

HIGH-ORDER ACCURATE AND EFFICIENT NUMERICAL SCHEMES FOR COMPLEX NONLINEAR SYSTEMS

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ABSTRACT

Complex nonlinear systems, governed by partial differential equations, are ubiquitous across science and engineering—from computational fluid dynamics and plasma physics to phase-field modeling and biological pattern formation. While high-order numerical methods offer superior accuracy per degree of freedom, their practical deployment for such systems faces persistent challenges: maintaining provable stability and physical fidelity (e.g., entropy stability, positivity preservation, energy conservation/dissipation), ensuring computational efficiency on modern architectures, and handling complex geometries with unstructured meshes .

This minisymposium brings together recent advances in the development of high-order accurate numerical schemes that address these challenges through rigorous mathematical design and algorithmic innovation.

SPEAKERS

1. Weizhu Bao (National University of Singapore): Multiscale methods and analysis for the Dirac equation in nonrelativistic regime.
2. Yue Feng (Xi'an Jiaotong University): Uniform error bounds on numerical methods for long-time dynamics of dispersive PDEs.
3. Ruchi Guo (Sichuan University): Solve electromagnetic interface problems on unfitted meshes.

4. Zhonghua Qiao (The Hong Kong Polytechnic University): Numerical approximations for Wasserstein gradient flows.
5. Limin Ma (Wuhan University): Structure-preserving Finite element method for Ginzburg-Landau equations.
6. Xiao Li(Beijing Normal University): Energy stable numerical schemes for phase field models.
7. Lili Ju (University of South Carolina): Energy-Dissipative Spectral Renormalization Exponential Integrator Method for Gradient Flow Problems.
8. Xianming Xu (Institute of Mathematics and Systems Science, Chinese Academy of Sciences): Model reduction based on the Onsager variational principle.
9. Chuchu Chen (Institute of Mathematics and Systems Science, Chinese Academy of Sciences): Accelerated Exponential Euler Scheme for Stochastic Heat Equation: Convergence Rate of Densities.