Statistical Sciences
UNIVERSITY OF TORONTO

SEMINAR

March 12, 2015 at 3:30pm

Sidney Smith Hall, room 1083

Refreshments will be served at 3:15pm

Embedology for Control and Random Dynamical Systems in Reproducing Kernel Hilbert Spaces

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We introduce a data-based approach to estimating key quantities which arise in the study of nonlinear control and random dynamical systems. Our approach hinges on the observation that much of the existing linear theory may be readily extended to nonlinear systems -with a reasonable expectation of success - once the nonlinear system has been mapped into a high or infinite dimensional Reproducing Kernel Hilbert Space. In particular, we develop computable, non-parametric estimators approximating controllability and observability energy/Lyapunov functions for nonlinear systems, and study the ellipsoids they induce. It is then shown that the controllability energy estimator provides a key means for approximating the invariant measure of an ergodic, stochastically forced nonlinear system. We also apply this approach to the problem of model reduction of nonlinear control systems.

In all cases the relevant quantities are estimated from simulated or observed data. These results collectively argue that there is a reasonable passage from linear dynamical systems theory to a data-based nonlinear dynamical systems theory through reproducing kernel Hilbert spaces.

This is a joint work with J. Bouvrie (MIT).