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Analytical Modeling of Drain Current for DNA Biomolecule Detection in Double-Gate Tunnel Field-Effect Transistor Biosensor

Authors : Ashwani Kumar

Abstract : Abstract- This study presents an analytical modeling approach for analyzing the drain current behavior in Tunnel Field-Effect Transistor (TFET) biosensors used for the detection of DNA biomolecules. The proposed model focuses on elucidating the relationship between the drain current and the presence of DNA biomolecules, taking into account the impact of various device parameters and biomolecule characteristics. Through comprehensive analysis, the model offers insights into the underlying mechanisms governing the sensing performance of TFET biosensors, aiding in the optimization of device design and operation. A non-local tunneling model is incorporated with other essential models to accurately trace the simulation and modeled data. An experimental validation of the model is provided, demonstrating its efficacy in accurately predicting the drain current response to DNA biomolecule detection. The sensitivity attained from the analytical model is compared and contrasted with the ongoing research work in this area.

Keywords : biosensor, double-gate TFET, DNA detection, drain current modeling, sensitivity
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