Dynamics of Continuous, Discrete and Impulsive Systems
Series **B:** *Algorithms and Applications* **11 (2004)** 537-552

DECENTRALIZED CONTROL FOR LARGE-SCALE NONLINEAR SYSTEMS: A REVIEW OF RECENT RESULTS

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Dedicated to Professor Siljak's 70th birthday

Abstract. In this paper, we review some of the recent results in decentralized control for large-scale nonlinear systems. Problems of decentralized stabilization, adaptive tracking, disturbance attenuation with internal stability are examined, with a special emphasis on output feedback control. Open challenges are discussed throughout the paper.

Keywords: Decentralized control, large-scale, nonlinear systems, state feedback, output feedback, stabilization, adaptive tracking, disturbance attenuation, ISS ("input-to-state stability"), nonlinear small-gain.

1 Introduction

A *large-scale system* is generally understood as a dynamical system composed of several lower-order subsystems with (possibly involved) interconnections. Other popular names carrying similar meanings are *interconnected system*, *composite system* and *decentralized system*, etc. Through the decomposition of a large system into smaller subsystems, with appropriate interconnecting structure, it is hoped that stability analysis and controller design can be greatly simplified. Specifically, one can derive stability properties for the entire system based on the stability analysis of individual local systems and the information of interconnections. For a decentralized control system, certain desirable stability properties can be achieved via the design of a decentralized controller using only the *a priori* knowledge of local subsystems and interconnecting structure. This is the main difference with a centralized controller which needs the exchange of information among subsystems, and in principle consumes more computational power. Stability and control of large-scale systems has attracted considerable attention of many researchers