

NEW PARADIGMS IN STRUCTURE-PRESERVING METHODS FOR COMPLEX FLUIDS

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ABSTRACT

Imbuing numerical algorithms with physical structure-preserving properties has led to a renaissance in physics-based simulations. The impact of such schemes has made a particularly strong impact on high order methods, where structure preservation has been shown to significantly improve robustness and avoid spurious numerical artifacts. Physical structures to preserve include, but are not limited to, conservation and dissipation of auxiliary quantities and the preservation of key steady states or solution invariants. Mimicking such properties significantly improves the robustness and accuracy of high order simulations in a wide range of applications in science and engineering. This minisymposium focuses on the application of emerging structure-preserving techniques within complex fluids, including (but not limited to) multi-species and multi-phase flows, thermally perfect gases, and non-ideal equations of state.

SPEAKERS

1. Gennaro Coppola (University of Naples Federico II, gcoppola@unina.it): “Structure-preserving discretization of compressible flow equations with an arbitrary equation of state”
2. Hiroshi Terashima (Hokkaido University, htera@eng.hokudai.ac.jp): “Analysis of a high-order approximate pressure-equilibrium-preserving flux for conservative simulations of compressible multispecies real-fluid flows” and “A consistent artificial-diffusion method for stabilizing multicomponent real fluid flow simulations with the high-order APEC scheme”

3. Nguyen Ly (NASA AMES Research Center, nguyen.ly@nasa.gov): “Discrete energy conservation for the pressure-evolution equation”
4. Francesco Capuano (Universitat Politècnica de Catalunya, francesco.capuano@upc.edu): “Structure-preserving discretization for monolithic interface-capturing fluid-structure interaction”
5. Georgii Oblapenko (RWTH Aachen, georgii.oblapenko@rwth-aachen.de): “Efficient high-order discretizations of thermochemically non-equilibrium flows”
6. Andrea Crivellini (Università Politècnica delle Marche, a.crivellini@staff.univpm.it): “Efficient entropy-conserving/stable discontinuous Galerkin solution of the multicomponent compressible Euler equations”
7. Florian Schaefer (New York University, florian.schaefer@nyu.edu): “Information Geometric Regularization for Shock-Turbulence Interaction”
8. Christian Rohde (Universität Stuttgart, christian.rohde@mathematik.uni-stuttgart.de): “Energy/entropy-preserving schemes for diffuse-interface models governing compressible two-phase flow”
9. Weifeng Zhao (University of Science and Technology Beijing, wfzhao@ustb.edu.cn): “A positivity preserving and oscillation-free entropy stable discontinuous Galerkin scheme for the reactive Euler equations”
10. Ye Wang (UNSW, ye.wang@unsw.edu.au): “Physically consistent high-order finite-difference methods for compressible multi-component flows”