



The
University
Of
Sheffield.

Shedding Light on the Control of Circadian Rhythms: From Genes to Cells to Systems

Francis J Doyle III

Wednesday 17th March 2010
Mappin Hall
Mappin Building

Programme:
4.00 – 5.00 pm Lecture
5.00 – 6.00 pm Reception

FREE ADMISSION
To book a place please email
d.proctor@sheffield.ac.uk

www.shef.ac.uk/acse

Automatic Control & Systems Engineering.

You are invited to the:

Inaugural Harry Nicholson
Distinguished Lecture in Control
Engineering

Delivered by:

Francis J Doyle III

*Duncan and Suzanne Mellichamp Chair in
Process Control,
University of California, Santa Barbara*

Francis J Doyle III is the Associate Dean for Research in the College of Engineering at UC, Santa Barbara and he is the Associate Director of the Army Institute for Collaborative Biotechnologies. He holds the *Duncan and Suzanne Mellichamp Chair in Process Control* in the Department of Chemical Engineering, as well as appointments in the Electrical Engineering Department, and the Biomolecular Science and Engineering Program. He received his B.S.E. from Princeton (1985), C.P.G.S. from Cambridge (1986), and Ph.D. from Caltech (1991), all in Chemical Engineering. Prior to his appointment at UCSB, he has held faculty appointments at Purdue University and the University of Delaware, and held visiting positions at DuPont, Weyerhaeuser, and Stuttgart University. He is the recipient of several research awards (including the NSF National Young Investigator, ONR Young Investigator, Humboldt Research Fellowship) as well as teaching awards (including the Purdue Potter Award, and the ASEE Ray Fahien Award). He is a Fellow of the IEEE, and a Fellow of IFAC. He served as the editor-in-chief of the *IEEE Transactions on Control Systems Technology* from 2004-2009, and currently holds Associate Editor positions with the *Journal of Process Control*, the *SIAM Journal on Applied Dynamical Systems*, and *Royal Society's Interface*. In 2005, he was awarded the *Computing in Chemical Engineering Award* from the American Institute of Chemical Engineers for his innovative work in systems biology. His research interests are in systems biology, network science, modeling and analysis of circadian rhythms, drug delivery for diabetes, model-based control, and control of particulate processes.



The
University
Of
Sheffield.

Automatic
Control &
Systems
Engineering.

Shedding Light on the Control of Circadian Rhythms: From Genes to Cells to Systems

Francis J Doyle III

Abstract and background

Natural control systems are paragons of optimality. Over millennia, these architectures have been honed to achieve robust regulation of a myriad of processes at the levels of genes, proteins, cells, and entire systems. One of the more interesting aspects of these circuits, and one of the challenges for control research, is unravelling the multi-scale, hierarchical control that achieves robust performance in the face of stochastic perturbations. These perturbations arise from both intrinsic sources (e.g., inherent variability in the transcription machinery), and extrinsic sources (e.g., environmental fluctuations). Robustness in key performance variables to particular perturbations is shown to be achieved at the expense of strong sensitivity to other perturbations. An exquisite example of such robustness is the timekeeping in circadian neurons. This example will be used to illustrate the challenges in reverse engineering biological circuits. Furthermore, this example will reinforce the talk's title; namely, the importance of analyzing complex behaviours in nature at multiple scales to achieve "systems" level understanding.

For further information please visit:
www.shef.ac.uk/acse