

Archimedes, the Free MC simulator

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INTRODUCTION

Archimedes [1] is the GNU package for Monte Carlo (MC) semiconductor devices simulation. Since its very first release (0.0.1 in 2005), users have been able to download the source code under GPL (GNU Public License). Since then, many new features have been included in the code.

Today Archimedes is able to simulate submicron devices and some nanoscale devices, like double gate MOSFETs, by means of first-order quantum approximations like effective potentials, and has even been released on nanoHUB which makes users more productive.

It is used by a wide community all around the world, from students to academic/company researchers/engineers that use it as a starting point. On nanoHUB, the tool has 325 users so far. In this abstract, the present and future features of Archimedes are presented along with the reasons why this code is released under GPL.

APPROACHES IMPLEMENTED

Archimedes is based on the very well-known MC method [2]. The method is based on the particle nature of electrons, at a semi-classical level, described by a position and a pseudo-wave vector. At each time step, the code evolves the two particle vectors, taking into account the interaction with the electrostatic potential (drift) and the interactions with the lattice phonons (scattering). To mimic some of the quantum effects several quantum effective potential models have been included into Archimedes, see for example Ref. [3]. These models are enough to simulate submicron devices and some (non-atomistic) nano-devices as it has been vastly demonstrated in the literature.

GPL LICENSE

The situation one observes today in the semiconductor community is that plenty of very advanced and interesting papers is available, plenty of new techniques can be learned, but it is extremely rare (if not impossible) to get a code from which to start. Usually, one reads a paper and then develop the method/model from scratch.

Archimedes wants to be the first step to change this situation. It is released under GPL and everybody can download it and use it as the starting point of a new program. For a good example on how it has already been used, see [4].

CONCLUSION AND FUTURE DEVELOPMENTS

Archimedes is certainly not the last word in the semiconductor community but it is the first one as a free software. We hope this package will not remain an isolated example of free scientific package, and hope to be a starting point for every scientist that needs a good MC code to start from. We are planning to include it as a reliable MC engine in NEMO5 [5].

REFERENCES

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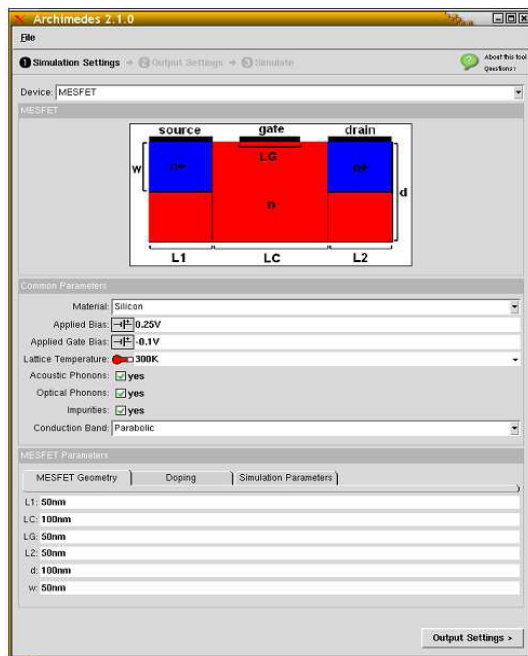


Fig. 1. Archimedes GUI on nanoHUB.

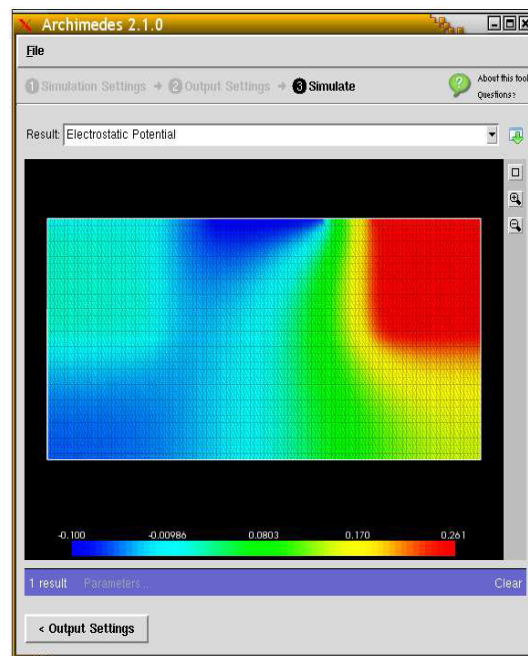


Fig. 3. Example of MESFET 2D Potential

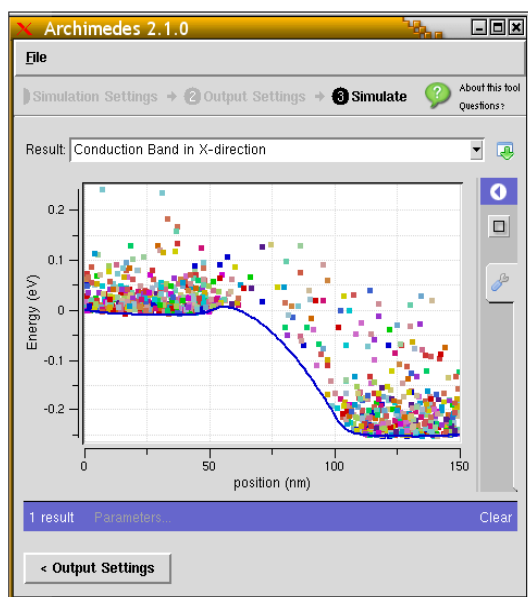


Fig. 2. Example of Electrons in Conduction Band.

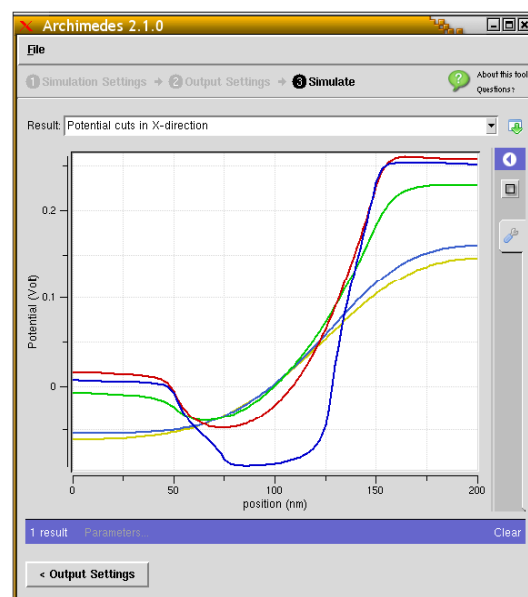


Fig. 4. Cuts in the MESFET Potential.