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Feedback Control of Chaotic Systems by Using Jacobian Matrix Conditions

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Abstract: In this work, we propose, for stabilizing chaotic systems at fixed points, new conditions based on the Jacobian matrix and its relation with the conditions of Routh-Hurwitz. We apply the results of feedback control method to the second type Rössler system, Liu system and Genesio system.

Keywords: *Routh-Hurwitz theorem; Jacobian matrix; feedback control; chaotic systems.*

Mathematics Subject Classification (2010): 34H10, 37N35, 93C10, 93C15, 93C95.

1 Introduction

Chaos, as a very interesting nonlinear phenomenon, has been intensively studied over the past decades. After the pioneering work of Ott et al [1], and Pecora and Carroll [2], research efforts have been devoted to the chaos control problems in many physical systems [3–5]. The control problem attempts to stabilize a chaotic attractor to either a periodic orbit or an equilibrium point [20, 21]. Many potential applications have come true in securing communication, laser and biological systems, and other areas [6–9, 19]. Different control strategies for stabilizing chaos have been proposed, such as adaptive control, time delay control, and fuzzy control. Generally speaking, there are two main approaches for controlling chaos: feedback control and non-feedback control. The feedback control [10, 17, 18] approach offers many advantages such as robustness and computational complexity over the non-feedback control method. The aim of this paper is to apply the feedback control to chaotic systems, with new conditions for the stability at fixed points based on the Jacobian matrix. We present the numerical simulation studies for control of the Rössler, Liu and modified Genesio systems.

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