Simulation of 2D Silicon MESFET using GNU/Archimedes

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Summary. GNU/Archimedes is the GNU Free Software for the design and simulation of Semiconductor devices. Here we show, briefly, how it is possible to simulate a 2D Silicon MESFET just typing a very simple script describing the MESFET. All the relevant scattering phenomena are taken into account in order to obtain a realistic simulation of the Electron-Dynamics. You can find the GNU/Archimedes package at the following web site: www.gnu.org/software/archimedes

1.1 Introduction

Using GNU/Archimedes is very simple. Indeed, in order to describe a semiconductor device, one only needs to type a brief script in which the description of the device is reported in a simple scripting language. We report, in the following, a brief script useful for the simulation of a 2D Silicon MESFET.

```
# Silicon MESFET test-1
# created on 22 sep. 2004, J.M. Sellier
# modified on 21 oct. 2004, J.M. Sellier

MATERIAL SILICON
TRANSPORT ELECTRONS

FINALTIME 6.0e-12
TIMESTEP 0.0015e-12

XLENGTH 0.6e-6
YLENGTH 0.2e-6

XPATIALSTEP 120
YSPATIALSTEP 40
```
# Definition of the doping concentration
# ======================================
DONORDENSITY 0. 0. 0.6e-6 0.2e-6 1.e23
DONORDENSITY 0. 0.15e-6 0.1e-6 0.2e-6 3.e23
DONORDENSITY 0.5e-6 0.15e-6 0.6e-6 0.2e-6 3.e23
ACCEPTORDENSITY 0. 0. 0.6e-6 0.2e-6 1.e20

# Definition of the various contacts
# ==================================
CONTACT DOWN 0.0 0.6e-6 INSULATOR 0.0
CONTACT LEFT 0.0 0.2e-6 INSULATOR 0.0
CONTACT RIGHT 0.0 0.2e-6 INSULATOR 0.0
CONTACT UP 0.1e-6 0.2e-6 INSULATOR 0.0
CONTACT UP 0.4e-6 0.5e-6 INSULATOR 0.0
CONTACT UP 0.0 0.1e-6 OHMIC 0.0 3.e23
CONTACT UP 0.2e-6 0.4e-6 SCHOTTKY -1.3
CONTACT UP 0.5e-6 0.6e-6 OHMIC 1.0 3.e23

NOQUANTUMEFFECTS
MAXIMINI
# SAVEEACHSTEP

LATTICETEMPERATURE 300.

STATISTICALWEIGHT 1000
MEDIA 500

OUTPUTFORMAT GNUPLOT

# end of MESFET test-1

1.2 GNU/Archimedes Simulation Results

We report, in the following, some pictures which show the results obtainable with GNU/Archimedes.
Fig. 1.1. Plot of the MESFET density and potential obtained by GNU/Archimedes.
Fig. 1.2. Plot of the MESFET x and y-component of velocity obtained by GNU/Archimedes.
Fig. 1.3. Plot of the MESFET electron energy obtained by GNU/Archimedes.