Universal Laws and Architectures:
brains, bugs, nets, dance, art, music, literature, fashion, and zombies

Monday, Feb. 18 at 4:30pm, Mason Hall Auditorium
Reception to Follow
Abstract

Complex networks arise in a wide range of applications from neuroscience and cell biology to the internet and social networks. The commonalities in these problems are often either overlooked or oversimplified while domain experts tend to apply different “languages” and mathematical “tools” to them. This talk will focus on progress towards a more “unified” theory for complex networks. The approaches described are motivated by neuroscience, cell biology, and technology, and involve several elements: hard limits on achievable robust performance (“laws”), the organizing principles that succeed or fail in achieving them (architectures and protocols), the resulting high variability data observed in real systems and in case studies (behavior, data), and the processes by which systems evolve (variation, selection, design). We will leverage a series of case studies from neuroscience, cell biology, human physiology, and technology to illustrate the implications of recent theoretical developments, also drawing on familiar examples from dance, art, music, literature, fashion, and the recent popular obsession with zombies.

Biography

John Doyle is the John G. Braun Professor of Control and Dynamical Systems, Electrical Engineering, and BioEngineering at Caltech. He has a BS and MS in EE, MIT (1977), and a PhD in Math, UC Berkeley (1984). His research interests are in the theoretical foundations for complex networks in engineering and biology, as well as multiscale physics, and include integrating modeling, ID, analysis and design of uncertain nonlinear systems, and computation in analysis and simulation, including complexity theory to guide algorithm development. He is interested in research applications motivated by the interplay between control, dynamical systems, and design and analysis of large, complex systems. His early work was in the mathematics of robust control, including extensions to nonlinear and networked systems. His group has been involved in software projects that include the Robust Control Toolbox (muTools), SOSTOOLS, SBML (Systems Biology Markup Language), and FAST (Fast AQM, Scalable TCP). Prof. Doyle’s awards include the American Automatic Control Council Eckman Award, the IEEE Control Systems Field Award, and the IEEE Centennial Outstanding Young Engineer Award. He has held national and world records and championships in various sports and is best known for having excellent co-authors, students, friends, and colleagues.
The Johns Hopkins Systems Institute
and
The Institute for Computational Medicine

Present

John Doyle

John G Braun Professor of Control and Dynamical Systems, Electrical Engineering, and BioEngineering
California Institute of Technology

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Introductions:

Tak Igusa
Professor, Department of Civil Engineering
Associate Director, Systems Institute

Dennice Gayme
Assistant Professor, Department of Mechanical Engineering

Reception to Follow
The Johns Hopkins Systems Institute

The Systems Institute’s mission is to promote collaborative research and education activities that use systems science and engineering to understand and solve real-world problems.

The Institute brings together students, faculty, and researchers from the Whiting School of Engineering; the Krieger School of Arts and Sciences; the Bloomberg School of Public Health; the Schools of Medicine, Nursing, and Education; the Carey School of Business; and the Applied Physics Laboratory. Together, these researchers are applying systems approaches to areas including public health, disaster response and mitigation, the science and technology of patient treatment and safety, informatics for individualized health and education, and civil infrastructure. Their goal is to find cross-disciplinary, systems-based solutions to problems that extend beyond the traditional boundaries of engineering.

The Institute for Computational Medicine

Today, biological research is entering a new and exciting phase, one in which computational methodologies and modeling will play a critical role in revealing the causes and treatment of human disease. At the forefront of this frontier is the Institute of Computational Medicine (ICM).

The Institute is an extraordinary initiative that builds on groundbreaking research at both The Johns Hopkins University Whiting School of engineering and the School of Medicine. ICM’s mission is to develop quantitative approaches for understanding the mechanisms, diagnosis and treatment of human disease through applications of mathematics, engineering and computer science. Specific research areas include modeling of human disease processes, algorithms-based disease risk prediction, and biomedical image understanding.