals and ceramics. It contains papers on "The Interaction of Dislocations with Hard Particles" by F. J. Humphreys; "Superplasticity—Mechanical and Microstructural Aspects" by A. Arieli and A. K. Mukherjee; "Grain Boundaries in High Temperature Deformation" by G. L. Dunlap and P. R. Howell; "Grain Boundary Segregation and Intergranular Fracture" by M. P. Seah; "Fracture Mechanics and Brittle Fracture of Ceramics" by R. W. Davidge; "Plasticity and Fracture Mechanisms in Ceramic Alloys Based on Si-Si<sub>3</sub>N<sub>4</sub>" by M. H. Lewis; "Ashby Maps" by D. M. R. Taplin, M. C. Pandey, and N. Y. Tang; "Micromechanisms of Fracture and the Toughness of Steel" by J. F. Knott; "Stability of Microstructure in Precipitation Hardened Alloys under Fatigue Loading" by R. D. Doherty; and "Micromechanisms in Fatigue" by J. W. Martin and L. Edwards.

The papers are intended to be used in a senior undergraduate or graduate course and by researchers requiring a survey of the current understanding of plasticity and fracture mechanisms. The editors stress the emphasis on real engineering solids in real service conditions as opposed to the use of structurally simplified models. This is true in the majority of the papers.

The articles in this book assume that the reader has a good materials background, including knowledge of dislocation theory, crystal structure, and fracture mechanics. The text gives detailed discussions of recent developments in understanding the micromechanisms involved in important areas of materials behavior, such as high temperature deformation, superplasticity, fatigue, and fracture. The quality of diagrams and photographs is excellent and each paper contains an extensive list of references to the studies being reviewed. While all the articles provide instructive reviews, two articles were particularly interesting to the present reader. Taplin's paper on "Ashby Maps" provides a unique discussion of every sort of mechanism map that has been published to date. As such, this article is a logical starting point for those interested in this method of data presentation and interpretation.

The article by Doherty is also particularly interesting, because it covers a very new subject: the alteration of precipitate size and distribution by dislocation motion. So, while plasticity is determined by the precipitates (as discussed in the chapter by Humphreys), the resulting dislocation motion itself modifies these flow controlling particles. The consequences of this effect suggest numerous areas of research.

This book should become an important reference source for those attempting to understand or improve the behavior of engineering

solids in terms of the micromechanisms involved in their deformation or fracture.

### Light-Microscopical Resinography

Reviewed by Herman F. Mark, Professor, Polytechnic Institute of New York, Brooklyn, NY. Member of ASTM.

**REFERENCE:** Rochow, T. G., *Light-Microscopical Resinography*, #57 of the Micro-Scope Series, Microscope Publications, Division of MacCrone Research Institute, 2598 S. Michigan Ave., Chicago, IL 60616, 1983.

It is amazing how much valuable information this little book contains for its readers; 82 pages of text, 61 figures, and 141 references provide an extremely educational and pleasantly readable story of "resinography," a branch of descriptive science devoted to the study of resinous materials both natural and synthetic. Systematic observations of this kind were first published by Henry Clifton Sorby in 1876 when he described his microscopic examination of the various and curious shapes of tiny bubbles of gas or liquids in polished thin sections of turbid fossil amber.

In 1946 the author of this monograph coined the word "resinography" for this activity in analogy to the then already popular word "metallography" which denotes similar efforts in the investigation of metals; it has since become a well-developed discipline of the macroscopic and microscopic characterization of resinous systems and has achieved great practical and theoretical importance through the enormous growth of synthetic fibers, films and plastic materials (Chapter One). The second chapter describes the observation of macrospecimens with magnifying lenses and simple microscopes and defines such phenomena as polarization and anisotropy and their observation.

Chapter Three familiarizes the reader with the stereoscopic microscopical resinography, its different kinds and uses, hot and cold stages, polarizing instruments, reflected illuminations, and fluorescence by ultraviolet excitation. The next two chapters (four and five) are devoted to the description and discussion of microresinography in reflected and transmitted light with particular emphasis on the preparation of the samples and the interpretation of the results. Special attention is given to the investigation of fibers, their various structural characteristics such as brightness, cross sections, birefringence, and extinction.

The author has used great care in the selection of the numerous illustrations, some photographs and some drawings, and throughout the text recommends to the reader to carry out his own experiments (altogether about 40) to get familiar with the topic through work of his own hands. Altogether this little book is a most welcome addition to our literature and an example how a topic of seemingly minor general importance can be made highly attractive and educational through the devotion and dedication of the author.

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### **Structural Vibration Analysis: Modelling, Analysis and Damping of Vibrating Structures**

*Review by George J. O'Hara, College of Engineering, Glenn L. Martin Institute of Technology, Department of Mechanical Engineering, University of Maryland, College Park, MD.*

**REFERENCE:** Beards, C. F., *Structural Vibration Analysis: Modelling, Analysis, and Damping of Vibrating Structures*, Halstead Press Division, John Wiley and Sons, 605 Third Ave., New York, NY 10016, 1983, ISBN:0-470-27422-0, hardcover, \$44.95, 153 pp.

The author has composed an interesting book to insert into the area between basic vibration texts and more advanced specialized books. The mathematical techniques used are the ones that do not require advanced mathematical knowledge. The book is intended for senior undergraduates, graduates, and practicing engineers and is an approach to the understanding of practical, yet elementary, engineering analysis of simple structures.

This small-sized book is very short, consisting of 119 pages of text in five chapters, followed by Chapter Six which consists primarily of 66

problems, about half of which have answers included. Chapter One labeled "Introduction" is only seven pages long and discusses the philosophy and approach to be followed.

The four short chapters that present the main contents of the book are well written and illustrated. The elementary results and formulas from standard vibration analyses of simple structures are shown and used by means of numerical examples to illustrate some points. For example Rayleigh's and Dunkerly's Techniques, Matrix Iteration, and Fourier Series are utilized. This is a "how to" book on the elementary level, and the reader is advised by the author that solutions for more complicated structural configurations such as those for Rotary Inertia and Shear Effects on continuous structures exist elsewhere.

There are relatively few references given. This may not be a serious drawback since most standard references can provide the needed details on background theory if required.

The book seems well suited as a text for a short course, a second complimentary text for some other courses such as structures or machine design, or a handy memory refresher for the practicing engineer.