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INVITATION TO THE LECTURE

OCTOBER 17, 2025 10:30 ROOM 213

PHYSICS-INFORMED NEURAL NETWORKS (PINNS): FROM FUNDAMENTALS TO PRACTICAL TRICKS AND BENCHMARKS

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The lecture introduces the principles of Physics-Informed Neural Networks (PINNs) for solving partial differential equations. In the first part, we explain the formulation of residual losses for the domain and boundary, the use of automatic differentiation, sampling strategies, and the practical training procedure combining ADAM and L-BFGS optimizers, including strong enforcement of Dirichlet boundary conditions. The second part focuses on techniques that improve learning: Fourier features, curriculum learning, sequence-to-sequence training, and reinitialization. We then present benchmarks with visualizations: the Laplace problem, convection, the heat equation (including a laser-heated insulated plate), and steady-state Navier–Stokes (flow in a pipe with an obstacle, lid-driven cavity). We discuss loss evolution, residual maps, achieved L^2 errors, and typical issues. The goal is to provide a practical guide and “best practices” for stable and accurate training of PINNs in engineering applications.