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 a modified Chua's circuit 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 adaptive control are proposed to control chaos of the system to the equilibrium points.

In [6], M.T. Yassen's studied the feedback control and adaptive control of a modified Chua's circuit system which is described by

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

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

In [5], X.Wu and J.Lu's studied adaptive control with two controllers of Lü system, which is described by

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

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

The concept of choas synchronization involves making two chaotic systems which oscillate in a synchronized manner. The idea of synchronizing two identical chaotic systems with different initial conditions was introduced by [4,6-8].

In [4], Y.Wang, Z.H.Guan and X.Wen's studied Adaptive synchronization for Chen chaotic system with fully unknown parameters, which is described by

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

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

In [6], M.T.Yassen's studied Adaptive control and synchronization of a modified Chua's circuit system.

In [7], M.T.Yassen's studied Chaos synchronization between two different chaotic systems using active control.

The objectives of this thesis are as follows. Firstly, to study the stability of the equilibrium points E_+, E_0 and E_- of a modified Chua's circuit system. Secondly, to give sufficient conditions of parameters that make equilibrium points of the perturbed Chua's circuit system to be asymptotically stable. Thirdly, to apply linear feedback control and adaptive control for controlling chaos of the perturbed Chua's circuit system, 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 and p, q and r are real positive constants.

Fourthly, to study synchronization of perturbed Chua's circuit system using active control. Finally, to present adaptive synchronization for perturbed Chua's circuit system when the parameters of the drive system are fully unknown and different with those of the response system.