

THE UNIVERSITY



OF HONG KONG

Department of Mathematics

## Qualifying Research Seminar

# Operator Learning for Parametric Eigenvalue Problems

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May 15, 2026 (Friday) at 11:00am

Rm 210, Run Run Shaw Building, HKU

### Abstract

In this talk, we study operator learning for parametric eigenvalue problems. We first consider eigenvalue problems of the Laplace operator on variable domains. We learn the mappings from domain geometry to the first few eigenvalues and eigenfunctions using convolutional neural networks and Fourier neural operators, respectively. We further investigate parametric non-self-adjoint Steklov eigenvalue problems with the refractive index as the input parameter. To overcome label instability induced by eigenvalue clusters, we develop a Deep Eigenspace Network and propose to learn isolated eigenspaces and recover eigenpairs via the Rayleigh-Ritz procedure, instead of directly learning individual eigenfunctions. We prove the Lipschitz continuity of the eigenspace with respect to the parameter and derive corresponding error bounds for the eigenvalues. Future work includes the theoretical analysis of the proposed method and its application to photonic material design.

*All are welcome*