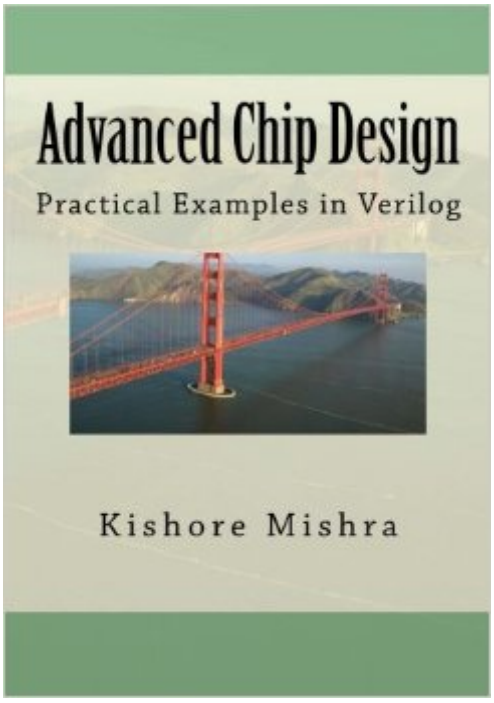
Advanced Chip Design, Practical Examples In Verilog



Synopsis

Designing a complex ASIC/SoC is similar to learning a language well and then creating a masterpiece using experience, imagination, and creativity. Digital design starts with RTL such as Verilog or VHDL, but it is only the beginning. A complete designer needs to have a good understanding of the Verilog language, digital design techniques, system architecture, IO protocols, and hardware-software interaction that I call the five rings of chip design. This book is the result of 20 years of experience and passion for chip design, love for the Verilog language, three years of focused research, and a genuine desire to share the practical design world with students and practicing engineers. I sincerely believe that you are not only going to get a jump-start, but also keep using this book for the rest of your career. A must digital design and Verilog book and a trusted companion that covers the five rings with plenty of real-world Verilog examples. Â The book is broadly divided into two sections - chapters 1 through 10, focusing on the digital design aspects and chapters 11 through 20, focusing on the system aspects of chip design. Chapter 3 focuses on the synthesizable Verilog constructs, with examples on reusable design (parameterized design, functions, and generate structure). Chapter 5 describes the basic concepts in digital design - logic gates, truth table, De Morgan's theorem, set-up and hold time, edge detection, and number system. Chapter 6 goes into details of digital design explaining larger building blocks such as LFSR, scrambler/descramblers, parity, CRC, Error Correction Codes (ECC), Gray encoding/decoding, priority encoders, 8b/10b encoding, data converters, and synchronization techniques. Â Chapter 7 and 8 bring in advanced concepts in chip design and architecture - clocking and reset strategy, methods to increase throughput and reduce latency, flow-control mechanisms, pipeline operation, out-of-order execution, FIFO design, state machine design, arbitration, bus interfaces, linked list structure, and LRU usage and implementation. Â Chapter 9 and 10 describe how to build and design ASIC/SoC. It talks about chip micro-architecture, partitioning, datapath, control logic design, and other aspects of chip design such as clock tree, reset tree, and EEPROM. It also covers good design practices, things to avoid and adopt, and best practices for high-speed design. The second part of the book is devoted to System architecture, design, and IO protocols. Â Chapter 11 talks about memory, memory hierarchy, cache, interrupt, types of DMA and DMA operation. There is Verilog RTL for a typical DMA controller design that explains the scatter-gather DMA concept. Chapter12 describes hard drive, solid-state drive, DDR operation, and other parts of a system such as BIOS, OS, drivers, and their interaction with hardware. Chapter 13 describes embedded systems and internal buses such as AHB, AXI used in embedded design. It describes the concept of transparent and non-transparent bridging. Â Chapter 14 and chapter 15 bring in practical aspects of

chip development - testing, DFT, scan, ATPG, and detailed flow of the chip development cycle (Synthesis, Static timing, and ECO). Chapter 16 and chapter 17 are on power saving and power management protocols. Chapter 16 has a detailed description of various power savings techniques (frequency variation, clock gating, and power well isolation). Â Chapter 17 talks about Power Management protocols such as system S states, CPU C states, and device D states. Chapter 18 explains the architecture behind serial-bus technology, PCS, and PMA layer. It describes clocking architecture and advanced concepts such as elasticity FIFO, channel bonding (deskewing), link aggregation, and lane reversal. Chapter 19 and 20 are devoted to serial bus protocols (PCI Express, Serial ATA, USB, Thunderbolt, and Ethernet) and their operation. Appendix B covers FPGA basics, and Appendix D covers SystemVerilog Assertions (SVA).

