TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

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Deterministic solvers for non-linear Boltzmann transport systems

by Irene M. Gamba
University of Texas, Austin

Abstract.

We will discuss two types of deterministic numerical schemes to to solve kinetic transport models associated to collisional theory or non-linear interactions given by the The Boltzmann transport equation (BTE). This is an integro-differential transport equation that describes the evolution of a single point probability distribution function. The mathematical and computational difficulties associated to the Boltzmann equation are due to the non local - non linear nature of the integral operator accounting for their interactions and/or the coupling to the Poisson equation for charges accounting for long range interactions.

Two particular approaches to two different problems will be discussed. The first one is a Discontinuous Galerkin (DG) scheme applied to deterministic computations of the transients for the Boltzmann-Poisson system describing energy band electron transport in semiconductor devices, where the collisional term models optical-phonon interactions that become dominant under strong energetic conditions corresponding to nano-scale active regions under relative strong applied bias.

The second approach is based on a spectral methods with Lagrangian constrains to secure conservation applied to the non-linear Boltzmann equation for binary conservative or dissipative collisions.