

MESHLESS NUMERICAL METHODS AND SCIENTIFIC MACHINE LEARNING WITH KERNELS AND GAUSSIAN PROCESSES

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ABSTRACT

Kernel methods have become ubiquitous across science and engineering. For more than two decades, radial basis function finite difference (RBF-FD) methods have provided flexible, high-order discretizations for partial differential equations on complex domains and manifolds. More recently, Gaussian Process (GP) perspectives have opened new directions in nonlinear solvers, uncertainty quantification, and operator learning, while retaining the potential for very high-order convergence. This four-slot minisymposium brings together researchers from these complementary communities to exchange ideas, identify common mathematical structure, and develop new connections between kernel-based numerical methods and kernel-based learning.

Corresponding Organizer: Varun Shankar

SPEAKERS

(in Alphabetical order of last name)

1. Martin Buhmann (University of Giessen): TBD.
2. Alberto Cattaneo (University of Utah): Differentiable High-Order Meshless Methods in KernelPack: Forward and Inverse Problems.
3. Oleg Davydov (University of Giessen): Error bounds for meshless finite difference methods.

4. Armin Iske (University of Hamburg): Fourier-free constructions of high-order kernel methods.
5. Mohammad Karimnejad (University of Venice): TBD.
6. Rüdiger Kempf (University of Bayreuth): Kernel-based Operator Learning: Error Analysis, Budget Allocation, and a Physics-Informed Extension.
7. Elisabeth Larsson (Uppsala University): Radial basis function partition of unity methods for linear elasticity - algorithms and theory.
8. Leevan Ling (Hong Kong Baptist University): Trajectory-Based RBF Collocation Method via Closest-Point Embedding for Surface Advection–Diffusion Equations.
9. Matthew Lowery (University of Utah): A kernel-based operator learning framework for time-skipping surrogates.
10. Stefano de Marchi (University of Padua): Learning with rational kernels.
11. Houman Owhadi (California Institute of Technology): Solving/learning PDEs and their solution operators with GPs.
12. Christian Rieger (Marburg University): Approximation of functions with small effective dimension.
13. Varun Shankar (University of Utah): A High-Order, Shock-Capturing, Meshless Finite Volume Method for Hyperbolic Conservation Laws.
14. Nathaniel Trask (University of Pennsylvania): Meshfree Exterior calculus (MEEC): structure preserving discretization directly from point cloud complexes.
15. Grady Wright (Boise State University): Fast computation of quadrature formulas on point clouds.