Scanning the Issue*

Quantized Control via Locational Optimization, *Bullo and Liberzon.*

One of the problems of networked control is the effect of quantization on closed-loop stability. This paper focuses on state quantization in full state feedback schemes. It is shown that the destabilizing effect of a quantizer can be quantified by a properly defined quantization error. The networked stability problem is then addressed by designing the state quantizer in such a way as to minimize the destabilization measure subject to such information constraints as the number of quantized states. It is shown how this can be naturally reduced to a version of the so-called multicenter problem from locational optimization. Iterative algorithms for obtaining solutions to such problems are described. They are shown to yield quantizers based on Voronoi partitions of a region of interest in the state–space.

Direct Nonlinear Control Design: The Virtual Reference Feedback Tuning (VRFT) Approach, *Campi and Savaresi.*

This paper presents a method for a direct nonlinear control design, called the virtual reference feedback tuning (VRFT), in which the controller design is based on input/output data without the knowledge of the model. The paper introduces a filter in the optimization to improve the controller design for an under-parameterized controller class. Furthermore, the article suggests a new multipass procedure for the proposed approach.

Bootstrap Control, *Aronsson, Arvatson, Holst, Lindoff, and Svensson.*

This paper presents a new way to control linear stochastic systems with unknown noise distributions. The method is based on statistical bootstrap techniques. The optimcal future control signal is derived in such a way that unknown noise distributions and uncertainties in parameter estimates are taken into account. This is achieved by resampling from existing data when calculating statistical distributions of future process values. The bootstrap algorithm takes care of arbitrary loss functions and unknown noise distributions, even for small estimation sets. In this paper, it is shown how, e.g., the quality control problem with non-Gaussian disturbances can be approached. The efficient way of utilizing data implies that the method is also well suited for slowly time-varying stochastic systems.

Frequency Response Estimation for NCFs of an MIMO Plant From Closed-Loop Time-Domain Experimental Data, *Zhou.*

This paper addresses the question of estimating the frequency response of normalized coprime factors of a multiple-input–multiple-output (MIMO) plant from closed-loop time-domain experimental data. An estimate is derived on the basis of constrained data-fitting and a linear fractional transformation representation for all the normalized coprime factors of plants internally stabilizable by a known controller. It has been made clear that the estimation bias and the estimation variance are always finite, which differs significantly from closed-loop nonparametric estimations for the plant itself. Asymptotic statistical properties of the estimate are investigated under the condition that the external disturbances and the measurement errors are zero-mean weak stationary random sequences with bounded second order central moments. The estimate is proved to be asymptotically unbiased and asymptotically has a normal/complex normal distribution, provided that the probing signals are periodic and the normalized coprime factors of the auxiliary plant are appropriately selected. For a general excitation signal, it is shown that the estimate can asymptotically be expressed as a linear combination of a normalized random matrix with all its columns normally/complex normally distributed. Computationally tractable procedures are suggested for choosing the desirable auxiliary transfer function matrices. Numerical simulation results are presented to illustrate the estimation procedure.

Stochastic Routing in *Ad-Hoc* Networks, *Lott and Teneketzis.*

The authors consider a routing problem in *ad-hoc* networks whereby a packet has to be transmitted from a node or a subset of the nodes to the rest of the network. There is reward associated with each subset of nodes that has received the packet so far. The controller's objective is to either decide to stop further transmission and collect the reward accrued so far or select a node for the next transmission. Each node incurs a cost to transmit the packet. Given that a particular node transmits the packet, its neighbors receive the packet with a certain probability. For this problem, it is shown that the optimal policy is an index policy. Generalizations of the above set-up are also considered and the authors demonstrate the performance of this policy in a realistic *ad-hoc* network scenario with a CDMA-type interference model.

Nonsmooth H_∞ Synthesis, *Apkarian and Noll.*

This paper considers H_∞ controller synthesis for linear systems with the following additional structural constraints on the controller: a) static/reduced order output feedback; b) decentralized control (includes PID); c) simultaneous stabilization; and d) multiple performance channels. It is well known that H_∞ controller synthesis with these constraints is nonconvex. The authors propose a general rigorous framework that employs generalized gradients applicable to the type of nonsmooth performance criteria and constraints listed previously, in conjunction with the H_∞ performance specification. Convergence to critical points is proved and the algorithm is demonstrated on reasonably large-sized problems.

Digital Object Identifier 10.1109/TAC.2005.861721

*This sections is written by the TRANSACTIONS Editorial Board.

0018-9286/$20.00 © 2006 IEEE