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ROBUST GUARANTEED COST CONTROL OF DESCRIPTOR SYSTEMS

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Abstract. This paper gives a parametrization of X in the non-strict inequality $XE^T = EX^T \geq 0$, which has been widely used in the study of continuous-time descriptor systems. Based on this paprametrization, necessary and sufficient conditions for generalized quadratic stabilization and a guaranteed cost control law are given in terms of strict LMIs for continuous-time descriptor systems.

Keywords. Guaranteed cost control, descriptor systems, linear matrix inequality (LMI), continuous-time.

1 Introduction

The descriptor system model is a natural representation of dynamic systems and describes a larger class of systems than the normal linear system model. Normal state-space description of linear systems cannot represent the algebraic constraints between state variables. For example, in chemical processes, such algebraic constraints often account for equilibrium relations, thermodynamic relations and empirical corrections [8]. Also, impulse and hysteresis phenomena, which are important in circuit theory, cannot be treated properly in the normal linear state-space models [10, 18]. Fortunately, descriptor system models offer an effective way to describe these behaviors. Such models can be widely seen in large-scale systems, economics, networks, power, neural systems and others [3, 10] .

Study of descriptor systems has been an area of active research in the last few decades. Many research works are aimed at generalizing existing theories from normal linear systems to descriptor systems. In [2, 10], controllability and observability were defined. The use of state feedback in control synthesis for descriptor systems may be found in [1, 9, 15]. The H_∞ control for descriptor systems has been solved in [11, 18] using generalized algebraic Riccati inequality and generalized algebraic Riccati equation respectively. Optimal H_2 controllers were given in [16] in terms of the solutions of generalized algebraic Riccati equations, and model reduction of descriptor systems was