Simulation of a Double Gate MOSFET through a hybrid quantum-classical model

Naoufel Ben Abdallah
Université de Toulouse
118 route de Narbonne F-31062 Toulouse Cedex 9
naoufel@math.univ-toulouse.fr

María José Cáceres Granados
Universidad de Granada
Campus de Fuentenueva, E18071 Granada, Spain
caceresg@ugr.es

José Antonio Carrillo de la Plata
ICREA/Universitat Autònoma de Barcelona
Edifici C Facultat de Cincies 08193 Bellaterra (Barcelona)
carrillo@mat.uab.es

Francesco Vecil
RICAM-Austrian Academy of Sciences
Altenbergerstrasse 69, 4040 Linz, Austria
francesco.vecil@oeaw.ac.at

The research in the improvment of Double Gate MOSFETs is focused on their downscaling. The smaller the device, the more relevant quantum effects become. The hybrid description consists in describing the electrons as waves along the dimension confined by two silicon oxide layers, and as particles along the unconfined dimensions. The wave-description is achieved by a series of 1D stationary-state Schrödinger equations, whose eigenvalues represent the energy levels, called sub-bands, into which the electron population is decomposed; the Schrödinger equations are coupled to a 2D Poisson equation for the computation of the electric field. Tne particle-description is achieved by a series of Boltzmann Transport Equations, one for each sub-band. We set up the numerical techniques for the solution of the complete problem; the relevant part is the use of Newton-Raphson schemes for the Schrödinger-Poisson block. The transport is solved by either Time-Splitting or standard Runge-Kutta tehniques. Some results are shown.