MECH 7710: Optimal Estimation and Control  
Spring 2015  
TR 2-3:15 (make-ups on R 3:15-4:00 or F 2-3:15)

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Class Website: [http://eng.auburn.edu/~dmbevly/mech7710/](http://eng.auburn.edu/~dmbevly/mech7710/)

Textbook: Optimal State Estimation by Dan Simon (not necessarily required)

Other References:
- Applied Optimal Control by: R.F. Stengel
- Applied Optimal Estimation by: Gelb
- Optimal Estimation of Dynamic Systems by Crassidis and Junkins
- Introduction to Random Signals and Applied Kalman Filtering by: Brown, R. G. and Hwang
- Digital Control of Dynamic System by: Franklin Powell and Workman
- Probabilistic Methods of Signal and System Analysis by George Cooper and Clare McGillem

Matlab Help located at:  

Pre-Requisites: ELEC 7500 or MECH5970: Basic understanding of classical and state-space systems/analysis and synthesis tools

Matlab: A good working knowledge of MATLAB is essential to this course and is assumed

Working knowledge of Discrete Systems, z-transforms, difference equations

Grading Policy:

1. 1 Exam 25
2. Homework 50
3. Project 25

Scale:

90-100 - A  
70-79 - C  
80-89 - B  
60-69 - D  
Below 60 - F
Tentative Lecture Topics (Subject to Change):

<table>
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<tr>
<th>Approximate Number of Weeks</th>
<th>Topics</th>
<th>Reading Materials</th>
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<td>2</td>
<td>Random Processes</td>
<td>FPW Appendix D</td>
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<td>Gelb</td>
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<td>Sten 2.4,4.1</td>
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<td>4</td>
<td>Estimation with a Stochastic</td>
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<td>Perspective</td>
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<td>Sten Chapter 4</td>
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<td>Optional</td>
<td>Parameter Identification</td>
<td>FPW Chapter 8</td>
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<td>STEN 4.1</td>
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<td>4</td>
<td>Optimal Control with Noise</td>
<td>FPW Chapter 9</td>
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<td>Sten Chapters 5,6</td>
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<td>Optional</td>
<td>Sensitivity and Robustness</td>
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<td>Analysis</td>
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<td>Optional</td>
<td>Model Predictive Control</td>
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<tr>
<td>Optional</td>
<td>UKFs and Particle Filters</td>
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Goals:

**Overall:** Develop skills for the design of real world, modern, digital controllers accounting for: Measurement noise, model uncertainty, and process noise. Introduce the Kalman filter

**Specific:**
- Understand Random Processes
- Introduction to Plant Identification
- Combine Optimal Estimation and Control Techniques
- Explore performance and robustness issues of new design techniques with examples

General Policies:
Class attendance is expected but not *formally* recorded. Late submission of assigned work or make-up examinations will be allowed if and only if accompanied by an approved University excuse. You are encouraged to discuss homework and problem sets but submitted work should be your own.

Accessibility:
It is the policy of Auburn University to provide accessibility to its programs and activities, and reasonable accommodations for persons defined as having a disability under Section 504 of the rehabilitation Act of 1973, as amended, and the Americans with Disabilities Act of 1990. Students who need special accommodations should make an appointment to see the instructor as soon as possible or contact The Student with Disabilities Program office at (334) 844-5943 (Voice/TT)