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Efficacy of the Thermalized Quantum Potential Approach for Modeling Nanoscale Semiconductor Devices. SHAIKH AHMED, Dept. of Electrical and Computer Engr., Purdue University, DRAGICA VASILESKA, Dept. of Electrical Engr., Arizona State University, GERHARD KLIMECK, Dept. of Electrical and Computer Engr., Purdue University, CHRISTIAN RINGHOFER, Dept. of Mathematics, Arizona State University — We propose a novel parameter-free effective potential scheme for use in conjunction with particle-based simulations of alternative semiconductor device technologies. The method is based on perturbation theory around thermodynamic equilibrium and leads to a quantum potential which depends on the energy and wavevector of each individual electron. The computation of the quantum potential involves only the evaluation of pseudo-differential operators and can be effectively facilitated using Fast Fourier Transform (FFT) algorithms. Our investigations suggest that for low doping densities, as it is usually the case in alternative device structures, such as dual-gate, FinFET and nanowire devices, the Hartree correction term (computationally expensive) can be neglected and the quantum correction for the Barrier potential/field term (one-dimensional and time-independent adding no additional computational cost) needs be included in the model only. Excellent agreement has been obtained with our Effective Potential Monte Carlo device simulations data and the results that utilize the NEGF formalism.

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