Weighted Performance Measure and Generalized H_∞ Control Problem for Linear Descriptor Systems

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Abstract: In this paper, the generalized problem of H_∞ control with transients is investigated for linear descriptor systems using a weighted performance measure that describes a mixed attenuation level of exogenous and initial disturbances. Based on a generalization of the bounded real lemma, involving special matrix variables, new necessary and sufficient conditions for the existence of static and dynamic output-feedback controller are proposed to ensure the admissibility of a closed-loop system with prescribed estimate of the weighted performance measure. The corresponding synthesis techniques are reduced to solving the linear and quadratic matrix inequalities with rank constraints. A numerical example is included to demonstrate the applicability of the present approaches.

Keywords: *descriptor system; robust stability; admissible system; weighted performance measure; H_∞ control.*

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1 Introduction

Descriptor (differential algebraic) equations arise naturally in many significant applications, for example, in constrained mechanical systems, power generation, chemical processing, network fluid flow, vehicle dynamics, robotics etc. (see, e.g., [5,6,11]). Problems of sensitivity reduction and exogenous disturbance attenuation in descriptor control systems are very important and, at the same time, insufficiently studied for practical applications. These problems are solved by the H_2/H_∞ control design for state-space systems that provide internal stability and minimize the negative influence of exogenous

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