Book Reviews

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Timing Verification of Application Specific Integrated Circuits

Prentice Hall, Upper Saddle River, New Jersey, USA, 1999, pp. xix, 179, ISBN 0–13–794348–2

With the constant growth of the use of the application specific integrated circuits (ASICs) of different kinds and the low prices those circuits achieve, it is becoming acceptable to implement a part of the project in some of those circuits. But, as the author of the book states, it is quite easy to develop a functionally correct logical model of the circuit, while it is quite a different thing when it comes to physical implementation. The physical world exercises delays that can severely affect the design itself. This book represents introductory material, both theoretical and practical, needed by every electrical engineer who is attempting to successfully design an ASIC for the first time. In particular, this book is aimed at practising engineers for self-study, but also for upper-level undergraduate and graduate students in electrical engineering as reference material. In order to use this book some basic knowledge of electrical engineering is necessary.

The whole book is organized around two parts, plus four appendices and the index on total of 179 pages. There are also 93 figures, and 23 tables spread throughout the book. In the book there are many examples, which are mainly from the Synopsis design tools.

The first part consists of two chapters and presents fundamental concepts involved in timing verification. In the first chapter, that has only 16 pages, some basic concepts are introduced, also the timing verification is contrasted to functional verification. The chapter ends with an interface timing analysis as an example of timing verification. In the second chapter, that has 27 pages, more concepts related to timing verification are introduced and explained,

for example, clock definitions are given, terms related to static timing analysis (STA) – very important concept in the timing verification of ASICs - are presented and also some principles for performing .STA. Apart from that, one part of the chapter is devoted to timing analysis of Phase-Locked Loops.

In contrast to the first part, the second part is purely practical. In two relatively large chapters, that comprise the second part, two important subgroups of ASICs are considered. The third chapter is devoted to ASICs that are produced by specialized technology companies. Those ASICs are economical only if targeted at the high volume markets. Design of such kind of chips is basically a two-part process. The in-house designers do one part, mainly functional, and the technology company performs the other one, mainly technological, with some iteration between the two parties. Two objectives have to be achieved: functionality and speed. In order to reduce back propagation and accelerate the development, different tools and techniques are used. The third chapter does exactly that, introduces methods and techniques, mainly through the description of the tools and HDL languages (Verilog in particular) aimed at the timing verification. Basically, timing verification can be performed only after the place and route process, when the results of delays are fed back to the synthesis tools and static verification tools. The first part of the third chapter is devoted to timing verification before the place and route process with estimated values of route delays. The second part of the chapter gives the overview of how delays are extracted from the technological circuit description in order to feed them back into the synthesis process. The fourth chapter deals with programable devices, FPGA and CPLD ASICs. Since there are only three major manufacturers of those circuits, namely Xilinx, Actel and Altera, their products are considered in some detail. The simplified structure and some technology of those devices is presented, and after that timing issues are intro-

duced. Some examples are given of manual calculation of delays so that the reader becomes familiar with the problems involved in the design of those circuits.

The book also contains four appendices. Three of them present capabilites and shortly discuss PrimeTime, Pearl and Timing Designer timing verification tools. In the last appendix transistor-level timing verification is reviewed, with the emphasis on Spice and on the commercial version HSpice. The book concludes with the 7-page index.

This book presents a good overview of problems of timing verification, especially for someone new to this area. Also, it will give you some basic knowledge that can be used for practical designs.

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Fawwaz T. Ulaby

Fundamentals of Applied Electromagnetics

Prentice-Hall, Inc., New Jersey, 1999, 433 pages, ISBN 0–13–011554–1

After receiving his Ph.D. degree, Fawwaz T. Ulaby spent 16 years as a member of the Electrical Engineering faculty at the University of Kansas, where he was involved in the development of radar sensor technology for environmental and industrial applications. In 1984, Professor Ulaby moved to the University of Michigan in Ann Arbor. He has published several books on microwave sensor technology, imaging radar design, and the physics of radar scattering from terrain.

"Fundamentals of Applied Electromagnetics" is a modern book which introduces readers to the field of electromagnetics (EM), probably the most demanding subject in electrical engineering curriculum.

In contrast to a traditional scenario which begins with vector calculus in various coordinate systems, continues with chapters on electrostatics and magnetostatics, and finishes by chopping students' attention and interest into pieces just before the start of lectures on the nicest parts of electromagnetics, i.e. time-varying fields, wave propagation, resonators and antennas, this book briefly reviews complex numbers and phasor analysis in Chapter 1 and, then, Chapter 2 covers transmission lines, Smith chart and impedance matching, i.e. the topics which clearly show how and where EM theory can be applied.

