THE ZYNQ® BOOK

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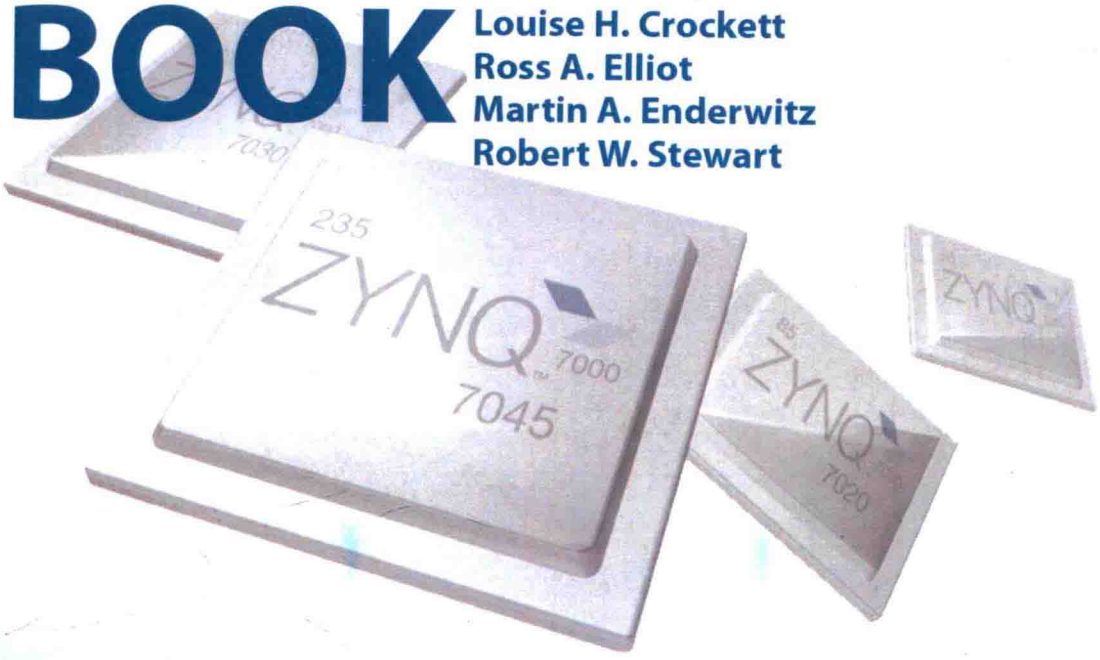

Embedded Processing with the ARM® Cortex®-A9 on the Xilinx® Zynq®-7000 All Programmable SoC

In association with

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University of Strathclyde Glasgow

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1st Edition

This edition first published July 2014 by Strathclyde Academic Media.

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L. H. Crockett, R. A. Elliot, M. A. Enderwitz and R. W. Stewart, *The Zynq Book: Embedded Processing with the ARM Cortex-A9 on the Xilinx Zynq-7000 All Programmable SoC*, First Edition, Strathclyde Academic Media, 2014.

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The Zynq Book

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Foreword

For over two years now, academics, industry professionals and "makers" worldwide have had access to development boards that use the Zynq®-7000 All Programmable SoC from Xilinx®. These boards including the ZedBoard, the Zc702, Zc706 and others have provided users heretofore unprecedented abilities to build their own customizable System on Chip (SoC) solutions. The Zynq SoC integrates an ARM® dual Cortex®-A9 based processor system with Xilinx 7-series FPGA fabric and by doing so it provides the power, performance and capacity benefits of an ASIC combined with the hardware programmability benefits of an FPGA.

The strong demand for these devices and the first of its kind nature goes hand-in-hand with a demand for supporting collateral in the form of documentation, training, tutorials and guidebooks. As the first book written in the English language, "The Zynq Book" does a remarkable job of filling a critical need, and the team from the University of Strathclyde have put together a very comprehensive book, which covers the essential information every Zynq user needs to know.

