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Practical Guide to the Packaging of Electronics, by Ali Jamnia. Marcel Dekker, Inc., New York, NY, 2003, 202 pp., $135.00, ISBN: 0-8247-0865-2

REVIEWED BY: ANTHONY J. RAFANELLI[1]

This reviewer says “kudos” to Ali Jamnia for going “back to the building blocks” of physical design of electronics assemblies. Perhaps the title should have been “Practical Guide to the Packaging of Electronics Assemblies,” since the product value of electronics is not significant unless they are in some kind of assembly. This is a very minor criticism. A review of the Table of Contents indicates that the key topics have been addressed.

In Chapter 1, I agree with Jamnia’s approach not to cover electromagnetics in detail, but perhaps a high level summary of EMI or EMC should have been indicated in order to raise the engineer’s level of awareness of this topic, since EMI effects will always be prevalent as electronics technology grows. Chapter 2 deals with basic heat transfer concepts. Concepts and general equations of conduction, convection, and radiation are succinctly presented without the theoretical derivations, a good, practical approach. Nondimensional heat transfer numbers are also provided. Chapter 3 goes into the details of conductive cooling. It includes an explanation of thermal resistance. There are plenty of examples; again kudos to the author. The chapter provides an explanation of the relationship between contact interface resistance and contact pressure and the subsequent influence on conductive heat transfer. The author makes a good point in mentioning that altitude, more so in space applications, does have an impact on contact resistance and therefore the engineer needs to be cognizant of aerospace applications.

Radiation cooling is the topic of Chapter 4. It provides the basics of radiation cooling and differentiates between wall-to-wall and participating media radiation. In the former case, the medium has no influence on the heat transfer process while in the latter case, the walls, while radiating to each other, also exchange heat from the medium. Suitable examples of both are provided. In Chapter 5, a classical approach is provided in explaining the concepts of free, natural, and forced convection, and includes a section on fin design. The forced convection section includes a very well laid out discussion on fan design. The author discusses basics of shock and vibration in Chapter 6. While this chapter does cover the basics of both concepts, its organization could be improved by providing two distinct sections on vibration and shock. This reviewer experienced some difficulty in locating the information on shock (discussion on vibration led the chapter). This comment is based on the assumption that this book would be used as a quick reference guide for the practicing engineer.

Chapter 7 discusses the finite element method (FEM). At first glance, one might question why this book would dedicate a chapter to a discussion of a mechanical analysis tool. However, “speaking” from experience, this reviewer has seen that the finite element is continuously used (despite arguments from some engineers) as the tool of choice in verifying electronic interconnection design as well as failure analysis. Therefore, it is appropriate that the author has dedicated a chapter to FEM.

The title of Chapter 8 is “Design and Analysis for Mechanically Reliable Systems.” The chapter includes discussions on the basic strength of materials concepts (e.g., stress analysis, anisotropic/orthotropic/isotropic behaviors, stress-strain curves) and basic mechanical failure categories (elastic deflection, extensive yielding, fracture, and fatigue). The content also includes explanations on thermal stresses and strains with practical examples regarding die attachment, IC devices, and printed circuit board warpage.

Chapter 9 discusses reliability. The content of this chapter, as the case for most of the chapters, justifies the use of this book as a quick reference guide based on format, i.e., this chapter is organized to provide succinct sections on basic reliability concepts such as cumulative distribution function, survivor function, hazard function, reliability models, etc. Chapter 10 provides some very timely and effective information (the chapter title is “Some Analysis Tips in FEMs”). The discussion includes materials properties, CAD to FEA considerations, and criteria for selecting software. Chapter 11 gets into some specifics to consider in avionics applications. Included are discussions on specific design parameters such as operational characteristics, electrical design specifications, mechanical design specifications, electrical thermal parameters, and others.

In conclusion, Ali Jamnia should be commended for providing a useful and well-written work. The book serves as an excellent desk reference for the practicing engineer.

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