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book utilizes FPGA devices, Nios II soft-core processor, and development platform from Altera Co., which is one of the two main FPGA manufactures.

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contents of this
book will be useful
to students and
professionals alike.

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issues of FPGA design as the underlying theme of the work. In practice, an engineer typically needs to be mentored for several years before these principles are appropriately utilized. The topics that will be

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discussed in this
book are essential
to designing
FPGA's beyond
moderate
complexity. The
goal of the book is
to present practical
design techniques
that are otherwise
only available
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This book teaches
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digital circuits using
the VHDL hardware
description

language and

synthesis software.

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design, which is
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of functional units,
routing circuit, and
storage, the

book illustrates the
relationship

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between the VHDL
constructs and
the underlying
hardware
components, and
shows how to
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that faithfully
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parameterized
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* One chapter
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between multiple
clock domains

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the overall develop
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design practices

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to ensure that an

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textbook for upper-
level undergraduate
or graduate

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courses in
advanced digital
logic. Engineers
who need to make
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today's
synthesis software
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should also refer to
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and SoC design

This Second Edition
of the popular book
follows the same

“learning-by-doing”
approach to teach
the fundamentals
and practices of
VHDL synthesis
and FPGA

prototyping. It uses
a coherent series
of examples to
demonstrate the

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process to develop sophisticated digital circuits and IP (intellectual property) cores, integrate them into an SoC (system on a chip) framework, realize the system on an FPGA prototyping board, and verify the hardware and software operation.

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The examples start with simple gate-level circuits, progress gradually through the RT (register transfer) level modules, and lead to a functional embedded system with custom I/O peripherals and hardware accelerators.

Although it is an

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introductory text,
the examples are
developed in a
rigorous manner,
and the derivations
follow strict design
guidelines and
coding practices
used for large,
complex digital
systems. The new
edition is
completely
updated. It

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presents the hardware design in the SoC context and introduces the hardware-software co-design concept. Instead of treating examples as isolated entities, the book integrates them into a single coherent SoC platform that allows readers to

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explore both
hardware and
software

“programmability”

and develop

complex and

interesting

embedded system

projects. The

revised edition:

Adds four general-

purpose IP cores,

which are multi-

channel PWM

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(pulse width modulation) controller, I2C controller, SPI controller, and XADC (Xilinx analog-to-digital converter) controller. Introduces a music synthesizer constructed with a DDFS (direct digital frequency

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synthesis) module
and an ADSR (attac
k-decay-sustain-
release) envelop
generator. Expands
the original video
controller into a
complete stream-
based video
subsystem that
incorporates a
video
synchronization
circuit, a test

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pattern generator,
an OSD (on-screen
display) controller,
a sprite generator,
and a frame buffer.

Introduces basic
concepts of
software-hardware
co-design with
Xilinx MicroBlaze
MCS soft-core
processor. Provides
an overview of bus
interconnect and

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interface circuit.

Introduces basic
embedded system
software

development.

Suggests additional
modules and
peripherals for

interesting and
challenging

projects. The FPGA

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