SEMINAR NOTICE

Department of Electrical and Systems Engineering

SEMI-GLOBAL AND GLOBAL OUTPUT REGULATION FOR CLASSES OF NONLINEAR SYSTEMS

by

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Many phenomena of interest to scientists and engineers can be modeled by nonlinear systems of ordinary differential equations with inputs and outputs. The dynamics of a rocket, for example, may have input and output variables representing thrust and velocity, respectively.

The problem of output regulation entails the control of a given plant in such a way that the output of the system asymptotically tracks some reference trajectory while simultaneously rejecting disturbances, where the desired trajectory and the unwanted disturbances are both generated by an autonomous and exogenous system. Achieving this objective necessitates a dynamic nonlinear controller driven only by the regulated error, since neither the state of the plant nor the exogenous signals are assumed to be available for measurement. All trajectories of the resulting closed-loop system are required to remain bounded, and the regulated error must also decay asymptotically to zero. These conditions may need to be satisfied in spite of uncertainties regarding the plant, the exosystem, or the range of allowable initial states.

If the state-space representation of the plant can be expressed with finitely many variables, the system is called finite-dimensional. When a solution is sought for every fixed, compact set of initial conditions, the problem is said to be semi-global. By contrast, if a solution is desired for the entire state-space, the problem is known as global regulation. In this dissertation, rather than addressing a particular application, such as a rocket, we present results on both semi-global and global output regulation for multiple classes of finite-dimensional, nonlinear control systems. In so doing, we generalize, in whole or in part, a number of recent papers in the literature.

Among the concepts shared by all of these results are the notions of input-to-state stability with respect to compact sets, nonlinear immersion of the steady-state control, the normal form of nonlinear systems with input, and nonlinear internal models with high-gain error feedback. We also utilize the small-gain theorem (with restrictions) for input-to-state stable systems, Nussbaum-type functions, backstepping, and the adaptation of unknown parameters.

DATE: Friday, April 13, 2007
TIME: 10:30 a.m.
PLACE: Room 305, Bryan Hall

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Christopher I. Byrnes and Alberto Isidori

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