A NOVEL METHOD FOR DECENTRALIZED ROBUST EXPONENTIAL STABILIZATION OF LARGE-SCALE SYSTEMS

BATOOL LABIBI
Iranian Research Organization for Science and Technology
Tehran, Iran
e-mail: blabibi@yahoo.com

YAZDAN BAVAFAT-TOOSI
Department of Mathematics, MA 4-5
Technical University of Berlin
D-10623, Berlin, FRG
e-mail: ybavafat@math.tu-berlin.de

ALI KHAKI-SEDIGH
Department of Electrical Engineering
K. N. Toosi University of Technology
P. O. Box 16315-1355, Tehran, Iran
e-mail: sedigh@eetd.kntu.ac.ir

BORIS LOHMANN
Department of System Dynamics and Control
University of Bremen
Bremen, FRG
e-mail: bl@iat.uni-bremen.de

ABSTRACT—A novel approach to the design of decentralized controllers for large-scale systems by dynamic/static output/state feedback is presented. A new formulation of the interaction which introduces some degrees of freedom into the design procedure is offered. Sufficient conditions for exponential stability with desirable rate of decay and maximal robustness to unstructured uncertainties in the controller and plant parameters are established. The derived conditions are generic, applicable to nonsquare and nonminimum-phase systems, and independent of the number of system states, inputs and outputs. Based on minimal sensitivity design of isolated subsystems, an analytical method for the satisfaction of the aforementioned sufficient conditions is presented. To this end, through eigenstructure assignment, compact-form sufficient conditions for minimal sensitivity are derived. Illustrative examples are presented to demonstrate the effectiveness of the proposed methodology. Genetic algorithm is employed in the simulations.

Key Words: Large-scale systems, decentralized robust exponential stabilization, minimal sensitivity, interaction measure, output feedback, eigenstructure assignment