



**Economic optimization of large-scale systems with model predictive control**

***Dr. James B. Rawlings/University of California***

*Thursday, March 28, 2023, 2:30pm*

*Rose Event Commons*

*Mitchell Hall, East Wing, Rm 103*

Maintaining high standards of living while decreasing our impact on the planet requires both new technologies as well as increasingly efficient operation of these technologies at large scale. This talk presents the central ideas of model predictive control, which has become over the last 20 years the leading advanced feedback control method, both in industrial practice as well as a topic of control theory research. We discuss the fundamental reasons for this success, which builds upon the foundations of optimal control and dynamic modeling, supplemented with measurement feedback to make the resulting system robust against model inaccuracies and disturbances. We present a large-scale example of such a system performing in real time an economic optimization of a 155 building campus-wide energy system. Next we discuss the education of engineers to understand, operate and improve this kind of technology. We start with a motivational example that can be easily understood by any undergraduate engineering student. Although conceptually simple, the fundamental ideas of noisy measurements, unstable processes, Brownian motion, feedback stabilization, controller tuning, and integral control already play central roles in understanding the complex behavior that arises. The talk closes with two examples of recent experimental hardware advances that enable a rethinking of the control laboratory as a vehicle for both teaching and demonstrating new research results in feedback control theory.