

ADVANCES IN TIME INTEGRATION AND SPATIAL DISCRETIZATION FOR PDES

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ABSTRACT

The accurate and efficient numerical simulation of partial differential equations requires methods that remain robust in the presence of nonlinearity, multiple scales, degeneracy, and strongly convective behavior. At the same time, practical numerical algorithms must preserve essential mathematical or physical structure while keeping computational costs manageable. This minisymposium brings together recent advances in time integration, novel spatial discretizations, space–time formulations, and model order reduction for computational PDEs.

The presentations will address a variety of approaches both in time and space. These include perturbed Runge–Kutta methods and the development of their order conditions, smooth perturbations designed to improve the stability and efficiency of Runge–Kutta schemes, kernel-based tensor calculus in a unified space–time formulation, new discontinuous Galerkin methods, doubly conservative schemes for degenerate convection–diffusion equations, and model order reduction for convection-dominated problems. Together, the contributions illustrate how new analytical ideas and computational techniques can improve the accuracy, robustness, efficiency, and scalability of numerical methods for challenging PDE applications.

SPEAKERS

1. Sigal Gottlieb (UMassD): On Developing Order Conditions for Perturbed Runge–Kutta Methods.
2. Zachary J. Grant (UMassD): Smooth Perturbations for Runge–Kutta Methods

3. Andrew J.Christlieb (MSU): Kernel-Based Tensor Calculus: A Space–Time Formulation.
4. Chi-Wang Shu (Brown University): Doubly Conservative Schemes for Degenerate Convection–Diffusion Equations.
5. Jennifer K. Ryan (KTH): Is it Noise or is it Superconvergence?
6. Julia Docampo-Sánchez (BSC - CNS): Iterative Metric Rescaling for Mesh Adaptation with Prescribed Node Count.
7. Fengyan Li (RPI): A Model Order Reduction Framework for Convection-Dominated Equations.
8. Adi Ditkowski (TAU): Derivative-Coupled Discontinuous Galerkin Methods.