# MCHE 474: Control Systems Mid-Term Exam – Tuesday, October 3rd

## Covers Chapter 2 through Chapter 5.3 including (but not limited to):

#### Chapter 2

- Modeling and linearization of physical systems
- The Laplace Transform & Inverse Lapace Transform
  - Use to solve ODEs
  - Use to write the transfer function of linear systems
  - Use for systems with nonzero initial conditions
- Block diagram models
  - Block diagram algebra and reduction
  - Be able to draw a representative block diagram for a system (like the DC motor example we worked in class)
  - Know common block diagram forms

### Chapter 3

- State variable representation of systems
- The state differential equations and state-space form
  - Be able to write system equations in this form
  - Know the general matrix form and functions of each matrix
- State Transition matrix

#### Chapter 4

- Differences between open and closed-loop systems
- Error signal analysis
  - Sensitivity function
  - Complementary loop function
  - The relationship between these two functions
  - What we need from the controller to limit the effects of:
    - $\bullet$  disturbances,
    - $\bullet$  measurement noise, or
    - $\blacklozenge$  reference inputs
- Sensitivity to parmeter variations
- Analysis of steady-state error (Know the Final-value Theorem)

# Chapter 5

- Know the test inputs
- Have a high-level, qualitative understanding of the effects of changing natural frequency and damping on:
  - Rise time
  - Settling time
  - Overshoot