GUEST EDITORIAL

The field of automatic control studies the tools required to design systems that maintain desirable performance by sensing and automatically adapting to changes in the environment. Given the rapid advances in information and communication technologies, and the increased availability of sensors, the application of control principles is becoming increasingly frequent and widespread.

It is therefore not surprising that control theory and control applications continue to generate significant interest, as was again emphasised by the recent International Conference on Control Theory and Applications (ICCTA'01), held at the University of Pretoria during December 2001. ICCTA'01 was organized by the IEEE Control Chapter of Singapore and the South African Section of the IEEE, and was co-sponsored by the Lee Foundation and the South African Council for Automation and Computation.

More than 200 submissions were received from 31 countries, of which 125 reviewed papers were selected to be included at this conference. Of these, the Technical Programme Committee selected 13 papers, and invited the authors to prepare their papers for possible inclusion in a Special Issue of the Transactions of the South African Institute of Electrical Engineers. Eight papers were subsequently received and peer reviewed, seven of which are included in this Special Issue. The seven included papers are based on two keynote addresses and five regular papers.

1. KEYNOTE ADDRESSES

The paper by Goodwin et al., which is based on the keynote address given by Prof. Graham Goodwin of the University of Newcastle in Australia, looks beyond standard linear solutions to control problems by reviewing recent developments in nonlinear control. A practical viewpoint is followed using continuous metal casting as a motivating example, making this paper palatable to non subject-experts.

Tang et al. report on the application of an intelligent adaptive controller to an industrial fish-cutting machine. This paper is based on the keynote address given by Prof. Clarence de Silva of the University of British Columbia in Canada. For this application, intelligent adaptive control is compared to conventional model- reference adaptive control, and found to be more flexible in design, easier to implement, and more computationally efficient.

2. REGULAR PAPERS

The papers described below are based on presentations made by the authors during regular sessions at ICCTA'01. Three theoretical and two application-oriented papers are included here.

Theoretical papers

Schmid and Zhang analyse the performance of feedback controllers where the process being controlled is continuous in time, and where the controllers are implemented using digital computers. More specifically, periodic sampled-data H_2 and mixed H_2/H_8 controllers are studied in this paper. A distinction is made between linear time invariant and linear periodically time varying controllers, and it is found that under certain conditions, linear time invariant controllers provide better performance.

In their paper, Yang and Wang apply robust state feedback control to uncertain linear systems with multiple quadratic performance objectives. Iterative Linear Matrix Inequality algorithms, based on a parameter dependent Lyapunov function approach, are developed and used to solve the associated optimization problem.

Aubin introduces an alternate framework for the identification of systems that is valid for any nonlinear system. Information on the state is gathered along time and a detector is defined, the derivative of which provides the regulation map governing the evolution of detectable solutions.

Application-oriented papers

Chen et al. discuss decentralized control for multi-area, multi-machine overlapping and inter-connected power systems. The multi-area interconnected power system model is decomposed as a group of pair-wise area and/or subsystem models, and LQG/H_8 control schemes are used to improve frequency and tie-line power bias stabilization.

Brazil et al. present a network model to optimise cost in underground mine design. Development and haulage costs are emphasised, with a particular focus on the costs associated with the ramps and shafts that provide passage to and from the ore zones. The mine design problem is formulated as an optimisation problem and it is shown that the cost function of the associated underground mining network is convex under certain reasonable conditions.

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