

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 problems system such as Chen chaotic dynamical system. Chaos synchronization has seen a flurry of research activities for over decade.

Various control algorithms has 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 control chaos of the system to the equilibrium points.

In [7], M.T. Yassen's studied the optimal control of Chen chaotic dynamical system presented by

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

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

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

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

In [1], H.N. Agiza's studied the different methods to control chaotic behavior of the coupled dynamos system, where the mathematical model equations for this system are

$$\dot{x} = \mu x + y(z + \alpha)$$

$$\dot{y} = \mu y + x(z - \alpha)$$

$$\dot{z} = 1 - xy$$

where x, y, z are state variables and μ, α are positive constants.

In [2], H.N.Agiza and M.T.Yassen's studied synchronization of Rossler and Chen chaotic dynamical systems using active control.

In [6], Y.Wang, Z.H.Guan and X.Wen's paper 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 Chen chaotic dynamical system to be asymptotically stable. Secondly, to apply linear feedback control and bounded feedback control for controlling chaos of the perturbed Chen chaotic dynamical system, described by

$$\begin{aligned}\dot{x} &= a(y - x) \\ \dot{y} &= (c - a)x - xz + cy \\ \dot{z} &= xy - bz + dx^2\end{aligned}$$

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

Thirdly, to study synchronization of perturbed Chen chaotic dynamical system using active control. Finally, to present adaptive synchronization for perturbed Chen chaotic dynamical system when the parameters of the drive system are fully unknown and different with those of the response system.