

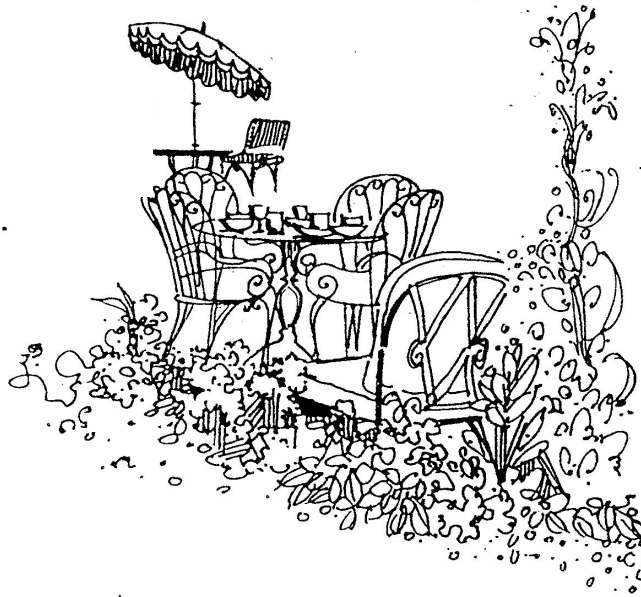
Chez Pierre

Presents ...

Monday November 2, 2015

12:00pm

MIT Room 4-331



Chez Pierre Seminar

J. Nathan Kutz

University of Washington

” Self-tuning complex systems: Integrating equation-free methods with dynamical systems, machine learning and sparsity“

We demonstrate that the integration of data-driven dynamical systems and machine learning strategies with adaptive control are capable of producing efficient and optimal self-tuning algorithms for many complex systems arising in the engineering, physical and biological sciences. The adaptive controller, based upon a multi-parameter extremum-seeking control algorithm, is capable of obtaining and maintaining optimal states while the machine learning and sparse sensing techniques characterize the system itself for rapid state identification and improved optimization. Additionally, we can use the data directly to construct, in an adaptive manner, governing equations, even nonlinear dynamics, that best model the system measured using sparsity-promoting techniques. Recent innovations also allow for handling multi-scale physics phenomenon in an adaptive and robust way. The overall architecture is equation-free in that the dynamics and control protocols are discovered directly from data acquired from sensors. The theory developed is demonstrated on two example physical systems: (i) a mode-locked laser driven by nonlinear polarization rotation in conjunction with waveplates and a polarizer and (ii) a metamaterial antenna array. We suggest how such a mathematical architecture can be ideal for controlling emerging neuro-stimulation devices as well.

Short Biography

Professor Kutz was awarded the B.S. in Physics and Mathematics from the University of Washington in 1990 and the PhD in Applied Mathematics from Northwestern University in 1994. Following postdoctoral fellowships at the Institute for Mathematics and its Applications (University of Minnesota, 1994-1995) and Princeton University (1995-1997), he joined the faculty of applied mathematics and served as Chair from 2007-2015.