

Title: Modern Analytical, Numerical, and Data-Driven Methods for Water Wave Problems

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Abstract

Water waves provide a rich source of challenging problems in applied mathematics, linking nonlinear partial differential equations, numerical analysis, scientific computing, and engineering applications. Recent advances have significantly improved our understanding of wave propagation, wave–structure interaction, coastal and ocean dynamics, and nonlinear dispersive phenomena, while new computational techniques have enabled realistic large-scale simulations and data-driven prediction.

This minisymposium will bring together researchers working on theoretical, computational, and application-oriented aspects of water wave problems. Topics include mathematical analysis of free-boundary problems, nonlinear and dispersive wave models, stability and bifurcation of traveling waves, structure-preserving numerical methods, high-order finite element and spectral discretizations, uncertainty quantification, inverse problems, machine learning for wave prediction, and applications to coastal engineering, offshore renewable energy, tsunami modeling, and environmental fluid mechanics. The session aims to promote interactions between analysts, numerical mathematicians, computational scientists, and engineers. By highlighting recent mathematical developments alongside emerging computational technologies, the minisymposium will provide a forum for discussing current challenges and future directions in water wave research. It will also foster collaboration across disciplines and encourage participation by early-career researchers.

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