

RECENT ADVANCES IN STRUCTURE-PRESERVING GALERKIN METHODS

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ABSTRACT

Structure-preserving Galerkin methods have emerged as a powerful class of numerical discretizations that faithfully reproduce key mathematical and physical properties of partial differential equations at the discrete level. By preserving structures such as divergence constraints, exact sequences, energy dissipation, symmetries, and long-time dynamics, these methods often deliver enhanced robustness, stability, and physical fidelity.

This minisymposium aims to bring together researchers working on the design, analysis, and implementation of structure-preserving Galerkin methods. Topics of interest include compatible finite element methods, discontinuous Galerkin methods, hybridizable discontinuous Galerkin methods, hybrid high-order methods, mixed finite element methods, pressure-robust and divergence-conforming discretizations and adaptive algorithms.

Applications include incompressible flow problems subject to divergence constraints, Maxwell equations, elasticity, wave propagation, kinetic equations, and other multi-physics systems. Particular emphasis will be placed on recent advances in preserving fundamental analytical structures, including mass conservation, incompressibility, energy and entropy stability, and hypocoercivity, as well as on rigorous numerical analysis, efficient solvers, and adaptive methodologies.

SPEAKERS

1. Andrea Cangiani (SISSA): Tentative title: TBA. Email: acangian@sissa.it

2. Andrea Dedner (University of Warwick, England): **On the approximation of the wave equation in first-order form.** Email: A.S.Dedner@warwick.ac.uk
3. Alexandre Ern (École des Ponts ParisTech and INRIA, France): **On the approximation of the wave equation in first-order form.** Email: alexandre.ern@enpc.fr
4. Emmanuil Georgoulis (Heriot-Watt University, United Kingdom and National Technical University of Athens, Greece): **Hypocoercivity-preserving space-time Galerkin discretization schemes.** Email: E.Georgoulis@hw.ac.uk
5. Christian Kreuzer (TU Dortmund University, Germany): **Pressure robust discretisations of the nonlinear Stokes equations** Email: christian.kreuzer@tu-dortmund.de
6. Philip Lederer (University of Hamburg, Germany): **Exact symmetric mass conserving stress (MCS) yielding methods for incompressible flows** Email: philip.lederer@uni-hamburg.de
7. Xiaoli Li (Shandong University, China): **A machine learning method for solving PDEs with a robust initial learning rate.** Email: xiaoli-math@sdu.edu.cn
8. Neela Nataraj (Indian Institute of Technology Bombay, India): **To add.** Email: neela@math.iitb.ac.in
9. Rong Tang (The Hong Kong Polytechnic University, China): **Accepted.** Email: claire.tang@polyu.edu.hk
10. Tabea Tscherpel (University of Göttingen, Germany): **Energy-consistent and asymptotic-preserving methods of high order for compressible fluid mixtures.** Email: tscherpel@mathematik.tu-darmstadt.de
11. Thomas Wihler (University of Bern, Switzerland): **On sharp L^∞ -stability of the DG time stepping scheme for parabolic evolution equations.** Email: thomas.wihler@unibe.ch
12. Martin Vohralík (INRIA Paris, France): **Structure preservation by local postprocessing.** Email: martin.vohralik@inria.fr
13. Andreas Veerer (University of Milan, Italy): **Fine approximation properties of nodally bound-preserving finite element methods.** Email: andreas.veerer@unimi.it

14. Pietro Zanotti (University of Milan, Italy): **Inf-sup-inspired preconditioning** Email: pietro.zanotti@polimi.it
15. Qian Zhang (Jilin University, China): **Structure-conserving enriched Galerkin methods for Incompressible Navier-Stokes Equations** Email: qzhang25@jlu.edu.cn