CSE/ECE 6730: Modeling and Simulation: Fundamentals & Implementation
CX 4230: Computer Simulation
Spring 2014

Meeting Time and Place: MWF 10:05 - 10:55 AM, 102 Clough Commons
Two of the class meetings each week (in general, Monday and Wednesday) will be devoted to lectures. The third (Friday) will focus on team discussion meetings to further develop topics and to work on projects.

Instructor
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Teaching Assistants
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Ryan Curtin (gth671b@mail.gatech.edu)
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Location: study area near Klaus 1324

Email is the preferred mode of communication.

Course Description

Modeling and simulation (M&S) has become indispensible in virtually all fields to analyze, understand, and design systems. This course will provide students the necessary knowledge and skills to formulate and solve modeling and simulation problems. A second goal is to develop the necessary skills to create efficient simulation software in a high level programming language such as C or Java.

M&S is a topic that is best learned by doing. M&S projects usually involve a team, often including individuals from different disciplines. The course is structured around projects where topics and skills are developed in the context of solving problems. This approach emulates how modeling and simulation is applied in practice.

The course lectures are divided into two parts:

- Part I: M&S Methodology and Complex Systems. This part is organized around the major steps in the life cycle of a modeling and simulation project, from problem formulation to development and application of the simulation model, to reporting results. Much of the material in this part will focus on an area called complex systems. Complex systems is area that focuses on understanding aggregate behaviors that arise from that of many interacting individuals.
- Part II: Discrete event simulation and parallel and distributed simulation. This part focuses on another modeling paradigm known as discrete-event simulation. Both sequential and parallel/distributed execution of discrete event simulation programs will be covered.

Course Materials

The bulk of the course will be based on material from the following textbooks. The first is available free of charge from the library. The others may be purchased through standard outlets such as Amazon.

- L. G. Birta and G. Arbez, Modeling and Simulation: Exploring Dynamic System Behavior, Springer, 2007 (available online from the Georgia Tech library: go to www.library.gatech.edu; in the search bar, in the menu "I need" select "Books"; under search, search for "birta arbez" and click "find"; log in and you should be able to access the book).
- M. Mitchell, Complexity: A Guided Tour, Oxford University Press, 2009.
- R. M. Fujimoto, Parallel and Distributed Simulation Systems, Wiley Interscience, 2000.

Additional papers for specific topics will be made available on t-square.

- Other recommended textbooks on complex systems include:
- J. A. Miller and S. E. Page, Complex Adaptive Systems, Princeton University Press, 2007.
- Y. Bar-Yam, Dynamics of Complex Systems, Addison Wesley 1997 (it is available online at http://necsi.edu/publications/dcs/index.html).

Schedule

The detailed schedule of topics and reading assignments for the course follows.

BA:Birta-Arbez; M: Mitchell; F: Fujimoto

Wk	Monday	Wednesday	Friday (Proj)	References
1/6	Complex Systems	M&S Life Cycle	Project intro	M:ch1,2; BA:ch 1,2
1/13	Emergence	Cellular automata	Lit. survey	M:ch10
1/20	holiday	Logistics equation/chaos	Sim model	
1/27	Random numbers	Random variates	Random num	BA 3.4
2/3	Input analysis	Output Analysis	Sim Results	BA 5.5, 3.1-3.3; 6
2/10	Scaling	Self Org., Criticality	Group mtg	M:ch15,16,17
2/17	Networks	Quiz	Posters Project due	papers
2/24	Discrete event sim	World views, processes	(drop date)	F: ch1,2
3/3	Priority queues	Parallel simulation	Group mtg	papers
3/10	Chandy/Misra/Bryant	Synchronous algorithms	Group mtg	F:ch3
3/17	Spring break	Spring break	Spring break	
3/24	Time Warp	GVT algorithms	Group mtg	F:ch4
3/31	Distrib. Virtual Env.	Dead Reckonning	Group mtg	F:ch7
4/7	HLA	HLA-Time Management	Group mtg	
4/14	Static data distr	Dynamic data distr	Presentations	F:8.5-8.7
4/21	Presentations	Presentations	Presentations Project due	

Projects

The course is organized around two class projects where students will work in teams of approximately 3-5 students each. The first project will be one assigned to the entire class. The second project will be one proposed by student teams based on their own particular interests.

Grading and Due Dates

Grading will be based on the following weights:

- Project 1: 30%
- Quiz: 15%
- Project 2: 30%
- Final Exam: 25%

All deliverables (reports, literature reviews, software) must be submitted electronically through T-Square and are due at 11:59 PM of the specified due date, unless other instructions are specified.