KYBERNETIKA — VOLUME 45 (2009), NUMBER 1, PAGES 49-62

Robust Decentralized H_2 Control of Multi-Channel Descriptor Systems with Norm-Bounded Parametric Uncertainties

Weihua Gui; Ning Chen; Guisheng Zhai

Abstract: This paper considers a robust decentralized H_2 control problem for multi-channel descriptor systems. The uncertainties are assumed to be time-invariant, norm-bounded, and exist in both the system and control input matrices. Our interest is focused on dynamic output feedback. A necessary and sufficient condition for an uncertain multi-channel descriptor system to be robustly stabilizable with a specified H_2 norm is derived in terms of a strict nonlinear matrix inequality (NMI), that is, an NMI with no equality constraint. A two-stage homotopy method is proposed to solve the NMI iteratively. First, a decentralized controller for the nominal descriptor system is computed by imposing block-diagonal constraints on the coefficient matrices of the controller gradually. Then, the decentralized controller is modified, again gradually, to cope with the uncertainties. On each stage, groups of variables are fixed alternately at the iterations to reduce the NMI to linear matrix inequalities (LMIs). An example is given to show the efficiency of this method.

Keywords: decentralized control; descriptor systems; parametric uncertainty; homotopy method; nonlinear matrix inequality;

AMS Subject Classification: 93A14; 93B51; 93B52; 93B40; 93C15;

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