Book Information

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Customer Reviews

Embedded chip design has greatly changed the old game, where a few LSI geniuses created "do it all" ICs and downstream engineers worked (with and around!) the chip’s objectives and constraints. Today, the application is key and very specialized, and with FPGA’s, even the "end users" are part of the design process! Design at the end? Has to be some kind of oxymoron.The book, in 700 pages, doesn’t go into depth in any given area. For example, if you’ve got race conditions or other problems to contend with in parallel, you’ll find a few pages on that topic with encyclopedic - glossary level information but not tutorials or specific code. On the other hand, numerous pipeline sections cover the essence of parallel, piece by piece.This book is outstanding for beginners, as an

overview, as an encyclopedia, and certainly a reference to brush up on the latest trends. There is no copyright date as a print on demand, and over the past year I've noticed the author has updated the file at various times, so you're getting the best of that technique if you buy this new. Which brings me to price: at $35 US, the content/value for this text is off the charts. Similar books (there are not many this comprehensive and up to date) run over $200. This is not organized pedagogically for learning, but more as a section by section reference to go as deep as you need to into individual topics. Each one is covered in about half a page to a page and a half, so there are over 1,000 topics covered!My one gripe is that the index is very tiny compared to the content. The TextExtras dot com website is preparing an extensive free searchable page index (you have to prove you bought the book) that's ten times the size of the native version you get with the book, and membership is free.

There are probably hundreds of books on Chip Design and related areas with various types of readers in mind. The types of readers may fall into following categories - Experts, Technicians, Technical Managers and Non-Specialists, and the book content may range from a very specific area to very general big picture.However, if you want to read only one book that deals with all aspects of chip/system design, written and organized in a way that addresses most types of readers, then this book is it! Just get "Advanced Chip Design with Practical Examples in Verilog" by Kishore Mishra and you are all set! Seriously...This is the first book I came across that pays equal attention to details of "Digital Design" and "System Design." Gone are the days of designing the best chip possible and then let the system designers decide what usage the users would like to apply the system for. Today the chip design has changed - first find usage users would love, define system architecture for it and then design the chip(s). In other words, a designer now is both a system and chip designer. I recommend this book because it deals digital chip design and system design holistically.I like the organization of the book. In the first ten chapters (Section I), Kishore first trains on the language of hardware design (Verilog), followed by the basics of digital design and advanced concepts of digital design. It then describes architecture of ASIC/SoC and finally, ends the section with nuggets of good design practice. In the next ten chapters (Section II), Kishore dedicates the entire section to System related concepts.

Over the years, I have referenced many books in the field of ASIC Engineering.This book is by far the most "Practical" of them all.For seasoned engineers who know all the Design techniques, this book is a very good quick reference and starter when working on technologies (Especially SoCs). This book gives readers a very good overview of different technologies. Additionally, there are times

we would like to refer to some source for an optimum way of designing a block. This book has more pages in examples with detailed explanations than any I have every seen.For engineers who are still on the learning side, this books is the best guide for learning the basics. My favorites here are Chapters 5(Digital Design Starters) and Chapter 6(Digital Design, Building Blocks). Here we get a very good chance of referencing some very well defined concepts to build a very strong foundation for our careers.For the learners (even the seasoned learners) who have already familiarized themselves with this foundational concepts, Advanced topics in Chapter 9 and 10 will take you to the next level. These chapters have a lot of code that clearly explains the best ways to implement many Standard, yet Extremely important building blocks of a Full fledged ASIC.Chapter 9 deals with the approach to "Architecting" an ASIC. This chapter focuses on the aspects that need to be considered from a bird’s eye including Timing, Datapath, Exception Handling, clocking, boundary conditions and more.One mostly ignored aspect of digital design is dealt well in Chapter 10, "Good Design Practices". This chapter gives you the feeling: "Yeah that makes Sense".