FUDAN UNIVERSITY

Applied Math Ph.D. Seminar

AI for Physics: Learning Hamiltonian Systems and Conservation Laws

Speaker: Jingdong Zhang (Fudan University)

Time: 2025-03-27, 16:10 to 17:00

Location: Rm 1801, Guanghua East Tower

Advisor: Wei Lin (Fudan University)

Abstract: Accurately identifying and predicting dynamics from observational data with noise perturbations or data missing is a significant challenge in the field of dynamical systems. In my talk, I will introduce the Hamiltonian Neural Koopman Operator (HNKO), a novel approach that combines principles from Hamiltonian mechanics with the learning of the Koopman operator. This framework not only sustains but also discovers conservation laws automatically, leveraging my foundational knowledge of mathematical physics. The effectiveness of the HNKO and its extensions are demonstrated across various representative physical systems, even those with hundreds or thousands of degrees of freedom. The findings indicate that incorporating prior knowledge of the underlying system and relevant mathematical theories into the learning framework significantly enhances the ability of machine learning to address complex physical problems.