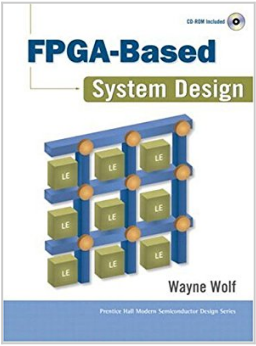

FPGA-Based System Design

By Wayne Wolf

FPGA-Based System Design By Wayne Wolf

Everything FPGA designers need to know about FPGAs and VLSI
Digital designs once built in custom silicon are increasingly implemented in field programmable gate arrays (FPGAs). Effective FPGA system design requires a strong understanding of VLSI issues and constraints, and an understanding of the latest FPGA-specific techniques. In this book, Princeton University's Wayne Wolf covers everything FPGA designers need to know about all these topics: both the "how" and the "why."
Wolf begins by introducing the essentials of VLSI: fabrication, circuits, interconnects, combinational and sequential logic design, system architectures, and more. Next, he demonstrates how to reflect this VLSI knowledge in a state-of-the-art design methodology that leverages FPGA's most valuable characteristics while mitigating its limitations. Coverage includes:

- How VLSI characteristics affect FPGAs and FPGA-based logic design
- How classical logic design techniques relate to FPGA-based logic design
- Understanding FPGA fabrics: the basic programmable structures of FPGAs
- Specifying and optimizing logic to address size, speed, and power consumption
- Verilog, VHDL, and software tools for optimizing logic and designs
- The structure of large digital systems, including register-transfer design methodology
- Building large-scale platform and multi-FPGA systems
- A start-to-finish DSP case study addressing a wide range of design problems

PRENTICE HALL
Professional Technical Reference
Upper Saddle River, NJ 07458
www.phptr.com
ISBN: 0-13-142461-0

FPGA-Based System Design

By Wayne Wolf

FPGA-Based System Design By Wayne Wolf

Everything FPGA designers need to know about FPGAs and VLSI
Digital designs once built in custom silicon are increasingly implemented in field programmable gate arrays (FPGAs). Effective FPGA system design requires a strong understanding of VLSI issues and constraints, and an understanding of the latest FPGA-specific techniques. In this book, Princeton University's Wayne Wolf covers everything FPGA designers need to know about all these topics: both the "how" and the "why."
Wolf begins by introducing the essentials of VLSI: fabrication, circuits, interconnects, combinational and sequential logic design, system architectures, and more. Next, he demonstrates how to reflect this VLSI knowledge in a state-of-the-art design methodology that leverages FPGA's most valuable characteristics while mitigating its limitations. Coverage includes:

- How VLSI characteristics affect FPGAs and FPGA-based logic design
- How classical logic design techniques relate to FPGA-based logic design
- Understanding FPGA fabrics: the basic programmable structures of FPGAs
- Specifying and optimizing logic to address size, speed, and power consumption
- Verilog, VHDL, and software tools for optimizing logic and designs
- The structure of large digital systems, including register-transfer design methodology
- Building large-scale platform and multi-FPGA systems
- A start-to-finish DSP case study addressing a wide range of design problems

PRENTICE HALL
Professional Technical Reference
Upper Saddle River, NJ 07458
www.phptr.com
ISBN: 0-13-142461-0

FPGA-Based System Design By Wayne Wolf Bibliography

- Sales Rank: #1536622 in Books
- Published on: 2004-06-25
- Original language: English
- Number of items: 1
- Dimensions: 9.55" h x 1.12" w x 7.23" l, 2.30 pounds
- Binding: Hardcover
- 576 pages

Editorial Review

From the Back Cover

Everything FPGA designers need to know about FPGAs and VLSI
Digital designs once built in custom silicon are increasingly implemented in field programmable gate arrays (FPGAs). Effective FPGA system design requires a strong understanding of VLSI issues and constraints, and an understanding of the latest FPGA-specific techniques. In this book, Princeton University's Wayne Wolf covers everything FPGA designers need to know about all these topics: both the "how" and the "why."
Wolf begins by introducing the essentials of VLSI: fabrication, circuits, interconnects, combinational and sequential logic design, system architectures, and more. Next, he demonstrates how to reflect this VLSI knowledge in a state-of-the-art design methodology that leverages FPGA's most valuable characteristics while mitigating its limitations. Coverage includes:

- How VLSI characteristics affect FPGAs and FPGA-based logic design
- How classical logic design techniques relate to FPGA-based logic design
- Understanding FPGA fabrics: the basic programmable structures of FPGAs
- Specifying and optimizing logic to address size, speed, and power consumption
- Verilog, VHDL, and software tools for optimizing logic and designs
- The structure of large digital systems, including register-transfer design methodology
- Building large-scale platform and multi-FPGA systems
- A start-to-finish DSP case study addressing a wide range of design problems

PRENTICE HALL
Professional Technical Reference
Upper Saddle River, NJ 07458
www.phptr.com
ISBN: 0-13-142461-0

About the Author

WAYNE WOLF is Professor of Electrical Engineering and Associated Faculty in the Department of Computer Science at Princeton University. His research interests include embedded computing, multimedia systems, VLSI and computer-aided design. He is the author of *Computers as Components: Principles of Embedded Computer System Design* and *Modern VLSI Design, Third Edition*. He is a Fellow of the IEEE and ACM, and an IEEE Computer Society Golden Core member. In 2003, he earned the ASEE/EED and HP Frederick E. Terman Award.

