

Title: Conundrums in Everyday Stochastic Control: the Excitation Price of Performance

Abstract: In all but fully known linear problems, there is a tension or ‘duality’ in stochastic optimal control between the competing duties of the control signal to regulate the plant system and to augment the observability of the state. This has been recognized at least since Fel’dbaum’s work of the early 1960s, where the problems were defined but not solved; they are computationally intractable because they require propagation of the Bayesian filter and solution of the Stochastic Dynamic Programming Equation. The origin and nature of the dual optimal control problem will be examined before moving on to present two very widely implemented real-world examples of suboptimal solutions in telecommunications: mobile wireless power control and equalization, and TCP/IP computer congestion management. In each case, the resources devoted to excitation are surprisingly significant but seemingly unavoidable. The latter part of the presentation will pose questions concerning how these ideas extend to adaptation and learning in autonomous systems where, at least for robotics, the fundamental aspects are preserved in the exploration-exploitation tradeoff. The questions posed for safety are challenging, to say the least.



Biography: Bob Bitmead occupies the Cymer Corporation Endowed Chair in Mechanical & Aerospace Engineering at the University of California, San Diego. He holds degrees in Applied Mathematics and Electrical Engineering from Sydney University and Newcastle University, both in Australia. He has held faculty positions at the Australian National University and James Cook University of North Queensland. He is a control theorist with a long experience in control applications in many industrial sectors. His theoretical work is strongly informed and guided by these applications. He was the recipient of the 2014 ASME Rufus Oldenburger Medal and of the 2015 IEEE Controls Systems Transition to Practice Award. Bob is President of the IEEE Control Systems Society for 2019. He was a member of the IFAC Council from 1996 to 2002 and is Editor-in-Chief of the IFAC Journal of Systems & Control. He is Fellow of IEEE, IFAC and the Australian Academy of Technological Sciences and Engineering. Bob brews his own beer and is an accredited and active Australian Rules Football umpire.