# Numerical Simulation of Tunneling Effects in Nanoscale Semiconductor Devices Using Quantum Corrected Drift–Diffusion Models

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**Abstract**

In this article, we deal with the numerical approximation of a Quantum Drift–Diffusion model capable of describing tunneling effects through the thin oxide barrier in nanoscale semiconductor devices. We propose a novel reformulation of the mathematical model that allows a natural generalization of the Gummel decoupled algorithm, widely adopted in the case of the Drift-Diffusion system. Then, we address the finite element discretization of the linearized problems obtained after decoupling, and we prove well-posedness and a discrete maximum principle for the solution of the continuity equations. Finally, we validate the physical accuracy and the numerical stability of the proposed algorithms on the simulation of a real-life nanoscale device.

*Key words:* Quantum Drift–Diffusion Models, Functional Iterations, Finite Element Method, Nanoscale Semiconductor Devices, Tunneling.