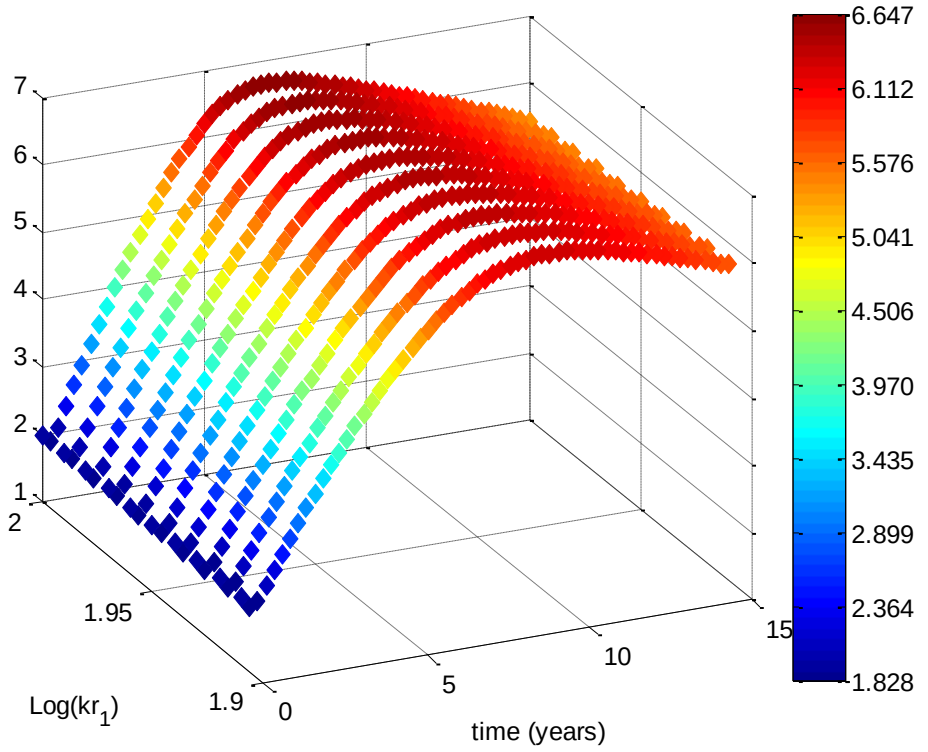
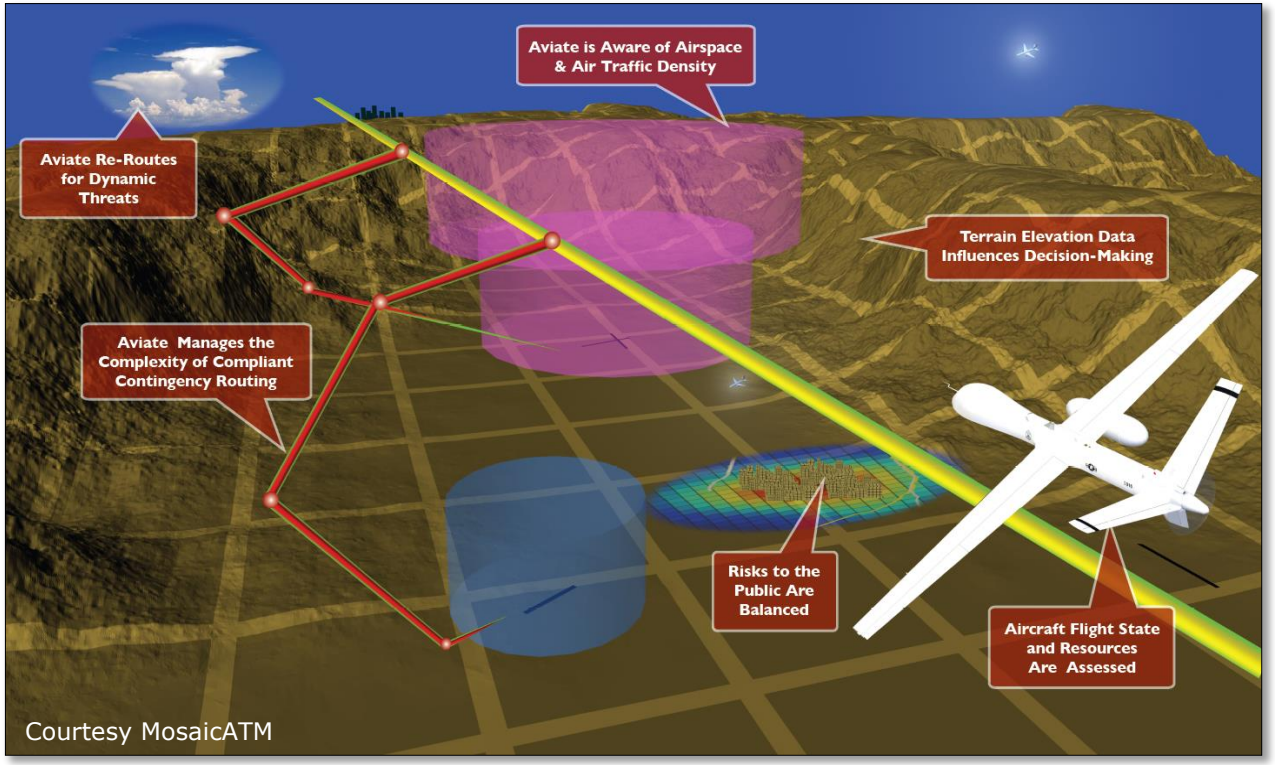
Dynamic Optimization

