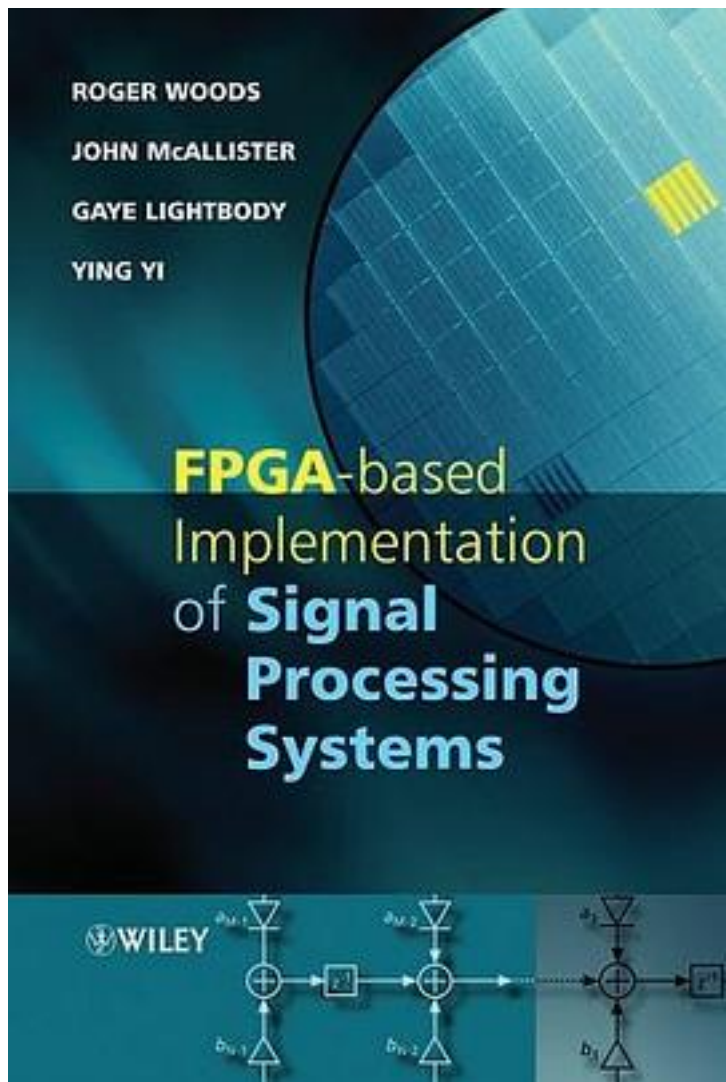


FPGA-based Implementation of Signal Processing Systems



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Product Description

Field programmable gate arrays (FPGAs) are an increasingly popular technology for implementing digital signal processing (DSP) systems. By allowing designers to create circuit architectures developed for the specific applications, high levels of performance can be achieved for many DSP applications providing considerable improvements over conventional microprocessor and dedicated DSP processor solutions. The book addresses the key issue in this process specifically, the methods and tools needed for the design, optimization and implementation of DSP systems in programmable FPGA hardware. It presents a review of the leading-edge techniques in this field, analyzing advanced DSP-based design flows for both signal flow graph- (SFG-) based and dataflow-based implementation, system on chip (SoC) aspects, and future trends and challenges for FPGAs. The automation of the techniques for component architectural synthesis, computational models, and the reduction of energy consumption to help improve FPGA performance, are given in detail.

Written from a system level design perspective and with a DSP focus, the authors present many practical application examples of complex DSP implementation, involving:

- * high-performance computing e.g. matrix operations such as matrix multiplication;
- * high-speed filtering including finite impulse response (FIR) filters and wave digital filters (WDFs);
- * adaptive filtering e.g. recursive least squares (RLS) filtering;
- * transforms such as the fast Fourier transform (FFT).

FPGA-based Implementation of Signal Processing Systems is an important reference for practising engineers and researchers working on the design and development of DSP systems for radio, telecommunication, information, audio-visual and security applications. Senior level electrical and computer engineering graduates taking courses in signal processing or digital signal processing shall also find this volume of interest.

