

國立中央大學數學系

專題演講

主 講 人：呂秉澤博士 (國立成功大學數學系)

演講題目：Learning Dynamics with Neural ODEs: When Numerics Matter

演講茶會：2025年05月15日(星期四) 3:30 p.m. ~ 4:00 p.m.

茶會地點：中央大學鴻經館M306

演講時間：2025年05月15日(星期四) 4:00 p.m. ~ 5:00 p.m.

演講地點：中央大學鴻經館M107

Abstract：

In this presentation, I will introduce Neural ODEs—a framework that integrates traditional numerical methods into the design of its loss function. A primary application of Neural ODEs is to uncover the governing dynamics of a system from time-series snapshots of observable data. For an autonomous system described by the differential equation $dx/dt = f(x)$, the ODENet uses a trainable neural network to approximate the unknown function $f(x)$, minimizing the error between the numerically simulated states and the observed data sampled at fixed time intervals. My talk will focus on the specific case of learning linear dynamical systems, both conservative and dissipative.

In the first part, I'll address structural challenges—such as rotational dynamics and long-term trends—associated with using one-step versus multi-step integration schemes. Even when the loss function is minimized effectively, the learned dynamics may fail to reflect the true behavior of the system. I will share our findings and conclude this section with practical recommendations for selecting numerical integrators that better preserve the underlying structure of the system.

In the second part, I'll explore the effects of observational noise. By comparing results obtained from clean data with those from noisy inputs, I'll demonstrate how different noise levels can impact the accuracy and stability of the learned dynamical model.

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