

Preface

The compact models of semiconductor devices are the bridges between design and manufacturing in the integrated circuit industry. As such, compact models play an important and unique role in the IC technology, which brings gigantic benefits to the world economy and the quality of human life.

The compact models are as old as the computer simulation of integrated circuits with models such as MOS Level 1 and Gummel-Poon bipolar junction transistor models dating back to the 1970's. In the 1990's, the advent of the foundry-fabless partition in the IC industry changed compact modeling in several ways. First, the compact models were suddenly under the limelight because they became the bridge between IC chip foundries and hundreds of design companies that use these foundries. Second, the need for very accurate compact models was heightened because the models would now serve as the "contract" on transistor behaviors between the foundries and their many customers. Third, the compact models became much more complex than MOS Level 1 and Gummel-Poon BJT for deep-submicron and nanometer process technologies and, as a result, many major IC companies sought to reduce the high cost of developing their own compact models by joining force to seek, select, and support *standard* compact models under the banner of Compact Model Council. The first international standard compact model was BSIM (Berkeley Short-channel IGFET Model).

The authors have been honored and privileged to develop and support the BSIM4 model for the IC industry worldwide. Following its predecessor BSIM3v3, the industry's first standard, BSIM4 has served nearly all IC design and manufacturing companies from the 130-nanometer technology node down to the 20-nanometer node as of the

date of this book publishing. Over the years, BSIM4 has contributed to the development of IC products worth untold billions of dollars. During that time, we communicated with innumerable BSIM4 users around the globe. Often the same discussion topics would be brought up in those communications. Thus, we set out to write this book to provide the insights and comprehensive descriptions of BSIM4 and address those topics.

Another aim of this book is to share the knowledge and experiences we have gained from developing the BSIM models so as to further the art of compact modeling for emerging IC technologies.

Behind this book are many unsung heroes, counted in hundreds. It is impossible for us to name them all. We would like to thank them collectively. But we particularly would like to give special thanks to the following.

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