Once the students know what EM is used for, they are offered vector analysis, electrostatics, magnetostatics, and time-varying fields, contained in Chapters 3 to 6. Chapter 7 covers plane-wave propagation in dielectric and conducting media, while Chapter 8 covers reflection and transmission at discontinuous boundaries and introduces the student to fiber optics.

Apart from fiber optics, Professor Ulaby further emphasizes EM applications, by explaining fundamentals of antenna theory, satellite communication systems and radars, and thus encircles the exciting field of electromagnetics.

This is a well written, nicely illustrated, equipped with 370 chapter-end problems, worth studying, and pleasant-to-read book.

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Advanced Internet Technologies

Prentice Hall PTR, Upper Saddle River, NJ, 1999, pp. xvi+346, ISBN 0–13–759515–8

This book is one in a series authored by Uyless Black, a widely known and respected consultant and lecturer on computer networks and communications, which appears within Prentice Hall's Series in Advanced Communications Technologies. It is meant to explain the new and revolutionizing technologies which underlay the present, spread in the use of the Internet, by providing a plethora of new services and applications, primarily those related to continuous media. As is already known, Internet technology

and communication have such a great influence that nowadays almost every network provider is at least considering transition from traditional circuit-switched operation to IP-based packet-switched one, if not even making serious steps along it. *Advanced Internet Technologies* covers the basics of Internet architecture, protocols, and traffic characteristics and reviews key issues in transforming it to a true multiservice network, which handles all types of traffic (voice, video and multimedia), at the same time ensuring quality and reliability to all of them.

The book consists of twelve chapters, a suitable Abbreviations list and an Index. The first chapter introduces basic Internet terms and concepts; Internet architecture is presented following a 5-layer shortened OSI Reference Model. Internet's chronological development is described and the rationale for the change from a data-only network to a multiservice one is given, hence transporting also voice and video, along with its basic requirements. The chapter also previews advanced Internet features to be studied afterwards. In the following chapter, *The Internet: Architecture and Traffic Characteristics*, Internet's protocol suite is shortly described together with the naming and addressing procedures, including the Domain Naming System (DNS) and upper layer identifiers. The chapter also offers a short overview of the respective basic protocols IP, TCP and UDP, a rather detailed explanation of traffic transmission through various Internet component networks, and some Internet traffic characteristics.

Chapter 3: *Digital Voice and Video* covers the standards for voice digitization with the emphasis on ITU-T G standards being either presently used or suitable candidates for IP telephony. After a review on A/D, conversion specific procedures are described, along with those for voice packetizing. The chapter also describes digitized video compression techniques with the emphasis on the MPEG-2 standard. The subsequent Chapter 4 complements the topic with configuration options, performance issues, and evaluation of several Voice-over-IP (VoIP) gateways. The analysis of ITU-T H.323 as the most probable candidate for the dominant audiovisual protocol is provided in Chapter 5: *The H Series: Audiovisual and Multimedia Systems*. The single topics include H.323 architecture, codec requirements, protocol stack, as well as registration, admission and status (RAS) functions. The chapter overviews some other related protocols from ITU-T H- and T-series, too.

The next three chapters delve into network operation proper. Chapter 6: *Routing, Route Discovery, and Traffic Integrity Operations* gives a short tutorial on connection/connectionless transmission, payload data integrity management in layers 2-4, and relaying/switching traffic through the network. Chapter 7: *IP Routing and Label Switching* offers a deeper insight on IP, emphasizing specific matters such as subnetworking, various routing methods as well as switching ones (label, IP and tag switching). MultiProtocol Over ATM (MPOA) is also mentioned. Chapter 8 gives the rationale for designing the new version of IP - IPv6, also comparing the two versions (the old IPv4 and IPv6) and positioning IPv6 with respect to other network protocols. The protocol design philosophy, along with the Ipv4 to Ipv6 migration problems are commented.

Chapters 9 to 11 bring forward characteristic protocols used in conjunction with the Internet. First in Chapter 9 the widely used PPP datagrams encapsulation protocol is shortly discussed, its architecture and major operation features described. Then in Chapter 10 the particular protocols to support multimedia Internet traffic are outlined. They include multicasting (IGMP, MBONE) as well as real-time ones (RTP, RTCP, RSVP). Chapter 11 summarizes the Mobile IP protocol and furnishes the reasons for its deployment. The chapter discusses Mobile IP node and mobile router issues, along with the accommodation of TCP timers and congestion control operation to computer roaming.

This book is a good general survey of the state-of-the-art in Internet communication. It is relatively contained, and with its less than 350 pages a very readable text to be recommended for reference purposes. I fully agree with Black's claim that *Advanced Internet Technologies is* "a valuable addition to [the professional's] library."

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