DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Miniaturization of semiconductor devices is the most important growth factor of semiconductor circuits integration scale described by Moore's Law. When scaling down the dimensions of MOSFETs (Metal-Oxide-Semiconductor Field Effect Transistor) new unwanted effects appear, e.g.: DIBL (Drain Induced Barrier Lowering), carrier velocity saturation, hot carrier effects or impact ionization. These effects degrade the device electrical characteristics. Moreover, in modern integrated circuits (IC), power consumption is the biggest problem which limits the computational technology progress. The minimum supply voltage (V_{dd}) is related to the slope of the transfer characteristic of a device which can be described by a factor called the subthreshold swing (SS). It is a crucial factor influencing a possibility of scaling of the power supply of transistor.The conventional MOSFET has the fundamental limit for the subthreshold swing determined to $SS = 60\, mV/decade$ at room temperature due to the thermionic electron emission-type transport over the potential barrier.

Reducing V_{dd} by 10x results in a 100x save in a dynamic power of a device which transfers to an enormous save in power of integrated circuit built of even billions of transistors (100 x "number of transistors in IC"). In order to continue the progress in computational technology a new class of devices is needed. One of the most promising candidates is the Tunnel Field Effect Transistor (TFET) It exploits the quantum mechanical effect called interband tunneling as a transport mechanism. Due to this fact it is possible to obtain the subthreshold swing smaller than 60 mV/dec .

There is a need of development of physics-based models and simulation tools for TFET in different configurations to study the carrier transport in these structures. A main goal of the project is theoretical investigation of tunneling between low-dimensional regions in tunnel field-effect transistors (TFETs) of different structures. To achieve this goal, advance numerical simulation tool will be developed.