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## The Simulation of Resonant Tunneling Diodes

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### ABSTRACT

The goal of this project is to improve the simulation of an electrical device known as a Resonant Tunneling Diode (RTD). Diodes are in most electronic devices today, but RTDs have 10 times greater switching speeds than regular diodes. This increase in efficiency would have impacts from supercomputers to the next big cell phone. The increased functionality of the simulation tool will come from implementing more recent mathematical solvers and modeling techniques. The simulation tool makes use of a variant of Non-Equilibrium Green Functions (NEGF) with an effective mass approximation. The two contacts are treated as equilibrium regions and the channel as a non-equilibrium region. The tool is capable of simulating multi-barrier devices and allows for significant user input. The output is being developed to allow the user to see the results of bias sweeps as well as side-by-side graphs of conduction band edge, transmission probability, energy resolved current and current-voltage characteristics. Upon completion of the tool it will become available through nanoHUB, a scientific and engineering gateway providing interactive online resources. This will allow for the broad impact in classrooms, laboratories, and industries around the world. RTDs will become significantly more important as our electronics continue to grow in power and shrink in size. The simulation tool will continue to be updated with future advancements in technology.

### KEYWORDS

Nanotechnology, Resonant Tunneling Diodes, simulation, nanoHUB

### REFERENCES

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