

ADVANCES IN NONSTANDARD FINITE ELEMENT METHODS FOR FOURTH-ORDER PROBLEMS AND THEIR APPLICATIONS

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ABSTRACT

Fourth-order partial differential equations arise in a wide range of applications, from thin plate and shell mechanics to phase-field models, fluid dynamics, and biological membranes. Their numerical approximation poses significant challenges, particularly when trying to avoid the construction of C^1 conforming finite element spaces, which can be complex and restrictive. Nonstandard finite element methods — such as discontinuous Galerkin, C^0 interior penalty, mixed formulations, virtual element methods, and Hybrid High Order methods — offer flexible alternatives that accommodate general meshes, local adaptivity, and robust handling of singularities and interfaces. In this minisymposium, we aim to discuss recent advances in the design, analysis, and efficient implementation of these nonstandard discretizations for both fourth-order problems and their extension to problems that require (local) H^2 -regularity. Topics include, but are not limited to, novel a priori and a posteriori error analysis, hp-adaptivity, structure-preserving schemes and the application of such methods to emerging problems in engineering and the sciences.

SPEAKERS

1. Andrea Cangiani (SISSA): Virtual element methods for a class of fully nonlinear elliptic PDEs
2. Théophile Chaumont-Frelet (INRIA, Lille): Stabilization-free a posteriori error estimates for IPDG discretizations of the biharmonic problem
3. Zhaonan Dong (INRIA, Paris): A posteriori error estimates for the discontinuous Galerkin methods for quad-curl problems

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4. Joscha Gedicke (University of Bonn): A Generalized Hessian-Based Error Estimator for the 2D Biharmonic Problem via SIPDG
 5. Benedikt Gräßle (Universität Zürich): Quasi-optimal adaptive methods for semilinear fourth-order problems.
 6. Anwesh Pradhan (Charles University, Prague): A posteriori error estimates for the virtual element method for the vanishing moment formulation of Monge–Ampère
 7. Rekha Khot (IIT Palakkad): TBD
 8. Neela Nataraj (IIT Bombay): TBD