
C. T. Kelley
**A scalable preconditioner for the Wigner-Poisson
equations**

Dept of Mathematics
NC State University
Box 8025
Raleigh
NC 27695-8205
tim_kelley@ncsu.edu
M. I. Lasater
A. G. Salinger
D. L. Woolard, G. Recine, P. Zhao

In this paper we propose and analyze a scalable preconditioner for the Wigner-Poisson equations for a resonant tunneling diode (RTD), and apply that preconditioner to a matrix-free continuation study of the dependence of the current through the device on the applied voltage.

The equations are a integro-partial differential equation for the distribution of the electrons in the device couples with Poisson's equation for the electrostatic potential. Our preconditioner is the inverse of the kinetic energy operator. We prove that, after elimination of the Poisson equation, the equation after left preconditioning is a compact fixed point problem for the Wigner distribution. We then apply that compactness to show mathematical scalability of the inner Krylov iteration, and use that to show scalability of the continuation. We present numerical results that support the theory.