



THE HONG KONG UNIVERSITY OF SCIENCE & TECHNOLOGY

Department of Mathematics

SEMINAR ON APPLIED MATHEMATICS

**Data-Driven Identification and
Prediction of Dynamical Systems with
Integrated Physical Structural Information**

By

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Abstract

Modeling and prediction of dynamical systems constitute central issues in the field of dynamics, holding significant importance for uncovering the evolutionary laws of complex systems. With the advancement of data science and artificial intelligence technologies, machine learning-based data-driven approaches have opened new paradigms for nonlinear dynamical research. However, these methods face persistent challenges including dependence on data quality, insufficient model interpretability, and limited accuracy in long-term prediction.

To address these challenges, this report proposes a dynamical research paradigm that integrates data with physical structural information. By constructing a model discovery framework based on sparse structures and an evolution prediction framework grounded in field structures, we explore methodologies for embedding physical mechanisms into dynamical representations through hard constraints. Using representative complex systems—including Hamiltonian systems, high-dimensional chaotic systems, stochastic systems, and fluid-structure interaction systems—as case studies, the proposed approach demonstrates robust and efficient system identification capabilities under sparse data, strong noise, and cross-operating condition scenarios, while achieving high-precision long-term prediction performance.

Date : 29 July 2026 (Wednesday)

Time : 3:00p.m. – 4:00p.m.

Venue : Room 4504 (near Lift 25/26)

All are Welcome!