AN BMI APPROACH TOWARDS SINGLE AND SIMULTANEOUS ADMISSIBLE STABILIZATION OF CONTINUOUS-TIME DESCRIPTOR SYSTEMS VIA STATIC OUTPUT FEEDBACK

Xin Huang[1] and Biao Huang[1,2]

[1] Department of Chemical and Materials Engineering,
University of Alberta, Canada, T6G2G6

[2] Corresponding author. Tel: (780)492-9016; fax: (780)492-2881

Abstract. In this paper the problem of admissible stabilization of continuous-time descriptor systems and simultaneous stabilization of several descriptor systems via static output-feedback is addressed. Necessary and Sufficient conditions for a descriptor system to be admissibly stabilized via static output feedback are given in a bilinear matrix inequality form. An iterative optimization algorithm is proposed to numerically calculate the static feedback gain. The results are then extended to the simultaneous admissible output feedback stabilization.

Keywords. Descriptor systems; generalized Lyapunov inequality; bilinear matrix inequalities; simultaneous stabilization

1 Introduction

Descriptor systems are also referred to as differential-algebraic systems, generalized state space systems, semi-state systems, or constrained systems. Study of the descriptor systems has attracted significant attentions recently due to its flexibility in modeling physical systems. Descriptor systems have a great significance for process control because they capture not only the dynamics of the systems but also the static constrains. In chemical process this type of algebraic constraints accounts for equilibrium relations, thermodynamic relations and empirical correlations (Kumar and Daoutidis, 1998).

The studies of descriptor systems can be traced back to 1970s (Singh and Liu, 1973; Luenberger, 1978). Since their pioneering work, extensive studies have been done on descriptor systems, such as Campbell (1980), Dai (1989), Verghese et al. (1981), Lewis (1986), Bender and Laub (1987), Fletcher (1988), Masubuchi et al. (1997), Duan (1999), Rehm and Allgower (1999), Chu and Ho (1999), and Lin et al. (1999).

Stabilization of linear systems via output feedback is theoretically appealing because of its simple control structure. Static output regulation has been extensively studied for regular systems (Iwasaki and Skelton, 1995; Syrmos et al., 1997; Cao and Sun, 1998; Geromel et al., 1998). However, the literature has been relatively sparse on static feedback control for the descriptor systems. Some representative work can be found in (Bunse-Gerstner, 1994;