



Numerical Analysis Seminar

Physics-Informed Laplace Neural Operators for Data-Efficient and Out-of-Distribution-Robust PDE Surrogate Modeling

Professor Minseok Choi

Department of Mathematics, Pohang University of Science and
Technology (POSTECH), Republic of Korea

Abstract: Differential equations are fundamental for modelling complex scientific and engineering processes. Operator learning offers a powerful framework for approximating the mapping from parametric inputs such as initial/boundary conditions or forcings to the corresponding solutions. However, purely data-driven operator learning methods such as the Laplace Neural Operator (LNO) or Fourier Neural Operator (FNO) often require large training datasets and may exhibit limited generalization, particularly for out-of-distribution inputs. We propose the Physics-Informed Laplace Neural Operator (PILNO), which embeds the governing physical laws directly into the learning process. This physics-informed approach reduces data dependency, enabling effective learning in small-data regimes and enhancing generalization to out-of-distribution inputs where purely data-driven LNOs often fail. By leveraging both data (when available) and physics, PILNO offers a more robust and data-efficient pathway to learning solution operators. We demonstrate advantages of PILNO across diverse parametric differential equation problems, highlighting its improved data efficiency and extrapolation performance. If time permits, we will also present practical examples of operator learning in scientific and engineering applications.

Date:	May 20, 2026 (Wednesday)
Time:	10:00 am - 11:00 am
Venue:	ZOOM: https://hku.zoom.us/j/ Meeting ID: 913 6532 3891 Password: 310656