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Computational Mathematics Seminar Series

DL for PDEs: towards parametric, high-dimensional and PDE-constrained optimization**Xili Wang, Peking University**

School of Mathematical Sciences

Digital Media Center 1034

October 22, 2024 - 03:30 pm

Abstract:

Despite advances in simulating multiphysics problems through numerical discretization of PDEs, mesh-based approximation remains challenging, especially for high-dimensional problems governed by parameterized PDEs. Moreover, other PDE-related problems, such as PDE-constrained shape optimization, introduce additional difficulties including mesh deformation and correction. While Physics-Informed Neural Networks (PINNs) offer an alternative, they often lack the accuracy of traditional methods like finite element methods. Relying solely on a 'black-box' approach may not be the best choice for scientific computing. Inspired by adaptive finite element methods, we propose a deep adaptive sampling approach to solve low-regularity parametric PDEs and high-dimensional committor functions in rare event simulations. Additionally, by integrating the mesh-free nature of neural networks into the direct-adjoint looping (DAL), we achieve fully mesh-independent solutions for PDE-constrained shape optimization problems.

