Variations of Lyapunov Exponents for Coupled Chaotic Oscillators

Student : Yi-Da Chiou Advisor : Chih-Wen Shih

Department of Applied Mathematics
National Chiao Tung University
Hsinchu, Taiwan,R.O.C.

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Abstract

In this thesis, we aim at understanding the behaviors of Lyapunov exponents for the system of two identical or two distinct chaotic oscillators coupled through some or all of their components. We investigate how the Lyapunov exponents vary as the coupling strength (parameter) increases from zero. Such a consideration naturally involves the notions of synchronization and generalized synchronization for chaotic dynamical systems. In addition, it is an interesting task to formulate a functional relation between Lyapunov exponents and coupling parameter in the coupled system. Several interesting phenomena are derived through extensive numerical experiments. Some of them can be justified by analytical arguments. For the purpose of this study, we also summarize various definitions of Lyapunov exponent in the literatures and discuss connections among them.