EEL 4890 M,W 4:30-5:45 HEC 111

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Text: <u>Simulation of Dynamic Systems with MATLAB and Simulink</u>, second ed. by Harold Klee and Randal, Allen, CRC Press, 2011. Available from <u>http://www.crcpress.com/</u> or <u>http://www.amazon.com/</u>

<u>Course Description</u>: Introduction to the field of continuous system simulation. Numerical integration. Difference equations. Continuous-time and discrete-time linear systems. Matlab programming and introduction to Simulink.

Chapter 1 – Mathematical Modeling

- 1.1 Introduction
- 1.2 Derivation of a Mathematical Model
- 1.3 Difference Equations
- 1.4 First Look at Discrete-Time Systems
- 1.5 Case Study: Population Dynamics (Single Species)

Chapter 2 – Continuous-time Systems

- 2.1 Introduction
- 2.2 First Order Systems
- 2.3 Second Order Systems
- 2.4 Simulation Diagrams
- 2.5 Higher Order Systems
- 2.6 State Variables
- 2.7 Nonlinear Systems
- 2.8 Case Study: Submarine Depth Control System

Chapter 3 – Elementary Numerical Integration

- 3.1 Introduction
- 3.2 Discrete-time System Approximation of a Continuous-time Integrator
- 3.3 Euler Integration
- 3.4 Trapezoidal Integration
- 3.5 Numerical Integration of First Order and Higher Continuous-time Systems
- 3.6 Improvements to Euler Integration
- 3.7 Case Study: Vertical Ascent of a Diver

Chapter 4 – Linear Systems Analysis

- 4.1 Introduction
- 4.2 The Laplace Transform
- 4.3 The Transfer Function
- 4.4 Stability of Linear Time Invariant Continuous-time Systems
- 4.5 Frequency Response of LTI Continuous-time Systems
- 4.6 *z*-Transform
- 4.7 *z*-Domain Transfer Function
- 4.8 Stability of LTI Discrete-time Systems
- 4.9 Frequency Response of LTI Discrete-time Systems
- 4.12 Case Study: Notch Filter for ECG Waveform

Chapter 5 – Simulink

- 5.1 Introduction
- 5.2 Building a Simulink Model
- 5.3 Simulation of Linear Systems
- 5.4 Algebraic Loops
- 5.5 More Simulink Blocks
- 5.6 Subsystems
- 5.7 Discrete-time Systems
- 5.8 MATLAB and Simulink Interface
- 5.10 Monte Carlo Simulation
- 5.11 Case Study: Pilot Ejection

Homework and Projects are done by groups consisting of two members. A single homework and project is submitted from each group and the same grade is assigned to each member. Only a select few homework problems will be collected and graded.

Exams are to be taken on the scheduled dates. Only exception is absence due to sickness. Notification must be given to instructor **prior** to exam (when possible) and a doctor's note will be required to take missed exam. Exams are Open Book with a 1-page crib sheet (both sides) only. Optional quizzes may be given after the first exam.

Chapter	Sec	Problems
1	1.2	1.1 (a),(b),(c),(d)
	1.3	1.5
	1.4	1.9
2	2.2	2.1
	2.4	2.11
	2.6	2.17
3	3.3	3.6 (a),(b)
	3.4	3.10 (a),(b)
	3.5	3.17
	3.6	3.29 (a)
4	4.2	4.1 (a),(b),(g),(j)
		4.2 (a),(b),(c),(d)
	4.3	4.7 (a),(b),(c),(d)
	4.4	4.19 (a),(b),(c),(d),(e)
	4.6	4.36 (a),(b),(c),(d)
		4.37 (a),(b),(c),(d)
		4.39
	4.7	4.44
	4.8	4.59 (a),(b),(c)
5	5.2	5.1, 5.3
	5.3	5.6 (a),(b),(c)

Homework

Grading: HW (10%), Projects (50%), Exams (2) (40%) A (90-100), B (80-89), C (70-79), D (60-69), F (<60)

Information about the course is available at http://www.eecs.ucf.edu/courses/eel4890/fall2011/