On Nonlinear Control and Synchronization Design for Autonomous Chaotic Systems

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Abstract: In this paper, a chaos control and synchronization technique is presented. The proposed technique is applied to achieve both control and synchronization for some autonomous chaotic dynamical systems. Numerical simulations are used to show the effectiveness of the proposed technique.

Keywords: Chaos; autonomous systems; control; synchronization.

Mathematics Subject Classification (2000): 34C15, 34C28, 49J15, 93B52.

1 Introduction

Control and synchronization of chaotic dynamical systems have received a great deal of interest among scientists from various fields [5, 13]. These two ideas were first proposed in 1990 [22, 24]. The idea of controlling chaos consists on stabilizing one of the unstable periodic orbits within the strange attractor of the chaotic dynamics, and the task was fulfilled by perturbing an accessible parameter around its nominal value. The idea of synchronizing chaotic systems refers to a process wherein two or many chaotic systems starting from different initial conditions adjust a given property of their motion to a common behaviour. Since then, many possible applications of chaos control and synchronization methods have been discussed by computer simulation and realized in laboratory condition [3, 8, 12, 14, 17, 19, 20, 21, 26, 28].

The Ott–Grebo–Yorke method, known as OGY method, is a feedback control method, which uses the chaos in system to stabilize an unstable periodic orbit. The main idea of the method is to adjust the parameter perturbations for relatively small time in order to stabilize the desired unstable periodic orbit (UPO) and obtain an attracting time-periodic motion. This control technique is practical from an experimental standpoint because it requires no analytical model of the system. It just requires determining the fixed point and the stable and unstable directions. However, the success of...