Department Colloquium

Speaker: Roland Malhamé, GERAD and École Polytechnique de Montréal
Date: Friday, November 4
Time: 2:30 p.m.
Place: Jeffery 234
Title: A class of Networked Control Systems: Interference Induced Games, Filtering, Nash Equilibria

Abstract: We consider a class of networked linear scalar stochastic control systems whereby a large number of controlled agents send their states to a central hub, which in turn sends back noiseless control commands based on its observations, and aimed at minimizing a given quadratic cost. The communication technology is CDMA, and as a result signals received at the central hub are corrupted by interference. The power levels of signals sent by agents are considered proportional to their state, and CDMA based signal processing reduces other agents' interference by a factor of $1/N$ where N is the number of agents. The existing interference inadvertently creates a game situation whereby the actions of one agent affect its state and thus through interference, the ability of other agents to estimate theirs, in turn influencing their ability to control their state. This leads to highly coupled estimation problems. It also leads to a dual control situation as individual controls both steer the state and affect the estimation potential of that state. Ignoring the interference term and using a separation principle for control provably leads to Nash equilibria asymptotic in N, as long as individual dynamics are stable or ``not exceedingly" unstable. Past a certain instability threshold, time invariant linear controls based on the outputs of growing dimension filters appear to always maintain system stability, and intriguing state estimate properties are numerically observed. Finally, a fixed point based algorithm for identifying Nash equilibria, if they exist, within the class of linear time varying output feedback strategies is presented. It involves repeatedly alternating a forward sweep for state estimation and a backwards sweep for dynamic programming based optimization.

This is joint work with Mehdi Abedinpour Fallah, Francesco Martinelli and David Saussié