MICROELECTRONICS PACKAGING HANDBOOK,
edited by Rao R. Tummala and Eugene J. Rymaszewski,
Van Nostrand Reinhold, New York, 1989, 1194 pages, $94.95.

REVIEWED BY Y. C. LEE[1]

This book serves a dual purpose: it introduces the industrial and academic communities to the state-of-knowledge and research in microelectronics packaging and contains new practically important data. It also provides a comprehensive source of information ranging from consumer electronics to the most complex computers on all the major aspects of microelectronics packaging.

The book is organized into 16 chapters as listed below.

Chapter 1, an overview chapter, defines the subject of microelectronics packaging and indicates what important package parameters one should use when distinguishing various packages. Chapter 2 and Chapter 3 address primarily the signal transmission aspects of the package, providing wiring and electrical groundrules for the microelectronic systems. Chapter 4 addresses removal of heat generated in the chip, and Chapter 5 suggests criteria and measurement techniques for the assessment of the reliability of various packaging elements.

The remaining chapters systematically address package technologies involved in forming a total system. One technology is presented at a time in a given chapter, starting with the interconnection between chips and first-level packages in Chapter 6. Then, three first-level packaging technologies, namely ceramic, plastic and thin-film, are covered in Chapters 7–9. In the package, device circuits need to be protected from an adverse environment, and the required sealing and encapsulation technologies are described in Chapter 10.

Chapter 11 discusses interconnection technologies involving both surface mount and pin-through-hole for the second-level packaging. The following two chapters cover the board technologies such as printed circuit boards (Chapter 12) and either inorganic or organic dielectrics deposited on metal substrates (Chapter 13). For systems requiring several boards, the third level packaging is needed and often achieved by connector and cable technologies described in Chapter 14.

The last two chapters deal with application examples of packaging technologies discussed in the preceding chapters, ranging from consumer products to midrange computers, as in Chapter 15, and mainframe to supercomputers, as in Chapter 16.

Achieving most of the targets set by the editors, the book is

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Chapter	Comments
1. Microelectronics Packaging—An Overview	Overview
2. Package Wiring and Terminals 3. Package Electrical Design	Layout and Electrical Design
4. Heat Transfer in Electronic Packages	Thermal Design
5. Package Reliability	Reliability
6. Chip-to-Package Interconnections 7. Ceramic Packaging 8. Plastic Packaging 9. Thin-Film Packaging	1st Level Packaging
10. Package Sealing and Encapsulation	Environmental Protection
11. Package-to-Board Interconnections 12. Printed-Circuit Board Packaging 13. Coated-Metal Packaging	2nd Level Packaging
14. Connectors and Cable Packaging	3rd Level Packaging
15. Consumer Product through Mid-Range Computer Packaging 16. Large General-Purpose and Supercomputer Packaging	Application Examples

a good textbook and also an effective reference on microelectronics packaging both for industry and academia. The book covers all the aspects of microelectronics packaging with detailed reviews and analyses of the state-of-the-art technologies.

It is natural that the book, written entirely by IBM professionals, shows, first of all, numerous IBM approaches. However, the authors include also many non-IBM technologies. An example is shown in the front cover design presenting an interconnection hierarchy of a multichip module. Interestingly, this hierarchy originated from NEC instead of IBM. In addition, the authors use common terminology.

Although the book is well organized and written, it still needs to be enhanced in two areas: (1) manufacturing technology and planning and (2) critical research.

Manufacturing no doubt influences the packaging advancement. Currently, manufacturing lines are being significantly improved by machine automation as well as system integration. The book does cover almost all the technologies, but lacks detailed descriptions regarding the associated machine development. It also requires more discussion about the concepts and techniques applied to an integrated manufacturing system, e.g. just-in-time, scheduling, simulation, quality control, information flow, etc.

Identifying critical research areas that could impact the industrial needs is one of the primary objectives of the book. Nowadays, the industrial research community is aggressively exploring numerous packaging studies that will actively affect rather than merely support the design methodologies for the advanced electronic/optoelectronic components and systems. This exploration is exciting and challenging. The book could have discussed the exploration more fully.

Nevertheless, I believe that this book will become one of the most useful reference books both for those just entering and those already engaged in packaging design and development.

Handbook of Numerical Calculation in Engineering, By Jan J. Tuma, McGraw-Hill Publishing Company, New York, NY, 1989. x + 406 pp. ISBN 0-07-065446-8.

Reviewed by M. Michael Yovanovich[1]

The book *Handbook of Numerical Calculation in Engineering* by Jan J. Tuma is a small volume which deals exclusively with numerical methods and complements the author's other publication *Engineering Mathematics Handbook*. It was prepared to serve as a professional, users-oriented, desktop reference book for engineers, scientists and others who prepare computer programs in engineering and applied science for micro-, mini-, and mainframe computers. The material is presented in sixteen chapters and three appendices. The topics covered are: 1) Evaluation of numerical constants; 2) Approximations of elementary and advanced functions; 3) Numerical differentiation and integration; 4) Solutions of algebraic and transcendental equations; 5) Solutions of systems of equations; 6) Applications of Fourier series and Laplace transforms; and 7) Solutions of ordinary and partial differential equations. Ten-digit tables of numerical values of selected special functions such as: the gamma and related functions; circular sine and cosine integrals; exponential integrals; error function and its derivative; complete elliptic integrals of the first and second kind; and the ordinary and modified Bessel functions of the first and second kind of order zero and one are given in appendices.

The author has presented in a relatively small handbook, 1400 analytical relations, 7000 micronumerical models, and over 400 numerical examples which should be useful to a wide audience for many years. It is a handbook which should be available wherever one finds computers.

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