From the Back Cover

Field programmable gate arrays (FPGAs) are an increasingly popular implementation technology in a wide range of applications in engineering fields, including communications, information, security and measurement. This type of semiconductor device can be reprogrammed after manufacture, meaning that designers have the power to create circuit architectures to suit their needs and achieve high levels of performance for many digital signal processing (DSP) applications. This gives a considerable gain over conventional microprocessors and dedicated DSP processors, in producing efficient and sometimes low-cost, solutions for many complex DSP systems. However, the key challenge is to create this 'circuit architecture' and represents the main focus of this book.

This book describes the methods and current tools for the design, optimization and implementation of DSP systems in programmable FPGA hardware. It presents a review of the leading-edge techniques in this field, analyzing advanced DSP-based design

flows for both signal flow graph (SFG) based and dataflow-based implementation on FPGA, system on chip (SoC) aspects, and future trends and challenges for FPGAs. This text details the automation of the techniques for component architectural synthesis, computational models, and the reduction of energy consumption to help improve FPGA performance.

With over thirty years of experience in the field, the authors present many practical application examples of complex DSP implementation for a number of systems, including electronic support measures (ESM) receivers, radar processing, speech compression, and adaptive beam forming. Written from a system level design perspective and with a DSP focus, the reader gains a better idea of the broad spectrum of system level issues involved. The book considers solutions for applications including:

- * high-performance computing e.g. matrix operations such as matrix multiplication;
- * high-speed filtering including finite impulse response (FIR) filters and wave digital filters (WDFs);
- * adaptive filtering e.g. recursive least squares (RLS) filtering;
- * speech compression specifically adaptive differential pulse coded modulation (ADPCM);
- * transforms such as the fast Fourier transform (FFT).

FPGA-based Implementation of Signal Processing Systems is an important reference textbook for practising engineers and researchers working on the design and development of DSP systems for radio, telecommunication, information, audio-visual and security applications. Senior level electrical and computer engineering graduates taking courses in signal processing or digital signal processing shall also find this volume of interest.

作者介绍:

Roger Woods

Roger Woods has over 17 years experience in implementing complex DSP systems, both in ASIC

and FPGA. He leads the Programmable Systems Laboratory at Queen's University (PSL@Q) which

comprises 15 researchers and which is applying programmable hardware to DSP and telecommuni-

catins applications. The research specifically involves: developing design flows for heterogeneous

platforms involving both multiprocessors and FPGAs; programmable solutions for programmable

networks; design tools for FPGA IP cores; and low-power programmable DSP solutions.

Roger

has been responsible for developing a number of novel advanced chip demonstrators and FPGA

solutions for image processing and digital filtering.

John McAllister

John McAllister is currently a Lecturer in the Programmable Systems Laboratory and System-on-

Chip (SoC) Research Cluster at Queen's University Belfast investigating novel system, processor

and IP core architectures, design methodologies and tools for programmable embedded DSP

systems, with a particular focus on FPGA-centric processing architectures. He has numerous peer-

reviewed publications in these areas.

Gaye Lightbody

Dr Gaye Lightbody received her MEng in Electrical and Electronic Engineering in 1995 and PhD

in High-performance VLSI Architectures for Recursive Least-squares Adaptive Filtering in 2000,

from the Queen's University of Belfast. During this time she worked as a research assistant before

joining Amphion Semiconductor Limited (now Conexant Systems, Inc.) in January 2000 as a senior

design engineer, developing ASIC and FPGA IP cores for the audio and video electronics industry.

She returned to academia after five years in industry, taking up a position in the University of

Ulster. Since then she has maintained an interest in VLSI design while broadening her activities

into the area of Electroencephalography (EEG) evoked potential analysis and classification.

Ying Yi

Dr Ying Yi received the BSc degree in Computer and Application from Harbin Engineering Uni-

versity, Harbin, China, and the PhD degree from the Queen’ s University, Belfast, UK, in 1996 and

2003, respectively. She worked at the Wuhan Institute of Mathematical Engineering, China, as aSoftware Engineer and then in research and development at the China Ship Research and Develop-

ment Academy, Beijing, China. Currently, she is a Research Fellow at the University of Edinburgh,

Edinburgh, UK. Her research interests include low-power reconfigurable SoC systems, compiler

optimization techniques for reconfigurable architecture, architectural level synthesis optimization,

and multiprocessor SoC

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