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ON CHAOTIC SYNCHRONIZATION VIA IMPULSIVE CONTROL AND PIECEWISE CONSTANT ARGUMENTS

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Abstract. This paper is concerned with a system of differential equations with continuous and piecewise constants arguments of a delay type. An application to chaotic systems is presented and the synchronization problem is established, where the output of the sender system, evaluated at the piecewise constant arguments, is transmitted to the receiver system. A global synchronization is achieved via impulsive effects, which are evaluated at the discrete arguments. The methodology of Lyapunov function together with linear matrix inequality (LMI) is used to analyze the synchronization. This approach can be applied to chaos-based secure communications with transmission delay at individual moments. To justify the proposed theoretical result, the hyperchaotic Lü system is considered.

Keywords. Chaotic synchronization; hyperchaotic Lü system; impulses; asymptotic stability; Lyapunov function method; LMI.

1 Introduction

By synchronization, we mean the occurrence of coupling two chaotic systems. The notion of synchronization of two chaotic systems was presented by the work of Pecora and Carroll [30]. It is well-known fact that in chaotic systems two orbits starting from slightly different initial states separate exponentially with time. This sensitive feature of the chaotic systems makes the chaotic synchronization very important in many application fields, such as secure-based communication, biological systems, chemical systems, and physical systems [12, 19, 20, 21, 25, 36]. As a result, there have been different types of synchronizations, such as complete synchronization, phase synchronization, generalized synchronization, and lag synchronization [17, 18, 26, 31, 32, 33].

Generally, the dynamics of the differential equations with piecewise constant arguments (EPCA) have both continuous and discrete arguments. The