

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, the quality of initial logic synthesis steps is still very determinant for the quality of the final circuit.

Logic synthesis has been evolving into new research directions, including the use of large-scale computing power available through data centers. The availability of warehouse computing opens the way to the use of big data analytics and cognitive applications from recent advances in artificial intelligence and infrastructure for parallel processing of graph data structures.

Besides these advances in computer science, the underlying fabrication technology evolution is also bringing emergent circuit technologies that require new synthesis techniques. Advanced fabrication nodes also require a tighter integration of logic synthesis and physical design, in order to bring physical awareness early in the design flow to achieve design convergence.

Logic synthesis can also be expanded to exploit higher level of abstractions, including the identification and manipulation of datapaths. This can be done by identifying data paths at the gate level, as well as by performing architectural transformations at higher levels of abstractions.

The field of SAT solvers and quantified Boolean formula (QBF) solvers has had recent important advances. This way, it is natural that several logic synthesis problems are being addressed, modeled, and solved with these tools.

Stochastic and statistical methods are also gaining importance in the field of logic synthesis. These include stochastic circuits that may arise in novel technologies, as well as methods of synthesis using probabilistic approaches.

This book celebrates the 25th edition of the International Workshop on Logic and Synthesis, which happened in June 2016. In doing so, we present a selection of chapters that originated as keynotes, special sessions, and regular papers from IWLS 2015 and IWLS 2016. The selection of papers reflects relevant topics for the

advancement of logic synthesis. World-leading researchers contributed chapters, where they describe the underlying problems, possible solutions, and important directions for future work.

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

- “EDA3.0: Implications to Logic Synthesis” by Leon Stok
- “Can Parallel Programming Revolutionize EDA Tools?” by Yi-Shan Lu and Keshav Pingali
- “Emerging Circuit Technologies: An Overview on the Next Generation of Circuits” by Robert Wille, Krishnendu Chakrabarty, Rolf Drechsler, and Priyank Kalla
- “Physical Awareness Starting at Technology-Independent Logic Synthesis” by André Reis and Jody Matos
- “Identifying Transparent Logic in Gate-Level Circuits” by Yu-Yun Dai and Robert K. Brayton
- “Automated Pipeline Transformations with Fluid Pipelines” by Rafael T. Possignolo, Elnaz Ebrahimi, Haven Skinner, and Jose Renau
- “Analysis of Incomplete Circuits Using Dependency Quantified Boolean Formulas” by Ralf Wimmer, Karina Wimmer, Christoph Scholl, and Bernd Becker
- “Progressive Generation of Canonical Irredundant Sums of Products Using a SAT Solver” by Ana Petkovska, Alan Mishchenko, David Novo, Muhsen Owaida, and Paolo Ienne
- “A Branch-and-Bound-Based Minterm Assignment Algorithm for Synthesizing Stochastic Circuits” by Xuesong Peng and Weikang Qian
- “Decomposition of Index Generation Functions Using a Monte Carlo Method” by Tsutomu Sasao and Jon T. Butler

On the different abstraction layers, it is shown in which way logic synthesis can adapt to recent computer science and technological advances. The contributed chapters cover latest results in academia but also descriptions of industrial tools and users. Also, the chapters are very helpful in pointing out relevant novel topics for future work.

Porto Alegre, Brazil
Bremen, Germany
June 2017

André Inácio Reis
Rolf Drechsler

Advanced Logic Synthesis

Reis, A.I.; Drechsler, R. (Eds.)

2018, X, 232 p. 118 illus., 48 illus. in color., Hardcover

ISBN: 978-3-319-67294-6