Semester

Spring, 2005

Course Number

CSC-432-001-2005S

Course Title

Introduction to Simulation and Modeling

Course Prerequisites

CSC-280, and MATH-211 or MATH-221, or equivalents

Meeting Times

Monday and Thursdays, 12:45PM-2:00PM

Meeting Location

MCK 207

Course Materials

Required

1. *Notes on Simulation and Modeling*, Michael Gray, American University, Spring 2005.
2. *Simulink 6*, The MathWorks.

Highly Recommended

1. MATLAB Student Edition, The MathWorks.

Optional

1. *An Introduction to Computer Simulation Methods Applications to Physical Systems*, *2nd Edition*, Harvey Gould and Jan Tobochnik, Prentice-Hall, 2003, ISBN 0-201-50604-1, Addison-Wesley, New York.

Catalog Description

Design, implementation, and analysis of simulation models for dynamic continuous systems. Emphasis on continuous physical systems and analysis of their dynamic behavior from deterministic physical models. Overview of numerical integration models in simulation. Introduction to difference equations and chaotic system behavior and simulation systems such as SIMULINK/MATLAB.

Objectives

The physical systems found in the fields of physics, chemistry, biology, and other sciences, usually are continuous systems. The dynamical behavior of such systems unfolds smoothly in time so that the fundamental variables in these systems are modelled as continuous functions of time, and the behavior is likewise modelled by continuous equations in the fundamental variables. The simulation of these systems then becomes an exercise in the simulation of continuous equations, and is achievable in a broad, field-independent way, relying entirely on the nature of the dynamical equations describing the systems. An introductory understanding of continuous simulation then requires the achievement of three objectives:

the study of how the simulation of common physical systems is achieved through the simulation of continuous equations;

the study of the use of a commercial simulation system in building simulations; and

the study of how programming can be used to build customized simulations.

Methods of Instruction

The material will be studied through lectures, exercises, programs, demostrations, and group discussions

Student Responsibilities

The student is responsible for all material presented in class and posted on the course Blackboard site. It is the student's responsibility to check the Blackboard site regularly and frequently for class information. Student questions should be posted to the Discussion Board if not confidential, and instructor responses will be posted for all students. Confidential questions should be brought to office hours.

Grading Policies

Class Participation (regular attendance, regular preparation of class exercises, and discussion participation)

5%

Projects (Students may NOT work in teams on a project. Students may discuss a project with other students, but may not use the work of any other person.)

4 (12.25% each), for 50 %

Inclass Exam

15 %

Final Exam

30%

My grading process is to assign a number representing the project/exam/participation grade using the GPA scale used by the University Registrar (see the Catalog). The number is recorded in the course grade spreadsheet. It will be combined with the other numbers in a weighted average to produce a number for the course grade. The final course grade number is rounded to the nearest GPA number and the University Registrar's letter-to-GPA table below is used to assign a letter grade for the course grade.

3.85 - 4.00	A
3.70 - 3.84	A-
3.30 - 3.69	B+
3.00 - 3.29	B
2.70 - 2.99	B-
2.30 - 2.69	C+
2.00 - 2.29	C
1.70 - 1.99	C-
1.00 - 1.69	D
0.00 - 0.99	F

Late Project: Only allowed for documented medical reasons.

Make-Up Projects and Exams: Only allowed for documented medical reasons.

Incomplete Grade: The policy of the University is that the grade of Incomplete is rarely given. Approval for a grade of I is only granted in unusual documented circumstances. A grade of I is not approved in instances where students were unable to complete the course work during the alloted time for the semester.

Written work, whenever possible, should be prepared with a word processor or a desktop publisher (the AU laboratories have Word available) and checked with a spell-checker. Since all written material is also evaluated for grammar and structure, students are advised to use one of the many grammar-checkers that are available (the AU laboratories have several).

Academic Integrity / Plagiarism Policy

The Academic Integrity Code for the American University describes standards for academic conduct, rights and responsibilities of members of the academic community, and procedures for handling allegations of academic dishonesty. Academic dishonesty as defined by the Code includes, but is not limited to: plagiarism, inappropriate collaboration, dishonesty in examinations (in-class or take-home), dishonesty in papers, work done for one course and submitted to another, deliberate falsification of data, interference with other student's work, and copyright violations (including both document and software copyrights). Copies of the Academic Integrity Code are available from the Office of the University Registrar.

Plagiarism is defined as taking the language, ideas, or thoughts of another, and representing them as your own. If you use someone's ideas, cite them; if you use someone's words, clearly mark them as a quotation. Plagiarism includes using another's computer programs or pieces of a program. Consult one of the many "writer's guides" that are available in the library or bookstore for citation practices. All instances of plagiarism will be reported to the Dean of the College of Arts and Sciences for appropriate action.

If you experience difficulty in this course for any reason, please don't hesitate to consult with me. A wide range of services is available to support you in your efforts to meet the course requirements.

Student Services

Academic Support Center (x3360, MGC 243) offers study skills workshops, individual instruction, tutor referrals, and services for students with learning disabilities. Writing support is available in the ASC Writing Lab or in the Writing Center, Battelle 228.
Counseling Center (x3500, MGC 214) offers counseling and consultations regarding personal concerns, self-help information, and connections to off-campus mental health resources.
Disability Support Services (x3315, MGC 206) offers technical and practical support and assistance with accommodations for students with physical or psychological disabilities. If you have a disability and might require accommodations in this course, please notify me with a letter from DSS or ASC early in the semester so that we can make arrangements to address your needs.

