

Hands-on Experience with Altera FPGA Development Boards

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 Springer

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Foreword

The traditional teacher-centered classroom teaching is transforming into the newer student-centered approach to learning. During this transition, the teachers and students need to go through familiarization and training in the new pedagogy. This book entitled “Hands-on Experience with Altera FPGA Development Boards” is an effort by the authors to meet this challenge. The technology space is ever expanding, and it is not possible to teach all of it in the classroom teaching curriculum. It is true that students now have access to vast resources at their fingertips. However, a book of this kind, developed based on the experience of the authors in teaching this to their students, is more suited since it has been improved based on the feedback from the students who have used it in its early form. The authors and their peer group in their department have put in extra efforts to make it student-friendly. This is a third book in the series of books brought out by the group, specifically on the “hands-on-approach” to skill development.

Embedded systems are all-pervading and offer limitless possibilities in the use of FPGAs in systems of diverse nature. This book offers an in-depth, yet practical, explanation of the various elements that make up the subject matter. Understanding the contents of this book does not require high level of prior preparation. The case studies on signal processing and control application are very important for a beginner to put a practical system to work. The students and researchers who wish to explore this area will find it highly useful, shortening their learning time and get them onboard quickly. Authors have extensive experience in this field. They are in academia and understand the needs of students. Also, they have strong connection with industries and thereby have a good grasp of the present status. They have worked themselves on these systems, and hence, the book has a greater authenticity.

I recommend this book for intermediate programmers, electronics, electrical, instrumentation engineers, or any individual who is strongly inclined to take up his or her career in embedded C programming. I am sure the reader will experience

learning embedded programming by example and learning by doing. Last but not the least, this book will certainly be a value addition to the field of reconfigurable embedded programming platform.



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Director, BITS Pilani, Goa

Preface

Microprocessor and microcontrollers have revitalized the instrumentation world and now become ubiquitous. However, due to their niche role, when a particular microcontroller is discontinued, the entire product based on it has to be revamped, and the evolution of the technology means that the newer upgraded versions cannot be used in its place due to binary and socket incompatibility. Another issue which arises is of redundant hardware in microcontrollers posing a basic bottleneck in system optimization—many resources remain unutilized for routine applications.

In order to achieve portability, power efficiency, higher throughput, and less latency, the only alternative is to use the soft processor cores with FPGAs for small- and medium-scale production as they become more economic as compared to ASICs. Many vendors have come out with readymade cores such as NIOSII from Altera, Picoblaze and Microblaze from Xilinx. Building the system on FPGAs with these cores will not only facilitate earlier and easier market opportunities but will also give the advantage of using readymade full proof design alternatives, reducing the inconvenience of committing mistakes and debugging. The present book will explore the “know-how” for synthesizing chips for every embedded needs.

Methodologies in digital design have undergone tremendous changes over the past three decades. The use of FPGA and HDL for implementing digital logic has become widespread in the recent past, and use of FPGA in embedded systems is increasing almost day by day. A sign of the increasing importance of this area is that most of the technical institutes and engineering colleges have incorporated FPGA as the core subjects.

The domain of embedded systems is quite large and is centered around general-purpose processors and microcontrollers. The Altera FPGA forum receives numerous posts by newcomers to the technology asking questions on configuring FPGA, interfacing SRAM, building NIOS II system—this book is for those users as it essentially addresses most of these questions. The motivation behind writing this book was to ease out the difficulties faced by the students and researchers, so that they are not dependent on their supervisors to understand the field of reconfigurable embedded platform. To this end, it has many worked-out case studies in different areas of electronics like basic digital designs, sensors and measurement, biomedical

instrumentation. It is intended for graduate, postgraduate, and research students from the electrical, electronics, computer and instrumentation engineering backgrounds as a ready reference during their work.

We promise potential readers that this book will reduce the steep learning curve and will help them quickly develop their embedded systems application in the shortest possible time frame. We recommend that the readers begin by reading through the summary paragraphs of each chapter, which will introduce each section and provide an overall picture of how the book is organized and how it will help them in creating their own design.

We would like to thank our student community and friends—their work in various industries helped identify the problems used in the case studies.

Though this book is intended for beginners in the area wherein the students aspire to learn skills building FPGA platform, a prerequisite knowledge in C/C++ and HDL will greatly help in understanding the complexities more easily. Since these two languages are now part of regular curriculum, we feel the students can directly start working on case studies.

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