國 立 清 華 大 學 數 學 系 學 術 演 講
NTHU MATH Colloquium

講題	Bounded composition operators on functional quasi-Banach spaces and stability of dynamical systems
講者	Prof. Isao Ishikawa (Ehime University)
時間	2023.09.25 (Mon.) 16:00 – 17:00
地點	第三綜合大樓**2樓 Room 201**
茶會	15:30, Room 707

Abstract

The composition operator, also called the Koopman operator in engineering and physics, is the pullback of a dynamical system on a functions space. The composition operator has been developed to investigate behavior of dynamical systems (in engineering and physics as the Koopman operator) and has recently been attracting attention as a promising tool for time series data analysis. Mathematical analysis of composition operators is inevitable to provide a theoretical guarantee of the application to data analysis, but it is usually a difficult problem, for example, how much relation is there between the boundedness of composition operators and the behavior of the original dynamical system?

We investigate the boundedness of composition operators defined on a quasi-Banach space continuously included in the space of smooth functions on a manifold. We prove that the boundedness of composition operators strongly limits the behavior of the original map. It also provides us with an effective mathematical method to investigate the properties of composition operators via the theory of dynamical systems.

As a result, we prove that only affine maps can induce a bounded composition operator on any nontrivial quasi-Banach space continuously included in the space of entire functions on the complex plane. We also prove any polynomial automorphisms except affine transforms cannot induce a bounded composition operator on a quasi-Banach space composed of entire functions in the two-dimensional complex affine space under conditions.

We will explain the background for the theoretical study of composition operators (Koopman operator) in the context of application to data analysis and also provide several mathematical results and their sketch of the proof.
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