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ESTIMATION OF ATTRACTORS AND SYNCHRONIZATION OF GENERALIZED LORENZ SYSTEMS

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Abstract. In this paper, we will show how to obtain good estimations of attractors of a class of dynamical systems called *generalized Lorenz systems*. We will then analyze the synchronization of two linearly-coupled systems, and apply these results to the new chaotic system we introduce here.

Keywords. Generalized Lorenz attractors, Estimation of attractors, Synchronization, Lyapunov function, LaSalle invariance principle

AMS (MOS) subject classification: 37B, 65P.

1 Introduction

LaSalle invariance principle [6] is one of the most important mathematical tools used to study the asymptotic behavior of dynamical system solutions. Although most of its applications are concerned with the study of the system equilibria, the LaSalle invariance principle is also used to study the synchronization of the solutions to coupled differential systems, see [7], see also [2,3].

In this paper, we will establish theoretical results using this principle along with one of its extended versions. Then, we will apply these results to study the generalized Lorenz systems (GLS), see [1], estimate their attractors, and analyse the synchronization of linearly-coupled GLS. Our study is organized as follows. In Section 2, generalized Lorenz systems will be briefly presented; in Section 3, estimations for their attractors will be given, and in Section 4, the synchronization for coupled GLS will be analyzed. Numerical results proposed use the new chaotic system, which we will introduce in this paper.

First of all, we will start by reviewing the LaSalle invariance principle. Consider the autonomous differential system :

$$\frac{dX}{dt} = F(X, \mu), \qquad X \in \mathbb{R}^n, \mu \in \mathbb{R}^m. \tag{1}$$