Dynamics of Continuous, Discrete and Impulsive Systems
Series **A:** *Mathematical Analysis* **14 (2007)** 345-361
 http://www.watam.org

STRONGLY ABSOLUTE STABILITY OF LUR'E TYPE DESCRIPTOR SYSTEMS

C. Yang[1], Q. Zhang[1] and L. Zhou[1]

[1]Institute of Systems Science, Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University,
Shenyang, Liaoning province, 110004, P.R. China

Abstract. This paper considers Lur'e type descriptor systems (LDS) and introduces the concept of strongly absolute stability. Such a notion is a generalization of absolute stability for Lur'e type standard state-space systems (LSS). A sufficient condition for LDS to be strongly absolutely stable is derived and expressed in terms of matrix inequalities. Then, the criterion is reduced to a strict linear matrix inequalities (LMI) based algorithm. Finally, a numerical example is given to illustrate the effectiveness of our method.

Keywords. Lur'e type systems, Descriptor systems, Strongly absolute stability, Lur'e type Lyapunov function, Linear matrix inequality(LMI)

1 Introduction

In the last two decades, descriptor systems have been one of the major research fields of control theory due to their comprehensive applications in the Leontief dynamic model [1], electrical and mechanical models [2, 3], etc. Depending on the application areas, these models are also called singular systems, semi-state systems, differential-algebraic systems, or generalized state-space systems. As to the stability of linear time-invariant descriptor systems, many results have been reported (See, e.g., [4-7]) and almost all of these results are expressed by matrix rank conditions and matrix inequalities which can be verified efficiently by the existing tools. Recently, stability problems for nonlinear descriptor systems have attracted more and more attention. In [8-10], the researchers investigate the stability of nonlinear descriptor systems under the assumption that the set of consistent initial conditions is given. In [11], the Lyapunov stability theory for standard state-space systems is extended to nonlinear descriptor systems. [12] presents a sufficient condition for the system to be locally asymptotically stable. [13] considers the tractability and stability of nonlinear descriptor systems together. [14] investigates stability of large-scale nonlinear descriptor systems by using the method of vector generalized Lyapunov function. [15] studies generalized quadratic stability of descriptor systems with nonlinear perturbation and [16] studies generalized quadratic stability of discrete-time descriptor systems with time-delay and