Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Applications & Algorithms* **13 (2006)** 791-802

STABILIZATION OF LINEAR DELAY SYSTEMS VIA IMPULSIVE CONTROL[1]

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Abstract. This paper studies the problems of stabilization for a class of linear systems with time delay via impulsive control. Several criteria on stabilization are established using the method of linear matrix inequalities (LMI). It is shown that by using impulsive feedback control a linear delay differential system can be stabilized even if the delay-free system is not stable. Some examples are also discussed to illustrate the theorems.

Keywords: Stability, impulsive control, delay linear systems, linear matrix inequality (LMI).

1 Introduction

Many physical systems are described by continuous dynamic systems but on which only discrete control actions are exercised. Such control arises naturally in a wide variety of applications, such as orbital transfer of satellite [15, 17], ecosystems management [13] and control of money supply in a financial market. This kind of control is often called impulsive control. Impulsive control has attracted the interest of many researchers in recent years, see [9, 10-18] and relevant references therein. There are many cases where impulsive control can give better performance than continuous control. Sometime even only impulsive control can be used for control purpose. For example, a central bank can not change its interest rate everyday in order to regulate the money supply in a financial market.

Impulsive control problems are well described by impulsive differential systems. Significant progress has been made in the theory of impulsive differential systems in recent years, see [2],[3],[7],[8],[12],[14] and references therein. However, the corresponding theory for impulsive delay differential systems has not yet been fully developed. Recently, existence and uniqueness results for impulsive delay differential systems have been presented in [1], [4]. Boundedness results are given in [4] and [11], where impulses are treated as perturbations on the underlying continuous system. Criteria on asymptotic stability for impulsive delay differential systems are established in [10].

[1]Research supported by NSERC-Canada.