MAT 540: Kalman Filter

Spring 2016

Lecture: Tuesdays and Thursdays, 5:00pm - 6:50pm, Room 3-1616, Section 01

Webpage: [www.cpp.edu/~jlcannons/mat_540_2016_spring.html](http://www.cpp.edu/~jlcannons/mat_540_2016_spring.html)

Professor: Jillian Cannons

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Office: 94-224

Tentative Office Hours: Tuesdays and Thursdays 11:00am-12:00pm

Course Description: Discrete- and continuous-time Kalman Filter. Design, simulation, and implementation; the extended Kalman Filter. Applications to radar, tracking, communication networks, space navigation, and social and environmental systems.


Prerequisite: CS 128, MAT 208, MAT 216, STA 241 or STA 326

Homework: Near-weekly homework involving both hand-done and computer programming problems will be assigned in class, and your lowest score will be dropped.

Test: There will be 1 in-class test.

Final Project: A final project consisting of reading a section of the textbook, implementing a related aspect, and presenting the topic to the class is required. The project is to be done individually.

Late Policy: Late homeworks or projects will not be accepted.

Grade Scheme: Your grade will be based on a score computed using the following weighting

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>20%</td>
</tr>
<tr>
<td>Test</td>
<td>40%</td>
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<tr>
<td>Final Project</td>
<td>40%</td>
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Academic Honesty: Anyone caught cheating will be dealt with harshly. While group discussion of homework is permitted, your work should be your own. Source code taken from the Internet will result in a score of zero. Cheating on a homework, project, or test will result in a score of zero on that homework, project, or test.

Calculators: Calculators are permitted and may be a useful tool; however, you must show all work on all homework and tests.
Test and Final Project Schedule: The dates below are generally fixed; however, exceptions might be made for valid reasons. Please talk to me early to discuss options if you know of a conflict.

<table>
<thead>
<tr>
<th>Test</th>
<th>May 10, 2016</th>
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<tbody>
<tr>
<td>Final Projects</td>
<td>May 26, May 31, and June 2, 2016</td>
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Tentative Lecture Schedule: The following is subject to change:

Week 1 Mar 28 1.1, 1.2 Curve Fitting Example, Linear Batch Estimation
Week 1 Mar 31 N/A No class (César Chávez Day)
Week 2 Apr 5 1.3, 1.4 Linear Sequential Estimation, Nonlinear LSE
Week 2 Apr 7 1.5, 1.6 Basis Functions, Advanced Least Squares Approximation
Week 3 Apr 12 2.1, 2.2 Minimum Variance Estimation, Unbiased Estimates
Week 3 Apr 14 2.3, 2.4 Cramér-Rao Inequality, Constrained Least Squares Covariance
Week 4 Apr 19 2.5, 2.6 Maximum Likelihood Estimation, Properties of MLE
Week 4 Apr 21 2.7 Bayesian Estimation
Week 5 Apr 26 2.8 Advanced Probability Concepts in Least Squares
Week 5 Apr 28 3.1, 3.2 First-Order Filter Example, Full-Order Estimators
Week 6 May 3 3.3.1 - 3.3.4 Discrete-Time Kalman Filter
Week 6 May 5 3.3.5 - 3.3.8 Discrete-Time Kalman Filter
Week 7 May 10 N/A Test
Week 7 May 12 3.4.1 - 3.4.2 Continuous-Time Kalman Filter
Week 8 May 17 3.4.3 - 3.4.5 Continuous-Time Kalman Filter
Week 8 May 19 3.5, 3.6 Continuous-Discrete Kalman Filter, Extended Kalman Filter
Week 9 May 24 3.7, 3.8 Unscented Filtering, Constrained Filtering
Week 9 May 26 Ch 4, 6, 7 Final Projects
Week 10 May 31 Ch 4, 6, 7 Final Projects
Week 10 Jun 2 Ch 4, 6, 7 Final Projects