
Matthew Lasater
**Using Continuation Methods for Modeling Nanoscale
Semiconductor Devices**

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Resonant tunneling structures are quantum sized semiconductor devices, which both theory and numerical simulation predict can sustain terahertz current oscillations. The current in these devices are modeled by the Wigner-Poisson Equations: a nonlinear PDE which describes the time-evolution of the electrons and Poisson's equation to incorporate the potential effects of the electrons. To study the steady-state solutions of the PDE, we connected our simulator to LOCA (Library of Continuation Algorithms), a software library developed at Sandia National Labs. These algorithms track out steady-state solutions branches as a function of a parameter using Newton's method and can also determine the stability of these solutions. In this talk, the equations, simulator, and the algorithms of LOCA will be discussed. A scalable preconditioner was developed for the parallelized simulator to accelerate the convergence of the linear solves in Newton's method. Numerical results, including scalability and efficiency statistics of the simulator, will be presented.