

CHAPTER 1

INTRODUCTION

Chaos in control systems and controlling chaos in dynamical systems have both attracted increasing attention in recent years. A chaotic system has complex dynamical behaviors that possess some special features, such as being extremely sensitive to tiny variations of initial conditions, having bounded trajectories in the phase space. Controlling chaos has focused on the nonlinear systems such as Lü chaotic dynamical system, Chen chaotic dynamical system, Lorenz chaotic dynamical system, Chua's circuit system and Rossler's circuit system. Chaos synchronization has seen a flurry of research activities for over decade.

Various control algorithms have been proposed to control chaotic systems. The existing control algorithms can be classified mainly into two categories: feedback and nonfeedback. In this thesis, we only focus on feedback control.

Linear feedback control and bounded feedback control are proposed to controlling chaos of the system to the equilibrium points.

In [2], H.N. Agiza studied chaos synchronization of Lü dynamical system which is described by

$$\dot{x} = a(y - x)$$

$$\dot{y} = -xz + cy$$

$$\dot{z} = xy - bz$$

where x , y and z are the state variables and a , b , c are positive real parameters.

In [7], P. Tidarut studied controllability and stability of perturbed Chen chaotic dynamical system which is described by

$$\dot{x} = a(y - x)$$

$$\dot{y} = (c - a)x - xz + cy$$

$$\dot{z} = xy - bz + dx^2$$

where x, y, z are the state variables and a, b, c, d are positive real constants.

In [6], B.Thongchai studied adaptive control and synchronization of the perturbed Chua's circuit system which is described by

$$\begin{aligned}\dot{x} &= p(y - \frac{1}{7}(2x^3 - x)) \\ \dot{y} &= x - y + z \\ \dot{z} &= -qy + rx^2\end{aligned}$$

where x, y, z are state variables; p, q and r are real positive constants.

In [8], Y.Wang, Z.H.Guan and X.Wen studied Adaptive synchronization for Chen chaotic system with fully unknown parameters.

The objectives of this thesis are as follows. Firstly, to give sufficient conditions of parameters that make equilibrium points of perturbed Lü chaotic dynamical system to be asymptotically stable. Secondly, to apply linear feedback control and bounded feedback control for controlling chaos of the perturbed Lü chaotic dynamical system, described by

$$\begin{aligned}\dot{x} &= a(y - x) \\ \dot{y} &= -xz + cy \\ \dot{z} &= xy - bz + f(x)\end{aligned}$$

where x, y and z are the state variables. a, b, c are positive real parameters and $f(x)$ is on the sufficient conditions.

Finally, to study synchronization of perturbed Lü chaotic dynamical system by adaptive control method, Pecora and Carroll method and one-way coupling method.