ABSTRACT

Moore's law have been guiding the semiconductor industry for the last five decades. But now, as predicted by several research group, Moore's law is reaching its limit because of short channel effects. However, in order to push forward the semiconductor industry, researchers are looking into multi-gate field effect transistors (MUGFET). The most recent innovation in MUGFET has been of Nanosheet field effect transistor (NsFET), which is a gate-all around device, wrapping the semiconductor channel from all the four sides. Experimental and simulations results have shown its superiority in comparison to FinFET and Nanowire FET device for SCEs. But as NsFET is a quantum mechanically confined device, proper explanation of its characteristics are still missing which is necessary to develop compact models for NsFET.

As quantum mechanical effects becomes more prominent with decreasing dimension of NsFET device, so in order to get accurate potential and charge profile there is a need to solve Poisson and Schrodinger equation iteratively. So, in this work, first the development of a Poisson-Schrodinger solver is carried put which self-consistently solves the Poisson and Schrodinger equation. Then physical analysis of characteristics of NsFET, achieved from the simulation of PS solver is carried out, to understand the quantum mechanical effects present in NsFET. In last, a case study on centroid capacitance and development of its compact model is carried out.