Hamilton Institute

Information Flows in Cooperative Networked Control Systems

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Tuesday, February 20th, 2008

Abstract

The control-theoretic equivalent of Ahlswede et. al's network information theory is the problem of determining the rates at which information must flow between system components in order to be able to cooperatively achieve closed loop stability. This talk considers the case of a linear, time-invariant plant with multiple sensors and actuators that communicate with each other over a network of directional digital channels with finite bit rates. It is shown that, under the stabilisation objective, the graph of the system possesses a structure that permits a fluid flow interpretation. A necessary and almost sufficient condition for determining uniform stabilisability is derived, in terms of the feasibility of a set of linear inequalities in the unstable eigenvalues of the plant and the bit rates of the channels. This provides an exact characterisation, up to boundary points, of the region of all stabilising channel bit rate vectors. The auxiliary variables in this criterion have a natural interpretation as the effective rates of information flow associated with each unstable mode. When channel rates are set to either zero or infinity, this agrees with a classical result on decentralised stabilisability under linear, time-varying control.

Speaker biography:

Dr. Girish Nair is an Associate Professor in the Department of Electrical and Electronic Engineering at the University of Melbourne, with research interests in the overlap between feedback control and communications. He is a recipient of the 2006 Outstanding Paper Prize of the Society for Industrial and Applied Mathematics (SIAM), USA and the Best Theory Paper Prize at the UKACC International Control Conference in Cambridge, 2000. He serves as an associate editor for SIAM Journal on Control and Optimization and is an editorial board member for IET Control Theory & Applications.

Venue: Seminar Room, Hamilton Institute, Rye Hall, NUI Maynooth

Time: 2.00 - 3.00pm (followed by tea/coffee)

Travel directions are available at www.hamilton.ie

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