Book REVIEWS

VIBRATION ANALYSIS FOR ELECTRONIC EQUIPMENT (3RD ED.)

By D.S. Steinberg, John Wiley and Sons, Inc., 2000.

This book is a very practical book concerning only linear steady mechanical vibration of electronic equipment. It is a companion to a book by the same author and same publisher titled *Cooling Techniques for Electronic Equipment* (2nd edition).

There are 15 chapters in the book. Chapter 1 (pp. 1-16) reviews the concept of vibration modes. Chapter 2 (pp. 17-38), on principles of mechanical vibrations of simple electronic systems, is in fact very similar to the analysis of forced oscillation of passive electric circuits. Chapter 3 (pp. 39-55) is concerned with lead wire and solder joint vibrations on different types of printed circuit boards (PCBs). Chapter 4 (pp. 56-74) analyzes the various beam structures for electronic subassemblies. Chapter 5 (pp. 75-102) analyzes vibrations of component lead wires as bents, frames and arcs. Chapter 6 (pp. 103-149) analyzes vibrations of PCB and flat plates. Chapter 7 (pp. 150-165) discusses the effect of mechanical damping on the life of PCBs. Chapter 8 (pp. 166-187) discusses methods to prevent vibration failures in electronic equipment. Chapter 9 (pp. 188-233) is concerned with random vibration. Chapter 10 (pp. 234-247) is concerned with the effect of acoustic noise. Chapter 11 (pp. 248-299) covers designing electronics for shock environments. Chapter 12 (pp. 300-329) covers design and analysis of electronic boxes. Chapter 13 (pp. 330-345) describes the effects of manufacturing methods on reliability of electronics. Chapter 14 (pp. 346-378) is concerned with vibration fixtures and a few case histories. Chapter 15 (pp. 379-400) discusses environmental stress screening for electronic equipment. There is a list of references (pp. 401-403) and an index (pp. 405-414) at the end of the book.

The book is limited to the analysis of simple mechanical vibrations of linear systems. In practice, there are often complicated nonlinear couplings in the system leading to mechanical parametric excitations, especially in places where there is mechanical resonance but very low damping to suppress the resonance.

In the old days, around probably 1940, analog between mechanical vibration and electrical resonance was once a hot topic studied at schools. Much of the materials in this book appear to be a part of these topics. Mechanical vibrations in electronic equipment happened often in the old days when most of the electronic equipment used electron tubes. In the old television sets, for example, with the high voltage and heavy transformers in place, mechanical vibrations did appear. In fact, there was a time before color television came around and color picture tubes were being developed that one type of color picture tube used a set of long wires in the tube to control the electron beam for color switching. The wires sometimes started vibrating and created a problem of color purity. Eventually, the project was abandoned due to this problem.

With most of the electronic equipment nowadays using integrated circuits and VLSI, there is mostly no more vibration problems. But I did notice recently that the rotating table in some microwave ovens might vibrate if the load on the table is too off balance. Incidentally, the mechanical vibrations mentioned in this book refer mostly to the 60-Hz power-line frequency vibrations or maybe some audio frequency vibrations. Actually, some much higher frequency vibrations do occur in electronics. In long-distance optical-fiber communications, for example, there often are optically excited microwave frequency acoustic oscillations due to stimulated Brillouin scattering.

This book is not suitable for a textbook. But it can be a useful reference in the design of electrical and electronic equipment.

—H. Hsu

RAPID PROTOTYPING OF DIGITAL SYSTEMS: A TUTORIAL APPROACH

By James O. Hamblen and Michael D. Furman, Kluwer Academic Publishers, 2000.

This book provides an exciting and challenging laboratory component for an undergraduate student as well as design engineers working in industry. It introduces the field programmable logic device (FPLD) technology and logic synthesis using CAD tools. The book is organized in 13 chapters as follows. Chapter 1 provides a tutorial for CAD tools that covers the design entry, simulation, and hardware implementation using an FPLD. Chapter 2 provides an overview of the UP1 FPLD development board, where the features of the board are briefly described. Chapter 3 introduces the programmable logic technology where the most common complex programmable logic device (CPLD) and field programmable gate array (FPGA) are presented. Chapter 4 is a tutorial to use both a hierarchical and sequential design with different examples. Chapter 5 describes the UP1core library I/O functions. Chapter 6 introduces the use of VHDL for the synthesis of digital hardware. Chapter 7 describes a state machine that controls a virtual electric train system simulation with video output generated directly by the CPLD. Chapter 8 develops a VHDL model of a simple computer where a fetch, decode, and execute cycle is simulated.