

Koopman算符在埃农映射中的动力学

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摘要: 现实中大多数系统通常由于原理复杂而难以用准确的动力学方程描述, 只能得到一些实验观测到的系统特性数据, 我们希望通过系统的特性数据提取出动力学系统的动力学模式, 并对这些动力学模式做一定的划分。Koopman算符提供了一个有效的数学工具, 它描述了可观测量在相空间中的演化, 可以用于提取非线性系统的动力学特征。我们通过计算Koopman算符的本征值和本征函数对埃农映射系统的相空间进行划分, 并研究了埃农映射的稳定流型与不稳定流型、周期轨道与Koopman算符本征函数的关系, 这为在高维非线性系统中分析复杂的动力学提出了一种可行的方法。

关键词: 系统理论; Koopman算符; 埃农映射; 混沌; 动力学系统

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Koopman Operator and Dynamics in Hénon Map

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Abstract: In reality, most systems are usually difficult to describe with accurate equations of motion due to their complexity. Only some system data can be observed. We hope to extract the key features of the dynamical system through the observed data of the system. The phase space of the system is partitioned to different patches accordingly. The Koopman operator provides an effective mathematical tool, which describes the evolution of the observable in the phase space and can be used to extract the characteristic modes of a nonlinear system. We partition the phase space of the Hénon map by calculating the eigenvalues and eigenfunctions of the Koopman operator, and study the relationship between the stable manifold and the unstable manifold of the Hénon map, the periodic orbit and the eigenfunction of the Koopman operator, Which provides a possible method for analyzing complex dynamics in high-dimensional nonlinear systems

Key words: System Theory; Koopman Operator; Hénon map; Chaos; Dynamical System

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