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Decentralized Stabilization for a Class of Nonlinear Interconnected Systems Using SDRE Optimal Control Approach

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Abstract: This paper presents a new approach to assure the decentralized optimal control of interconnected nonlinear systems based on the decentralized state-dependent riccati equation (SDRE). To remedy the problem of persistent stability in other works, we based our approach on the foundations of the Lyapunov theory. It allows developing a new sufficient condition to guarantee the global asymptotic stability of the systems under study. We conducted a simulation of this new control method on a numerical example. It demonstrated its efficiency and the sufficiency of the new stability conditions.

Keywords: *decentralized optimal control; state-dependent Riccati equation (SDRE); interconnected nonlinear systems; Lyapunov theory; Kronecker product.*

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1 Introduction

In recent years, the modern dynamical systems are getting more complex, highly interconnected, and mutually interdependent. This change is caused either by physical attributes, and/or a multitude of information and communication network constraints [1–3]. The important dimension and complexity of these large-scale systems often require a hierarchical decentralized architecture to analyze and control these systems [4–10]. Since these complex dynamic systems can be characterized by an interconnection between many subsystems, possible control strategies are generally based on a decentralized approach. The

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