Scanning the Issue

Distributed Asynchronous Deterministic and Stochastic Gradient Optimization Algorithms, *Tsitsiklis, Bertsekas, and Athans.*

This paper addresses an important problem in distributed processing for optimization. Consider a set of processors that cooperate to minimize a certain function. In asynchronous iterative algorithms, each processor does not wait for the results of the computations of the others before proceeding with its next task. The advantage is that each processor can run faster. The price to pay is that it may be difficult to prove that the computations will converge to the desired objective. This paper presents a model of such asynchronous algorithms and obtains conditions for their convergence.

Optimal Hop-by-Hop Flow Control in Computer Networks, *Rosberg and Gopal.*

The flow control on a link of a packet-switched communication network is investigated in this paper. The protocol being considered is a window flow control, with the window size being periodically updated by the receiving node, on the basis of the number of packets transmitted in the previous periods. The window sizes are selected so as to minimize a linear combination of the average number of packets waiting at the transmitting node, of the average number of buffer spaces not utilized, and of the average number of buffer spaces allocated (the averages are calculated per period of the updating process). This paper is a good illustration of the value iteration technique of dynamic programming.

A Complete Characterization of Decoupling Control Laws for a General Class of Nonlinear Systems, *Ha and Gilbert.*

Methods for computing nonlinear decoupling control laws have been introduced by many authors, and there are now more-or-less standard procedures one can follow. In this paper, a local characterization of a general class of decoupling control laws for real analytic nonlinear systems is given in terms of a set of first-order linear partial differential equations. It is shown that this class encompasses the standard decoupling control laws recently proposed by a number of researchers. The utility of the characterization is illustrated by means of an example wherein the methods of the paper are shown to yield a stable decoupling control law, while standard techniques fail to do so.

Riccati Equations in Optimal Filtering of Nonstabilizable Systems Having Singular State Transition Matrices, *de Souza, Gevers, and Goodwin.*

This paper investigates the solutions of the discrete Riccati equations arising in optimal filtering and control for unstabilizable discrete-time systems with singular state transition matrices. Systems with singular state transition matrices arise in several important problems such as fixed-lag smoothing and systems with time delays. The authors exploit a generalized eigenvector approach to establish their results. Both convergence properties of the Riccati difference equation and solutions of the algebraic Riccati equation are investigated. The results are derived under the weakest assumptions to date.

A Geometric Approach to the Synthesis of Failure Detection Filters, *Massoumnia.*

This paper examines some earlier work on the problem of failure detection filtering for deterministic linear systems from a geometric viewpoint. Detection filters of Beard (1971) and Jones (1973) are a class of observers which accentuate the effect of certain failure modes on the "residuals" of the observer. The detection filter can both detect and identify certain failure modes under certain conditions by an appropriate choice of the observer gain. The geometric approach followed in this paper leads to a considerable conceptual simplification of the problem solution. This paper provides a complete solution of the Beard–Jones detection filter problem, and clarifies several unresolved points in the earlier work. From a practical viewpoint, it is perhaps worth noting that the filters considered in this paper can be quite sensitive to unmodeled dynamics.

Feedback Stabilization of Linear Autonomous Time Lag Systems, *Fiagbedzi and Pearson.*

This paper addresses the problem of stabilization of a linear system with fixed-point delays using state variable feedback. A method which is based on the stabilization of a reduced order finite-dimensional linear system is presented. The reduced order delay-free system is derived from a linear transformation of the delayed system. The basic requirements for stabilization are 1) spectral stabilizability and 2) computation of the unstable poles, which generally requires solving transcendental equations. Several examples are presented illustrating the results of the paper.