On LaSalle's Invariance Principle and Its Application to Synchronize Hyperchaotic Systems

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ABSTRACT

The notion of hyperchaotic synchronization is of fundamental importance because its wide range of important applications in secure communications, information processing, chemical reactions, and biological systems. In this talk, we want to focus on the adaptive control law to solve the synchronization problem. To synchronize two hyperchaotic systems, traditional approaches often require the number of nonzero outputs of the controller equal to the dimension of the state variables. However, in practice, it would be desirable to reduce the number of outputs but also synchronize two hyperchaotic systems. Compared to traditional approaches, we show that that two Rssler hyperchaotic systems with known and unknown parameters can be synchronized by only using three control functions. Theoretical proof is based on the LaSalle's invariant principle, which is one of the very useful theorems in dynamical systems and control theory. We believe that our idea of employing LaSalle's invariant principle leads to a general strategy for claiming the synchronization between two hyperchaotic systems. There is plenty of room for future research, including a refinement of the control functions for more efficient synchronization and a generalization to more complex structures. We hope that our discussion in this investigation offers a unified and an effectual avenue of synchronizing between two given systems.