Formal System Verification

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Editor

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State-of-the-Art and Future Trends

Springer

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DFKI
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ISBN 978-3-319-57683-1 ISBN 978-3-319-57685-5 (eBook)
DOI 10.1007/978-3-319-57685-5

Library of Congress Control Number: 2017938317

Printed on acid-free paper

This Springer imprint is published by Springer Nature
The registered company is Springer International Publishing AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

To Fatma Akin

Preface

For more than four decades the complexity of circuits and systems has grown according to Moore's Law resulting in chips of several billion components. While already the synthesis on the different levels from the initial specification down to the layout is a challenging task, for all the individual steps the correctness has to be considered.

In the past, classical approaches based on simulation or emulation have been used. But these techniques do not scale well and reach their limits. Correctness can only be ensured by the use of formal methods. These techniques were proposed more than 30 years ago in the context of circuit and system design, and in the meantime exist very powerful tools that are used in industry for specific tasks, like the equivalence check of netlists on the Register Transfer Level (RTL).

But with increasing complexity of the systems there is a high demand for tools that are better scalable and also consider modeling beyond plain digital circuits. In this context analog and mixed signal circuits have to be included on the lower level, but also hardware-dependent software towards the higher levels of abstraction.

In this book, these advanced topics of using formal verification along the design flow with a special focus on the system level are addressed. World's leading researchers have contributed chapters, where they describe the underlying problems, possible solutions, and directions for future work.

The chapters in the order as they appear in this book are:

- *Formal Techniques for Verification and Coverage Analysis of Analog Systems* by Andreas Fürtig and Lars Hedrich
- *Verification of Incomplete Designs* by Bernd Becker, Christoph Scholl and Ralf Wimmer
- *Probabilistic Model Checking: Advances and Applications* by Marta Kwiatkowska, Gethin Norman and David Parker
- *Software in a Hardware View: New Models for HW-dependent Software in SoC Verification* by Carlos Villarraga, Dominik Stoffel and Wolfgang Kunz
- *Formal Verification—The Industrial Perspective* by Raik Brinkmann and David Kelf

On the different abstraction layers it is shown in which way formal methods can assist today to ensure functional correctness. The contributed chapters cover not only the latest results in academia but also descriptions of industrial tools and perspectives.

Bremen, Germany Rolf Drechsler
June 2017

Acknowledgements

All contributions in this edited volume have been anonymously reviewed. I would like to express my thanks for the valuable comments of the reviewers and their fast feedback. Here, I also like to thank all the authors who did a great job in submitting contributions of a very high quality. My special thanks go to Daniel Große and Jannis Stoppe from my group in Bremen in helping with the preparation of the book. Finally, I would like to thank Nicole Lowary and Charles Glaser from Springer. All this would not have been possible without their steady support.

Bremen, Germany Rolf Drechsler
June 2017

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Rolf Drechsler received the Diploma and Dr. Phil. Nat. degrees in Computer Science from J. W. Goethe University Frankfurt am Main, Germany, in 1992 and 1995, respectively. He was with the Institute of Computer Science, Albert-Ludwigs University, Freiburg im Breisgau, Germany, from 1995 to 2000, and with the Corporate Technology Department, Siemens AG, Munich, Germany, from 2000 to 2001. Since October 2001, he has been with the University of Bremen, Bremen, Germany, where he is currently Full Professor and the Head of the Group for Computer Architecture, Institute of Computer Science. Since 2011 he is also the director of the Cyber-Physical Systems group at the German Research Center for Artificial Intelligence (DFKI) in Bremen. His research interests include the development and design of data structures and algorithms with a focus on circuit and system design.

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