Statistical Tools for Modeling Dynamic Systems

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Dynamic systems are typically input/output systems where a set of time-varying inputs to a process give rise to one or more time-varying outputs. We will draw examples from data on chemical reactors, HIV infection rates, lupus flares and single neuron recordings. In these systems, the emphasis is on modeling how the system responds to a change in one or more inputs, and the natural modeling tool is a differential equation. But, since most differential equations do not have closed form solutions, how is a statistician to fit data with such a model ? Recent work in functional data analysis has made possible the estimation of the parameters defining a nonlinear differential equation system, and these lectures will show in a non-technical way how to do this.

The first lecture will be a general introduction to functional data analysis, with illustrations of the main steps.

The second lecture will provide some background information on understanding and developing models for dynamic systems, and the final lecture will show by example how this methodology works and some of the results that are possible.