

UNIVERSITY of HOUSTON

Department of Mathematics

Scientific Computing Seminar

Dr. Samuel Van Fleet
Computational Applied Mathematics & Operations Research
Rice University

Structure Preserving Particle Methods for a Class of Continuity Equations

Thursday, February 13, 2025
1 PM- 2 PM
Room 646 PGH

Abstract: Structure-Preserving particle methods have recently been proposed for a class of nonlinear continuity equations, including aggregation-diffusion and the Landau equation. One common feature to these equations is that they both admit some variational formulation, which, upon proper regularization, leads to particle approximations that conserve some quantities with simultaneous energy decay at the semi-discrete level. In this talk, we extend the particle method to the multispecies Landau equation and examine its conservation of mass, momentum, and kinetic energy, and energy decay properties. We show that the equilibrium distribution of the regularized multispecies Landau equation is a Maxwellian distribution, and state a critical condition on the regularization parameters that guarantees a species independent equilibrium temperature. Furthermore, we demonstrate that the particle method discretization, paired with a discrete gradient time integrator, conserves mass with simultaneous energy decay at the fully discrete level in the case of the aggregation-diffusion equation. In the case of the Landau equation, we show that this method conserves mass, momentum, and kinetic energy with simultaneous energy decay. Several numerical examples will be presented to demonstrate the dissipative and conservative properties of our proposed method.

This seminar is easily accessible to persons with disabilities. For more information or for assistance, please contact the Mathematics Department at 743-3500.