This book is an experiment. Shortly after completing the third edition of *ModernVLSI Design*, I came to realize that an increasing number of digital designs that usedto be built in custom silicon are now implemented in field programmable gate arrays(FPGAs). While traditional VLSI system design won't go away any time soon, anincreasing number of designers will work with FPGAs and many of them will neverdesign a custom chip.

However, designers of large FPGA-based systems really do need to understand thefundamentals of VLSI in order to make best use of their FPGAs. While it is true thatmany system designers simply treat the FPGA as a black box, that approach makesthe system designer miss many opportunities to optimize the design to fit within theFPGA. The architecture of FPGAs is largely determined by VLSI constraints: logicelement structures, programmable interconnect structures, interconnection networks,configuration, pinout, etc. Understanding how the characteristics of VLSI devicesinfluence the design of FPGA fabrics helps the designer better understand how to takeadvantage of the FPGA's best characteristics and to minimize the influence of itslimitations.

Consider, for example, the interconnection networks in FPGAs. Most modern FPGAarchitectures provide designers with several different types of wires: local, generalpurpose,and global. Why do all these different types of connections exist? Becausewires become harder to drive as they grow in length; the extra circuitry required todrive long wires makes them more expensive. Understanding how these differenttypes of interconnect work helps a designer decide whether a particular logicconnection requires one of the more expensive types of wires.

Today's FPGAs are truly amazing. High-end FPGAs can hold several million gates.Several FPGAs incorporate one or more CPUs on-chip to provide a completeembedded computing platform. Many of the techniques for designing such largesystems are the same whether they are built using FPGAs or custom silicon. This isparticularly true when we want to make best use of the silicon characteristics of VLSIstructures.

As a result of these advances in VLSI systems, I decided to use Modern VLSI Designas a starting point for a new book on FPGA-based system design. Readers of ModernVLSI Design will recognize material from most of the chapters in that book. I haveextracted material on VLSI characteristics, circuits, combinational and sequentiallogic design, and system architectures. However, I have also added quite a bit of newmaterial, some of which is specific to FPGAs and some of which is simply a new (andI hope better) look at digital system design.

One of my major goals in writing this book was to provide a useful text for bothdesigners interested in VLSI and those who simply want to use FPGAs to build bigsystems. Chapter 2 of this book is devoted to a review of VLSI: fabrication, circuits,interconnect characteristics, etc. Throughout the rest of the book, I have tried to breakout most details of VLSI design into separate sections that can be skipped by thereader who is not interested in VLSI. However, those who want to understand moreabout the design of FPGAs as VLSI devices can read this material at their leisure.Chapter 3 is devoted to a survey of FPGA fabrics--the basic programmable structuresof FPGAs. The commercial offerings of companies change all the time, so thischapter is not meant to be a replacement for a data book. Its goal is to introduce somebasic concepts in FPGAs and to compare different approaches to solving the basicproblems in programmable logic. What to do with these FPGA structures is thesubject of the rest of the book.

Chapters 4 and 5 go into detail about combinational and sequential logic design,respectively. They describe methods for the specification and optimization of digitallogic to meet the major goals in most design efforts: size, speed, and powerconsumption. We introduce both Verilog and VHDL in this book. While this book isnot intended as a definitive reference on either language, hardware descriptionlanguages are the medium of choice today for designing digital systems. A basicunderstanding of these languages, as well as of the fundamentals of hardwaredescription languages, is essential to success in digital system design. We also studythe tools for optimizing logic and sequential machine designs in order to understandhow to best make use of logic and physical synthesis.

Chapter 6 looks at the structure of large digital systems. This chapter introducesregister-transfer design as a methodology for structuring digital designs. It uses asimple DSP as a design example. This DSP is not intended as a state-of-the-art CPUdesign, but it does allow us to consider a large number of different design problems ina single example.

Chapter 7 caps off the book by studying large-scale systems built with FPGAs.Platform FPGAs that include CPUs and FPGA fabrics allow designers to mixhardware and software on a single chip to solve difficult design problems. Multi-FPGA systems can be used to implement very large designs; a single multi-FPGAsystem can be programmed to implement many different logic designs.So what will happen to ASIC design? I don't think it will go away--people will stillneed the high density and high performance that only custom silicon provides. But Ithink that FPGAs will become one of the major modes of implementation for digitalsystems.

