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THE CHAOS EXPONENTIAL LAG SYNCHRONIZATION FOR A NEW THREE-DIMENSION CHAOTIC SYSTEM

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Abstract. *The exponential lag synchronization of a new three-dimension chaotic system is described in detail in this paper. The system which only exits two equilibria is quite different from others. Now according to the special characters of the system, we design control laws to realize exponential lag synchronization of the chaotic system by using traditional control approach–linear feedback control. The merits of controller we have designed are: (1) In our controller, there is two linear functions or only one linear function. (2) u_2 can't be zero. This is different from the classical situations. Meanwhile we give electronic circuit. At last, numerical experiments and electric experiment are also provided to illustrate the accuracy and feasibility of the theoretical analysis.*
Keywords: Chaotic system, Exponential lag synchronization, Linear feedback control, Circuit

1. **Introduction.** Chaos synchronization can be dated from 1983 theoretically when Yamada and Fujisaka proposed synchronization in coupled-oscillator chaotic system [1], but it didn't arouse attentions. Until 1990, Pecora and Carrol presented the principal of chaos synchronization to synchronize two identical chaotic systems with different initial values and realized that synchronization may be applied to secure communication in electronic circuit [2], from now on, the chaos synchronization has attracted a great interest in both theoretical studies [3,4] and practical applications [5-7], at the same time, a lot of methods about chaotic synchronization have been investigated, such as linear feedback control, adaptive control, fuzzy control, implosive control, nonlinear feedback control, time-delayed feedback control, PI observers, etc. [8-18].

Nowadays, it is perhaps not difficult to construct a new chaotic system. Recently in [19] Liuling presented the following three-dimension chaotic system:

$$\begin{cases} \dot{x} = a(z - x), \\ \dot{y} = bx - dxz, \\ \dot{z} = kxy - cy - gz. \end{cases} \tag{1}$$

In fact, system (1) has specific properties, for example, when $d = k = 1$ it has only two equilibria and u_2 can't be zero in the course of designing control laws. In this paper, for globally exponential lag synchronization of system (1), we design traditional linear feedback control laws in which only contain one or two linear functions based on reference [18], but different from [18], in our control laws, there contain one linear function and u_2 can't be zero, meanwhile we give an electronic circuit. At last the feasibility and advantages of the approach are illustrated by numerical simulation and electronic experiment.