ALPEN-ADRIA UNIVERSITÄT KLAGENFURT

Invitation to a Guest Lecture

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"A Lagrangian Scheme for the solution of nonlinear diffusion equations"

Z.1.29 | Wednesday, 2 July 2025 | 11:00 a.m.

Abstract

Nonlinear diffusion equations whose dynamics are driven by internal energies and given external potentials, e.g., the porous medium equation and the fast diffusion equation, have received a lot of interest in mathematical research and practical applications alike. Many of them have been interpreted as gradient flows with respect to some metric structure. When it comes to solving partial differential equations of gradient flow type numerically, it is natural to ask for appropriate schemes that preserve the equations' special structure at the discrete level. In this talk we present a Lagrangian numerical scheme for solving nonlinear degenerate Fokker-Planck equations in multiple space dimensions. The key ingredient in our approach is the gradient flow structure of the dynamics. For discretisation of the Lagrangian map, we use a finite subspace of linear maps in space and a variational form (minimising movement scheme) of the implicit Euler method in time. Thanks to that time discretisation, the fully discrete solution inherits energy estimates from the original gradient flow, and these lead to weak compactness of the trajectories in the continuous limit. We discuss the consistency of the scheme in two space dimensions and present numerical experiments

for the porous medium equation.

Elena Resmerita and the Department of Mathematics look forward to seeing you at the talk!