Xilinx has graciously allowed us to include CDs that contain the Xililnx StudentEdition (XSE) tools. The examples in this book were prepared with these tools andyou can follow along with the examples using the tools. You can also use them tocreate your own examples. Having a working set of tools makes it much easier topractice concepts and I greatly appreciate Xilinx's help with including these books.IYou can find additional materials for the book at the Web site:

http://www.ee.princeton.edu/~wolf/fpga-book

The Web site includes overheads for the chapters, pointer to additional Web materials,some sample labs, and errata. Properly accredited instructors can obtain a copy of theinstructor's manual by contacting the publisher. I hope you enjoy this book; pleasefeel free to email me at wolf@princeton.edu.

I'd like to thank the students of ELE 462 in the spring of 2003, who were patient withmy experimentation on the traditional VLSI course. I'd also like to thank Jiang Xuand Li Shang, my teaching assistants that semester, who improved our infrastructurefor FPGA design and helped me debug the DSP design. Mike Butts and MohammedKhalid gave valuable advice on partitioning algorithms. Steven Brown, JonathanRose, Zvonko Vranesic, and William Yu provided figures from their papers to be putdirectly into the book, providing data straight from the source for the reader as well assimplifying my life as a typesetter. I greatly appreciate the thorough review of a draftof this manuscript given by Andre De Hon, Carl Ebeling, Yankin Tanurhan, and SteveTrimberger; they all made many excellent suggestions on how to improve this book. Igreatly appreciate the efforts of Ivo Bolsens, Anna Acevedo, and Jeff Weintraub foraccess to the knowledge of Xilinx in general and permission to include the Xilinx ISEdisks with this book in particular. And, of course, I'd like to thank my editor BernardGoodwin for his tireless efforts on behalf of this book. All the problems remaining inthe book, both small and large, are of course my responsibility.

Wayne Wolf

Princeton, New Jersey

Users Review

From reader reviews:

Florence Croy:

Inside other case, little persons like to read book FPGA-Based System Design. You can choose the best book if you appreciate reading a book. As long as we know about how is important a book FPGA-Based System Design. You can add understanding and of course you can around the world by just a book. Absolutely right, since from book you can recognize everything! From your country until finally foreign or abroad you can be known. About simple thing until wonderful thing it is possible to know that. In this era, we could open a book or perhaps searching by internet product. It is called e-book. You need to use it when you feel bored stiff to go to the library. Let's learn.

Lee Rutledge:

What do you regarding book? It is not important with you? Or just adding material when you need something to explain what yours problem? How about your spare time? Or are you busy particular person? If you don't have spare time to do others business, it is give you a sense of feeling bored faster. And you have time? What did you do? Everybody has many questions above. They need to answer that question since just their can do which. It said that about e-book. Book is familiar in each person. Yes, it is correct. Because start from on guardería until university need this particular FPGA-Based System Design to read.

Ian Coghlan:

The event that you get from FPGA-Based System Design is the more deep you digging the information that hide inside the words the more you get serious about reading it. It doesn't mean that this book is hard to comprehend but FPGA-Based System Design giving you buzz feeling of reading. The article writer conveys their point in selected way that can be understood by simply anyone who read it because the author of this e-book is well-known enough. This kind of book also makes your own vocabulary increase well. So it is easy to understand then can go with you, both in printed or e-book style are available. We propose you for having that FPGA-Based System Design instantly.

Bruce Harrison:

What is your hobby? Have you heard that will question when you got students? We believe that that query was given by teacher to the students. Many kinds of hobby, Everyone has different hobby. So you know that little person like reading or as examining become their hobby. You must know that reading is very important and book as to be the thing. Book is important thing to increase you knowledge, except your teacher or lecturer. You discover good news or update concerning something by book. Different categories of books that can you choose to adopt be your object. One of them are these claims FPGA-Based System Design.

Read FPGA-Based System Design By Wayne Wolf for online ebook

FPGA-Based System Design By Wayne Wolf Free PDF d0wnl0ad, audio books, books to read, good books to read, cheap books, good books, online books, books online, book reviews epub, read books online, books to read online, online library, greatbooks to read, PDF best books to read, top books to read FPGA-Based System Design By Wayne Wolf books to read online.

Online FPGA-Based System Design By Wayne Wolf ebook PDF download

FPGA-Based System Design By Wayne Wolf Doc

FPGA-Based System Design By Wayne Wolf Mobipocket

FPGA-Based System Design By Wayne Wolf EPub

YJFAVT5BZWD: FPGA-Based System Design By Wayne Wolf