Foreword

This book is about three-dimensional RC extraction techniques for microelectronic designs. The authors are from the Parasitic Parameter Extraction Group, Department of Computer Science and Technology, Tsinghua University, which has made many significant contributions to the field since 1991. Some of their approaches, e.g., direct boundary element method (BEM) for C extraction (2001–2006) and hierarchical block BEM (2004), have been incorporated in industrial tools.

Resistance and capacitance (RC) extraction is an essential step to model the interconnect wires and substrate coupling in integrated circuits. The parasitic plays a significant role in the system performance. Advances of fabrication processes and new materials with various dielectric permittivities call for accurate and efficient extraction tools to handle complex geometries. Although RC extraction has been a research topic in the electronic design automation community for about 25 years, larger designs and faster project turnaround have kept pushing the demand for better extraction tools.

The authors cover the state-of-the-art techniques of RC field solvers, mainly the boundary element method (direct or indirect) with accelerating techniques and the fast floating random walk methods. These subjects are relatively new and of large impact theoretically and practically. The content also reflects the research activities of the authors in the last 10 years.

This book presents a systematic introduction to and treatment of the key concepts of the extraction. To the best of my knowledge, it is the first time for a monograph dedicated to the advanced RC extraction techniques. Various field-solver techniques are explained in details, with examples to illustrate the advantages and disadvantages of each algorithm. Readers are encouraged to consider the computational complexity, physical theory, numerical stability, robustness of the algorithm for general cases, and applicability for software development and maintenance. The presentation brings insights of suitable solvers for specific extraction problems.

San Diego, CA, USA — Chung-Kuan Cheng