Ballistic charge transport in a triple-gate Silicon nanowire transistor

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ABSTRACT

Silicon nanowire transistors (SNWTs) are considered an interesting alternative architecture to the conventional planar technology for devices, because of their improved electrostatic control of the channel via the gate voltage and the consequent suppression of short channel effects. Actual SNWTs are intrinsically three-dimensional, and spatial symmetries in non idealized devices cannot be invoked to reduce the spatial degrees of freedom. In addition, it is well known that the behavior of field-effect transistors is dominated by electrostatics, which has therefore to be accurately simulated in order to reproduce the device electrical behavior. Therefore, the investigation of these devices by means of numerical simulations can be very informative, provided that a realistic and complete physical model is employed. Specifically, we have to solve a 2D Poisson equation coupled with as many 1D Schroedinger equations as the number of mesh points along the channel.
In alternative the Schroedinger equation can be solved with a rigorous perturbation method, thus eliminating discretization errors and providing very accurate energy eigenvalues and eigenfunctions. The charge transport along the longitudinal dimension of the wire has been considered using the semiclassical approximation, in the ballistic regime. Simulation results for a triple-gate SNWT will be presented at the conference.

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