



Book Review

Digital Computer Arithmetic Datapath Design Using Verilog HDL, James E. Stine, Kluwer Academic Publishers, Boston, 2004, ISBN 1-4020-7710-6. Hardcover, pp. 180, plus XI, euro 122

Rapid progress in VLSI ICs technology and increased consumer demands have created increasing possibilities for using high-performance processors in a variety of platforms. High-speed processors are now supporting real-time computational intensive digital signal-processing applications such as video, image processing, wireless communications, and others complex data-flow throughput constrained processing that varies significantly from the specific applications. As a consequence, computation speeds have increased during the past twenty years, resulting primarily from faster, denser technologies and new concepts in computer architecture. An essential ingredient of high-speed processor is a high-speed execution unit. The execution unit performs all arithmetic and logical operations on operands as well as shifting and data manipulation. In general, the speed of a processor system is determined by the speed of the arithmetic unit and the speed of memory. Although the speed of both units depends directly on the implementation technology, arithmetic unit speed depends strongly on the logic design, too.

This book concentrates on basic implementation strategies for arithmetic datapath designs. It shows how to write efficient Verilog code to describe the arithmetic circuits. The book is divided into seven chapters, References with 103 entries, and an Index. The book goes with CD-ROM that contains the files discussed in the text. It is organized in the following way.

Chapter 1 (*Motivation*, pp. 1–5) is introductory. It points to motivation of using Verilog HDL, explains the main objective of the book, and briefly concentrates on the datapath design.

Chapter 2 (*Verilog at the RTL Level*, pp. 7–26) gives a quick introduction to the Verilog hardware descriptive language, and shows how to detail a digital system within the Verilog at the RTL level.

Chapter 3 (*Addition*, pp. 27–54) discusses implementations of several standard adder circuits including ripple-carry addition, carry-lookahead, carry-skip, carry-select, and prefix notation.

Chapter 4 (*Multiplication*, pp. 55–101) deals with multiplication datapath designs. Two types of standard multipliers, tree and carry-save array, are presented. Discussions related to trade-offs in terms of area and delay are included, for both implementations.

Chapter 5 (*Division Using Recurrence*, pp. 103–127) concentrates on class of division algorithms that are digit recurrence, i.e. a case when the quotient is obtained one iteration at a time.

Chapter 6 (*Elementary Functions*, pp. 129–159) covers several interesting implementations for computations of elementary functions, including generic table lookup, constant approximations, piecewise constant approximation, linear approximations, bipartite table methods, and CORDIC.

Chapter 7 (*Division Using Multiplicative-Based Methods*, pp. 161–169) focuses on methods for computing division by iteratively improving an initial approximation. Two implementations are discussed, Newton–Raphson method for reciprocal approximation and multiplicative-divide using convergence.

The main objective of this small and nice book is to provide a good understanding of the arithmetic specifics of algorithms and points to their implementation strategies and methodologies used in the design of datapaths. Several different implementations that relate to addition, subtraction, multiplication, division and realization of special functions are described. These circuits provide an excellent platform for illustrating the power and versatility of Verilog in specifying complex logic circuit assemblies.

The book is well written and readers, using it, will enjoy in the process of accepting more knowledge in overwhelmingly applicable field of digital logic design. This book is intended as a senior level text for students in electrical and computer engineering, and as a reference book for researchers and engineers active in the field of complex VLSI circuits design.

All in all, I highly recommend this book.

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