SYST 220: Dynamical Modeling I

Spring 2014

Systems Engineering and Operations Research

George Mason University

Course Overview: An important problem in engineering is to predict the behavior of systems that change in time. Such systems are called *dynamical systems*. This course introduces students to a set of mathematical methods used to model dynamical systems. In particular, students will learn to:

- Identify real world problems that can be modeled as dynamical systems.
- Take such systems and translate them into mathematical models.
- Predict the behavior of such systems using mathematical analysis and computation.

Course Objective: Students will use engineering mathematics as well as computers to simulate the behavior of dynamical systems and make predictions about the systems. Matlab will be introduced to solve the dynamical models in SYST 221. This course focuses on *continuous* and *discrete* dynamical models.

Class Hours: T / R, 12pm – 1:15 pm, IN 204

Instructor: Rajesh Ganesan, Ph.D.
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703-993-1693
Eng bldg, 2217
Office hours: TR 1:30- 2:30 PM

Required Textbook: *System Dynamics* by William J Palm III, Mc Graw Hill 3rd ed

Optional reference book for Matlab/Simulink:
Introduction to MATLAB 7 for Engineers (Paperback)
by William J Palm III

Pre-req: MATH 114, PHYS 160, Co-req: MATH 203, MATH 214, SYST 221

Topics

1. Introduction: Continuous and discrete dynamical systems
2. Modeling from data
3. Modeling of Rigid Body Mechanical systems
4. Modeling of Rigid Body Mechanical systems
5. Solution Methods (differential eqns, Laplace transforms, transfer functions)
6. Solution Methods (differential eqns, Laplace transforms, transfer functions)
7. Block Diagrams and state variable models
8. Block Diagrams and state variable models
9. Spring and Damper elements in Mechanical systems
10. Spring and Damper elements in Mechanical systems
11. Introduction: Discrete dynamical systems
12. Dynamic systems with inputs. Exponential terms. Polynomial terms
13. Higher order linear systems

14. Nonlinear dynamic systems

Student Evaluation Criteria

Homework assignments	10%
Group project	10%
Midterm	30%
Final exam	50%

Important Dates

Mar 6 Thur	Midterm Exam	
May 8 10:30-1:15 PM	Final exam	Group project: final report due

Homework policy:
HW will be posted on the website http://mason.gmu.edu/~rganesan/class.html. Try to work them by yourself. Working in groups is permitted but you must make sure that you understand the problems before you turn them in. Each student must turn in their HW even if worked in groups. Please remember that if you haven't learnt the HW problems you may not pass the exams and this will affect your final grade. All homeworks must be stapled and submitted on the due date prior to the beginning of the class. Late homework will be evaluated against 50% credit. Late beyond 2 weeks will receive no credit. Only 1 problem will be graded in every HW and the HW grade depends on submitting all assigned HWs and your approach to the problem that is graded.
Academic Policy:
All academic policies as given in the Honor System and code will be strictly followed. Visit URL http://www.gmu.edu/catalog/apolicies/#Anchor12
Grades:
Letter grades will be decided as follows:

97% and above –A^+, 94-96%- A, 90-93% -A^-, 86-89- B+, 83-85%-B, 80-82%-B-, 76-79%- C^+, 73-75%- C, 70-72%-C^-, 66-69%-D^+, 63-65%-D, 60-62%-D^-, at or below 59%-F

Grades will be posted on Blackboard. You must check your grades on the day the Hw is returned. Missing grades must be reported to me via email within 2 days.
Exams will only be given at the predetermined dates. Early or late exam taking will not be allowed, except for **very special** cases.

Use of MS Excel and MATLAB is needed for some problems.

One 8.5x11in. one sided formula sheet will be allowed in the midterm and the Final exam. The sheet must be submitted with the test.

Please visit http://mason.gmu.edu/~rganesan/class.html to check for announcements, Hw problems, and solutions.

Please turn off your cell phones before class and do not use your cell phone during lecture. Feel free to walk out without distracting the class as and when needed.