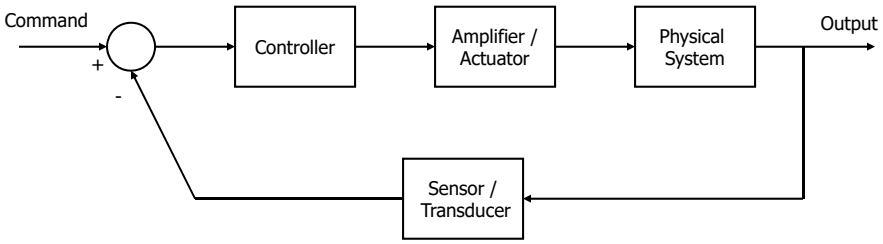
ABE 460
Final Exam
Review Session

ABE 460 Final Exam Overview

- Closed book and closed notes
- 1 single-sided 8.5” x 11” crib sheet
- Will provide equations/tables that were provided on the Midterm
- Thursday December 13, 8am – 10am, WALC B093

Chapter 1: Introduction

- Basic Control System Blocks
  - Review the general layout of a feedback control system and the common blocks.



Chapter 2: Modeling Dynamic Systems

- Write the equations of motion for common physical systems (Differential equations)
  - Mechanical (Translational and Rotational)
  - Electrical
  - Hydraulic
  - Liquid Level
- Block Diagram Reduction
- Linearization

Chapter 3: Analysis Methods for Dynamic Systems

- Differential Equations
  - 1st and 2nd order step input responses
  - Generalized characteristics
- Laplace Transforms
  - Transfer functions
  - Characteristic Equation and Response Types
- Frequency Response Plots (Bode Plots)
  - Construction and Deconstruction
  - General Characteristics (BW, GM, PM)

Chapter 4: Analog Control System Performance

- Open loop versus Closed loop
  - Command and Disturbance Inputs
    - Steady State Errors from both
    - Transient response (stability)
- Root Locus Methods
  - Constructing root locus plots
  - Understanding response characteristics
- Frequency Response Methods
  - Stability margins

Chapter 5: Analog Control System Design

- PID Controllers and characteristics
  - Role and characteristics of each gain
  - Phase-lag/lead similarities
  - Ziegler-Nichols tuning
- Root Locus design of controllers
- Frequency Response design of controllers
  - *Lag/Lead*

1: For this exam you should be able to:

- Describe the basic components of a control system
- Organize and simplify control systems using block diagrams
- Model simple dynamic systems and processes (i.e. differential equations)
- Linearize non-linear systems and designate a valid linear region
- Develop transfer functions from the differential equations using Laplace transforms
- Describe and analyze step responses to first and second order systems
- Describe the system response in terms of the system poles (roots of the characteristic equation—denominator of the system transfer function)

2: For this exam you should be able to:

- Identify the basic "factors" used in constructing/deconstructing Bode (frequency response) plots.
  - Construct a Bode (frequency response) plot from a transfer function.
  - Construct a transfer function from a Bode (frequency response) plot.
- Identify performance criterion and stability margins on Bode (frequency response) plots.
- Find the steady state errors resulting from command and/or disturbance inputs.
- Describe and/or predict system stability from block diagrams, CLTF, or s-plane plots (i.e. transient response characteristics).
- Construct root locus plots and explain transient performance from the plots.
- Describe the characteristics of PID controllers ("role" of each term)
- Design simple controllers using root locus techniques (able to achieve time domain specifications)

3: For this exam you should be able to:

- Design simple controllers using Bode plots (able to achieve time domain specifications)
- Relate Phase Lag/Lead controllers to PID controllers (role of each type, differences, advantages)
- Apply Ziegler-Nichols to provided "test" data