

SIE 631
Distributed Multi-paradigm Simulation Systems
Spring 2016

Class hours: MW 04:30 – 05:45 p.m., 301 ENGR Building

Course URL: <http://www.d2l.arizona.edu> (where you need to login with Arizona account)

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Office hours: MW 1:30 – 3 p.m. or by appointment (e-mail)

Purpose: This course is designed to emphasize on current research problems in the simulation field including 1) various modeling paradigms (discrete event, system dynamics, agent-based approach, O-O modeling, Petri-net), 2) modeling enhancement in discrete event simulation, 3) standards, methods, techniques, and cyber-infrastructures (web services and grid computing) enabling distributed simulation, 4) algorithms for partitioning a large scale simulation into smaller pieces, and 5) real-time simulation and simulation based control. If time permits, the course will also cover 6) simulation optimization techniques using search algorithms and 7) deadlock detection and resolution in simulation. This course will help graduate students identify potential research topics in simulation principles for the application areas in design and control for complex dynamic systems (systems of systems).

Pre-requisites: SIE 431/531 or MIS 521.

References:

1. Handouts – papers, book chapters, manuals

Software Availability – the following software is available in the SIE computer lab or CIM lab

1. Arena (OptQuest)
2. Anylogic (Multi-paradigm simulation software)
3. HLA/RTI
4. Web Services and Grid computing modules
5. Enterprise Architect or Visio (UML software)

Topics to be covered:

1. Modeling enhancement: inside the discrete event simulation mechanism (comparisons of default logic among contemporary discrete event simulation tool)
2. Various simulation modeling paradigms: 1) discrete event model, 2) system dynamics model, 3) agent-based approach, 4) object oriented model using UML, 5) Web Services, 6) Petrinet
3. Construction of a distributed simulation that integrates existing member simulations – High Level Architecture (HLA) / Runtime Infrastructure (RTI)
4. Time synchronization methods: 1) conservative, 2) optimistic, 3) hybrid and dynamic methods
5. Using Web Services and Grid Computing to enable distributed simulation
6. Algorithms for partitioning a large scale simulation into multiple pieces
7. Real-time simulation: enhancements made to the traditional simulation tool (simulation clock, event calendar, communication mechanism)
8. Simulation optimization with search techniques (1: genetic algorithm, 2: scatter search, 3:

- simulated annealing, and 4: neural network) – optional, if time permits
9. Deadlock detection and resolution schemes in the simulation using multiple seizures -- optional, if time permits

Grading:

1. Assignments: 25 %
2. Exam1: 20 % (a date will be determined later)
3. Exam2: 25 % (3:30~5:30PM on May 6 Friday)
4. Final Project: 30 %

Computer Usage:

1. Arena Simulation Package (major)
2. AnyLogic Simulation Package (major)
3. Web Services and Grid Computing (major for final project)

Course Rules:

1.
Homeworks need to be done individually unless otherwise mentioned.
2.
Students are expected to attend lectures and lab. Students not attending a lab session or arranging to make it up will receive a 0 for that assignment. The instructor reserves the right to give a pop quiz at any time. You should expect such a quiz on any day where less than 50% of the registered students are not in class at the designated start time.
3.
You can miss one quiz without affecting your grade. However, no make up quizzes or assignments will be given under any circumstances (except the situation mentioned in the item 4 below).
4.
All holidays or special events observed by organized religions will be honored for those students who show affiliation with that particular religion; Absences pre-approved by the UA Dean of Students (or Dean's designee) will be honored.
5.
Students are not allowed to use pagers and cell phones during the class.
6.
Plagiarism is not allowed to any extent for the assignments, exams, and final projects.
7.
Threatening behavior by students is prohibited (refer to the University policy at <http://policy.web.arizona.edu/~policy/threaten.shtml>).
8.
Students with Disabilities: If you anticipate the need for reasonable accommodations to meet the requirements of this course, you must register with the Disability Resource Center and request that the DRC send me official notification of your accommodation needs as soon as possible. Please plan to meet with me by appointment or during office hours to discuss accommodations and how my course requirements and activities may impact your ability to fully participate.
9.
The information contained in the syllabus (except the grade and absence policies) may be subject to change with reasonable advance notice, as deemed appropriate by the instructor.