Michael A. Gray

Course Plan

(See next page)

Course Plan

Date	Class	Topics	Format	Preparation	Projects
1/10	1 - M	Class Policies And Syllabus Review	Lecture	Blackboard Site	
		Continuous Systems and Their Models	Lecture	Notes Chp. 1	
		Dynamical Behavior of Continuous Systems	Lecture	Notes Chp. 1	
1/13	2 - TH	Dynamical Equations	Lecture/Recitation	Notes Chp. 1	
		Differential Equations	Lecture/Recitation	Notes Chp. 1	
1/17	M	**HOLIDAY**			
1/20	3 - TH	**HOLIDAY**			
1/22	3MU - SA	Introduction to Simulation	Lecture	Notes Chp. 2	
		SIMULINK Demo	Lecture/Demonstration	Learning SIMULINK	
		Creating a Simulation	Lecture/Demonstration	Learning SIMULINK	
		Recording Output	Lecture/Demonstration	Learning SIMULINK	
1/24	4 - M	SIMULINK's Fundamental Cycle	Lecture/Recitation	Notes Chp. 2	
		Computation of Simulation Values	Lecture/Recitation	Notes Chp. 2	
		Propagation of Simulation Values	Lecture/Recitation	Notes Chp. 2	
1/27	5 - TH	Systems Described by Difference Equations	Lecture	Notes Chp. 3	
		Simulation of Difference Equations	Lecture/Recitation	Notes Chp. 3	
		Using SIMULINK for Difference Equations	Lecture/Demostration	Learning SIMULINK	
1/31	6 - M	Simulation of Difference Equations	Recitation	SIMULINK	
2/3	7 - TH	Systems Described by 1st Order Differential Equations	Lecture	Notes Chp. 4	
		Simulation of 1st Order Differential Equations	Lecture/Recitation	Notes Chp. 4	
		Using SIMULINK for 1st Order Differential Equations	Lecture/Demostration	Learning SIMULINK	
2/7	8 - M	Simulation of 1st Order Differential Equations	Recitation	SIMULINK	
2/10	9 - TH	Simulation of 1st Order Differential Equations	Recitation	SIMULINK	
2/14	10 - M	Basic Numerical Integration Methods	Lecture	Notes Chp. 5	
		Using Numerical Integration Methods in Simultation	Lecture/Recitation	Notes Chp. 5	
		Basic Numerical Integration Methods in SIMULINK	Lecture/Demostration	Learning SIMULINK	
2/17	11 - TH	Numerical Integration Methods in SIMULINK	Recitation	SIMULINK	
2/21	12 - M	Systems Described by 2nd Order Differential Equations	Lecture	Notes Chp. 6	
		Simulation of 2nd Order Differential Equations	Lecture/Recitation	Notes Chp. 6	
		Using SIMULINK for 2nd Order Differential Equations	Lecture/Demostration	Learning SIMULINK	
2/24	13 - TH	**EXAM 1**	Lecture	2.2	
2/28	14 - M	Simulation of 2nd Order Differential Equations	Recitation	SIMULINK	
3/3	15 - TH	Simulation of 2nd Order Differential Equations	Recitation	SIMULINK	**1**
3/7	M	**SPRING BREAK**			
3/10	TH	**SPRING BREAK**			
3/14	16 - M	Advanced Numerical Integration Methods	Lecture	Notes Chp. 7	
		Advanced Numerical Integration Methods in SIMULINK	Lecture/Demostration	Learning SIMULINK	
3/17	17 - TH	Advanced Numerical Integration Methods in SIMULINK	Recitation	SIMULINK	
3/21	18 - M	Systems Described by Higher Order Differential Eqs	Lecture	Notes Chp. 8	**2**
		Simulation of Higher Order Differential Equations	Lecture/Recitation	Notes Chp. 8	
		Using SIMULINK for Higher Order Differential Eqs	Lecture/Demostration	Learning SIMULINK	
3/24	19 - TH	Simulation of Higher Order Differential Eqs	Recitation	SIMULINK	
3/28	20 - M	Chaos in Dynamical Systems	Lecture	Notes Chp. 9	
		Simulation of Chaotic Systems	Lecture/Recitation	Notes Chp. 9	
		Using SIMULINK for Chaotic Systems	Lecture/Demostration	Learning SIMULINK	
3/31	21 - TH	Simulation of Chaotic Systems	Recitation	SIMULINK	**3**
4/4	22 - M	Chaos in Dynamical Systems Continued	Lecture	Notes Chp. 9	
4/7	23 - TH	Simulation of Chaotic Systems Continued	Recitation	SIMULINK	
4/11	24 - M	Systems Described by Systems of Differential Eqs	Lecture	Notes Chp. 10	
		Simulation of Systems of Differential Equations	Lecture/Recitation	Notes Chp. 10	
		Using SIMULINK for Systems of Differential Eqs	Lecture/Demostration	Learning SIMULINK	
4/14	25 - TH	Simulation of Systems of Differential Eqs	Recitation	SIMULINK	
4/18	26 - M	Control System Theory and Laplace Transforms	Lecture	Notes Chp. 11	**4**
		Simulation in Control Systems	Lecture/Recitation	Notes Chp. 11	
		Using SIMULINK for Control Systems	Lecture/Demostration	Learning SIMULINK	
4/21	27 - TH	Simulation of Control Systems	Recitation	SIMULINK	
4/25	28 - M	Catch Up			
Consult Spring		**Final Exam**		Notes, Chps. 1-11	
Schedule				SIMULINK	