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A NEW UNIFIED CHAOTIC SYSTEM AND ITS IMPULSIVE SYNCHRONIZATION

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Abstract. This paper introduces a new unified chaotic system that connects the Chen's chaotic system to the classical Lorenz chaotic system through the Lü chaotic system. The continued transition from the Lorenz and the Chen systems is controlled by $|x|$, thereby the new attractor is composed by two parts, one part is half a Lorenz attractor, another part is half a Chen attractor. The dynamical behavior of the new unified system is investigated. An electronic circuit is also designed and built to confirm its dynamics of the new chaotic system. Then impulsive synchronization of the new unified chaotic system is studied.
Keywords. chaos, unified chaotic system, chaotic circuit, impulsive synchronization.

1 Introduction

Chaotic attractors are found to be very useful for various applications, such as network modeling [4], encryption and secure communication [3,5-15] and so on. This provides a strong motivation for the current research on exploiting some new chaotic attractors and their implementations. In 1999, a new chaotic attractor, known as Chen's attractor, is found [2]. It is proved to be topologically different from the classical Lorenz chaotic system 1,2,17]. Both systems can be expressed in terms of a generalized Lorenz system [1], consisting of linear and nonlinear parts, where the linear part is a constant matrix with $A = [a_{ij}]_{3\times 3}$. According to [1], the Lorenz system and Chen system satisfy the conditions $a_{12}a_{21} > 0$ and $a_{12}a_{21} < 0$, respectively, and in this sense they are dual systems. Recently, the transition between Lorenz and Chen is bridged with the Lü system, under the condition of $a_{12}a_{21} = 0$ [18]. In a canonical form, all these topologically non-equivalent 3-dimensional autonomous quadratic chaotic systems of various structures can be classified as a family of generalized hyperbolic chaotic systems [1]. Recently, a unified chaotic system was proposed in [19] for the generation of all these three classes of attractors, which has a broad spectrum of chaotic behaviors with