ZCCE Seminar

Title: Physics-Informed Neural Network (PINN): Algorithms, Applications, and Software

Abstract: *Deep learning has achieved remarkable success in diverse applications; however, its use in solving partial differential equations (PDEs) has emerged only recently. In this talk, I will first present an overview of physics-informed neural networks (PINNs) for solving forward and inverse PDEs, which embed a PDE into the loss of the neural network using automatic differentiation. I will then discuss several approaches to improve the accuracy and efficiency of PINN, including a residual-based adaptive refinement (RAR) method, gradient-enhanced PINN (gPINN), and PINN with hard constraints (hPINN). I will also demonstrate the effectiveness of PINN to diverse problems. The PINN algorithm can be applied to different types of PDEs, including integro-differential equations, fractional PDEs, and stochastic PDEs. Moreover, I will present a Python library for PINNs, DeepXDE.*

Short CV: Dr. Lu Lu is an Assistant Professor in the Department of Chemical and Biomolecular Engineering at University of Pennsylvania. He is also a faculty of Penn Institute for Computational Science and of Graduate Group in Applied Mathematics and Computational Science. Prior to joining Penn, he was an Applied Mathematics Instructor in the Department of Mathematics at Massachusetts Institute of Technology from 2020 to 2021. He obtained his Ph.D. degree in Applied Mathematics at Brown University in 2020, master's degrees in Engineering, Applied Mathematics, and Computer Science at Brown University, and bachelor's degrees in Mechanical Engineering, Economics, and Computer Science at Tsinghua University in 2013. Lu has a multidisciplinary research background with research experience at the interface of applied mathematics, physics, computational biology, and computer science. The goal of his research is to model and simulate physical and biological systems at different scales by integrating modeling, simulation, and machine learning, and to provide strategies for system learning, prediction, optimization, and decision making in real time. His current research interest lies in scientific machine learning, including theory, algorithms, and software, and its applications to engineering, physical, and biological problems. His broad research interests focus on multiscale modeling and high performance computing for physical and biological systems.

Date: 29 June 2022

Time: 14:00-15:00

Format: Online (zoom link will be circulated later)