Foreword

Zhiping Yu · Nobuya Mori

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Modern computational nanoelectronics may be thought as starting from the Kohn-Sham's equation in 1965, with density-functional theory (DFT) to transform an interacting electron system to a single electron Schrödinger equation. Together with the surge of nanoelectronic device research, symbolized by the proposition of single-electron transistor (SET) in mid-1980's, for more than two decades, the first-principles calculation for atomic-position relaxation in solids and electronic bandstructures has become a common practice and the technique is reaching maturity. For quantum transport in mesoscopic systems, to which most nanoelectronic devices fall, the NEGF (non-equilibrium Green's function) becomes the default approach in computation. On the other hand, as CMOS devices enter nano-scale regime (now at 32 nm technology node), the classical drift-diffusion (DD) approach has not lost its luster in technology CAD (TCAD), and IC device and processing engineers routinely rely on the macroscopic simulation tools, such as Sentaurus and other commercial software, in design analysis and optimization. The computational electronics at different physics levels just keep advancing and is now an indispensable part of microelectronics and nanoelectronics.

With contributions spanning from nano-materials to nanoelectronic devices to efficient numerical algorithms, this

special issue on *Advances in Computational Nanoelectronics* is evidence that the pace of progress in computational electronics has not slowed down. Material presented here reflects the many layers of physical complexity in nanoelectronics and includes articles from atomistic perspectives (articles 1–3), on mesoscopic and macroscopic quantum transport (articles 4–8), and on compact/equivalent-circuit modeling (articles 9, 10). In terms of materials, this special issue includes work on transition-metal oxide (TMO) for resistive-switching RAMs (ReRAM), graphene, silicon nanowires, and much more.

The original title for this special issue had been “The State of Computational Electronics in Asia”. We decided to revise and broaden this title, first in recognition that not all of the authors are from Asia, and second and more importantly, to emphasize that most of the work included is “nano” in orientation and is expressive of the growing centrality of nanoelectronic devices and phenomena to our field.

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Z. Yu (✉)
Tsinghua University, Beijing, China
e-mail: yuzhip@tsinghua.edu.cn

N. Mori
Osaka University, Osaka, Japan