The book begins appropriately with an overview of the Zynq device, following up with a description of the ZedBoard. The book then moves very quickly into information needed to build designs targeted for the Zynq family, describing in depth both the development flow for these devices as well as the implications of various design choices. As this is a hybrid device which is both software and hardware programmable, the content comprehensively spans hardware design tools as well as the higher level software tools and flow. A special spotlight on Vivado® High Level Synthesis (HLS) is included, which showcases the productivity benefits offered by HLS as well as the synergy with the high level programming model offered by the Cortex-A9 processors. Of critical importance are the

interfaces that connect the Processor System to the Programmable Logic or FPGA. The book does an excellent job of providing an overview of these interfaces and guidance on appropriately configuring them. Finally no book on an SoC is complete without a description of the embedded software run-time environment. The concluding chapter guides the reader through the nuances of booting Linux® on their very own custom SoC.

It is no coincidence that the first English language book on Zynq originates from the University of Strathclyde. Since 2005 Xilinx has worked closely with the Department of Electronic and Electrical Engineering at the University of Strathclyde in Scotland, UK. As the Xilinx Endowed Chair, Professor Bob Stewart played a leading role in developing and disseminating best practices for using Xilinx *All Programmable* technologies in academia and industry. He and his team have created outstanding pedagogical material that has enhanced the educational experience of tens of thousands of students and engineers around the world. The successful relationship undoubtedly reflects the University of Strathclyde's pragmatic, industry-driven ethos and its position as a leading technological institution with an excellent international reputation. Indeed the University of Strathclyde was founded in 1796 by Professor John Anderson, whose bequest was to create "a place of useful learning". It is very clear that the University continues to be a place of *useful learning* and a strong partner with Xilinx for technology education and research. It is also worth saying that we are particularly pleased to be associated with an institution recognized in the UK as University of the Year for 2013, and the UK Entrepreneurial University of the Year for 2014.

This book is indeed a must read item for the first time Zynq user!

Vidya Rajagopalan
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Xilinx, Inc.

June 2014.

Acknowledgements

There are a number of people to whom we must extend our sincerest thanks for their support and practical help in producing The Zynq Book.

First of all, it simply would not have come to life without the vision of Patrick Lysaght, Senior Director at Xilinx, whose idea it was to create a book about Zynq. The project soon took on a life of its own, and we realised that there are many interesting things to write about Zynq! The resulting book is the product not just of our own efforts, but the many people who have helped us along the way.

Firstly, nobody could have been more helpful than Cathal McCabe, who has managed the project from Xilinx University Program. His knowledgeable support has been absolutely vital, and we are indebted to him for his patience, thoughtful input, and thoroughness. This book would not have turned out nearly so well without Cathal.

We also greatly appreciate the input of several colleagues from Xilinx: Sagheer Ahmad, Brian Gaide, Austin Lesea, Joshua Lu, Duncan Mackay, Daryl Nees, Stephen Neuendorffer, Parimal Patel, Fernando Martinez Vallina, Tim Vanevenhoven, and Y.C. Wang all gave of their time to read the book and provide constructive criticism. Some of these helpful people also took the trouble to work through the tutorials and share their feedback. It has been a great help to access their experience — thanks guys! We must also thank Barrie Mullins for his help and support.

Our colleagues at University of Strathclyde have been a great help as well, and we would like to thank them for their various inputs to the project. Several of them generously took the time to read and review chapters, or to work through and test tutorials, and provided much thoughtful feedback: many thanks to Douglas Allan, Dani Anderson, Dale Atkinson,

Kenneth Barlee, Iain Chalmers, Fraser Coutts, David Crawford, Sam Edwards, Poppy Harvey, Connor Hughes, Sarunas Kalade, Phil Karagiannakis, David Northcote and Kenneth Osborne. We also appreciate the contributions of all to the general "Zynq-chat" which has now become a feature of our working environment!

Last but not least, we must of course extend our thanks to our family and friends, who accepted with good grace our lack of participation in social activities, particularly as the various deadlines approached (!), and were most generous with their encouragement.

Louise Crockett, Ross Elliot, Martin Enderwitz, Bob Stewart.
June 2014.

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