Scanning the Issue

A Unifying Passivity Framework for Network Flow Control, *Wen and Arcak.*

This paper is concerned with the problem of controlling the traffic flows between sources and links in congestion networks. By using a passivity approach, the authors provide a framework in which to unify and extend the recent works on global stability for network flow control. Traditionally, one constructed Lyapunov function proofs for specific flow control laws, but did not offer a motivating picture of how these were found and how much further these could be extended. This paper fills that gap, shows how passivity is at the heart of these proofs and can extend to cover a large class of flow control laws. Furthermore, the authors show that the added design freedom in flow control can be exploited to improve the disturbance rejection property and robustness with respect to time delays.

Flatness-Based Control of PER Protein Oscillations in a *Drosophila* Model, *Laroche and Claude.*

Computational and mathematical biology are an emerging field of interest to control engineers. In this paper the authors analyze a model of the protein network regulating circadian rythms in Drosophila melanogaster—the common fruit fly. For biologists, the Drosophila circadian clock is an ideal model system for deciphering the molecular mechanisms of circadian behavior. The authors demonstrate that the common model of this regulatory mechanism is differentiably flat. They can then analyze both the existence and robustness of periodic orbits to this system.

Computation of Maximal Safe Sets for Switching Systems, *De Santis, Di Benedetto, and Berardi.*

The authors address the computation of maximal safe sets and controllers for a special class of hybrid systems: switching systems. A computationally efficient procedure that requires the computation of a maximal controlled invariant set is given. For linear discrete-time systems, there is a wealth of results available in the literature for the computation of this set. However, even for this class of systems, the computation may not converge in a finite number of steps. The main contribution of the paper is the development of inner approximations that are controlled invariant and for which a procedure that terminates in a finite number of steps can be obtained. A tight bound on the error is given by comparing the inner approximation with the classical outer approximation of the maximal controlled invariant set. The procedure is applied to the idle-speed regulation problem in engine control to demonstrate its efficiency.

Nonuniform in Time Input-to-State Stability and the Small-Gain Theorem, *Karafyllis and Tsinias.*

This paper establishes sufficient conditions for nonuniform in time input-to-state stability (ISS) for composite time-varying systems. This type of stabilty arises, for example, in the stabilization problem of nonholonomic systems by means of a smooth time varying feedback. By establishing various equivalent characterizations of the nonuniform in time ISS properties, the authors generalize the corresponding result for uniform in time ISS due to Jiang–Teel–Praly.

Balanced Truncation of Linear Time-Varying Systems, *Sandberg and Rantzer.*

Balanced truncations have been used as a means of reducing the order of linear time-invariant plant models for over twenty years now. In this paper, the authors present an extension to the linear time-varying setting. Using time-varying Lyapunov equations and inequalities, they provide upper and lower error bounds to the truncated models. Moreover, stability of the lower order models is also proved.

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