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ROBUST DECENTRALIZED H_∞ CONTROL OF MULTI-CHANNEL DISCRETE-TIME DESCRIPTOR SYSTEMS WITH TIME-DELAY

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Abstract. *This paper considers a robust decentralized H_∞ control problem for uncertain multi-channel discrete-time descriptor systems with time-delay. The uncertainties are assumed to be time-invariant, norm-bounded, and exist in the system, time-delay and output matrices. Our interest is focused on dynamic output feedback. A sufficient condition for the uncertain multi-channel discrete-time descriptor system with time-delay to be admissible with a specified disturbance attenuation level is derived based on Lyapunov stability theory. By setting the Lyapunov matrix as block diagonal appropriately according to the desired order of the controller, the problem is reduced to linear matrix inequalities which are sufficient to the existence condition but much more tractable.*
Keywords: Multi-channel discrete-time descriptor system, Time-delay, Uncertainty, Decentralized H_∞ control, Linear matrix inequality

1. **Introduction.** Descriptor systems are referred as singular systems, implicit systems, generalized state-space systems, differential-algebraic systems [1,2]. A large number of results for decentralized control of descriptor systems have been obtained. For example, Wang and Soh considered an impulsive mode elimination problem by decentralized output feedback and gave necessary and sufficient conditions for full impulsive mode elimination [3]. Chang and Davison considered decentralized stabilization and servomechanism problems, and gave a constructive controller design procedure by transforming the descriptor system into a principal square subsystem and an equivalent proper state space model [4]. Yu and Wang studied algebraic multiplicity and geometric multiplicity of the impulsive decentralized fixed modes under static decentralized output feedback, and obtained results on controllability and observability of the closed-loop system through an external channel [5]. Ikeda, *et al.* considered centralized design of decentralized stabilizing controllers for interconnected descriptor systems [6]. The design problem was formulated as a feasibility problem for a bilinear matrix inequality (BMI), and to solve the BMI, a homotopy method was proposed, where the interconnections between subsystems are increased gradually from zeros to the given magnitudes. Recently, Wang and Bao considered a robust impulse control problem for uncertain singular systems by decentralized output feedback [7]. They derived an upper bound of perturbations and algebraic sufficient conditions for the existence of a robust decentralized controller to eliminate impulsive modes. They