$$\begin{aligned} \text{minimize} \quad & J(x,y,p) \\ subject\ to \quad & 0 = f\left(\frac{dx}{dt}, x, y, p\right) \\ & 0 \leq g\left(\frac{dx}{dt}, x, y, p\right) \end{aligned}$$

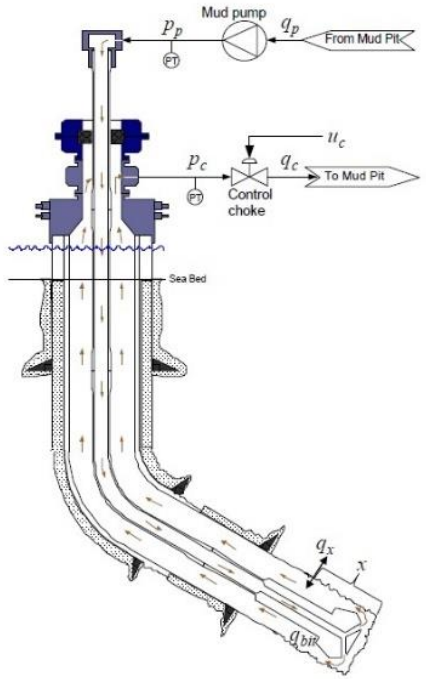


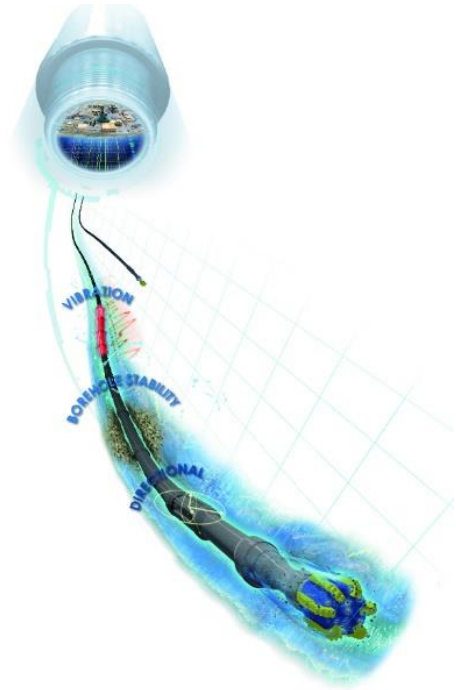
Dr. John Hedengren

Dynamic Optimization



Courtesy MosaicATM





Courtesy NOV IntelliServ

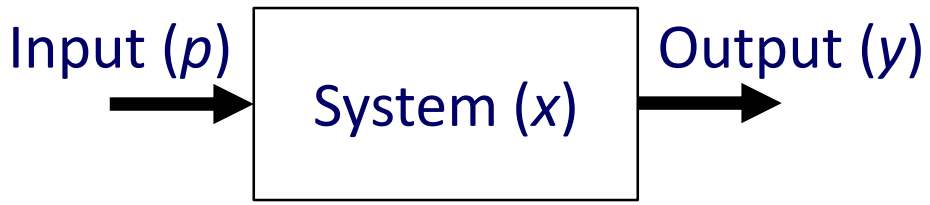
Course Overview

- Lecture Content, Tutorial Videos, Source Files
  - http://apmonitor.com/do
- Main Topics
  - Dynamic Modeling
  - Dynamic Data
  - Moving Horizon Estimation
  - Model Predictive Control
- Theory and Applications
  - Numerical methods
    - Standard form for dynamic optimization
    - Large-scale, gradient based methods
  - Engineering applications
    - Chemical, Civil, Electrical, Mechanical, Petroleum

Overview of Methods

- Part I: Dynamic Modeling
  - Empirical
  - Fundamental
- Part II: Dynamic Estimation
- Part III: Dynamic Control

$$\begin{aligned} \text{minimize} \quad & J(x, y, p) \\ subject\ to \quad & 0 = f\left(\frac{dx}{dt}, x, y, p\right) \\ & 0 \leq g\left(\frac{dx}{dt}, x, y, p\right) \end{aligned}$$



Applications

- Dynamic Modeling
  - Model building tutorials
  - Large-scale and complex systems
- Dynamic Estimation
  - Bias Update, Kalman Filter, **Moving Horizon Estimation**
- Dynamic Control
  - PID, Linear Quadratic Regulator, **Model Predictive Control**
- Hands-on Arduino Application
- Launch-pad for individual or group projects