CS 6420: DISTRIBUTED SIMULATION

Semester Hours: 3.0 *Contact Hours:* 3

Coordinator: Hassan Rajaei

Text: Various

Author(s): VARIOUS

Year: Various

SPECIFIC COURSE INFORMATION

Catalog Description:

Principles of distributed simulation and applications using multiprocessor systems. Synchronization and time management for distributed environments. High-level architecture for distributed simulation. Prerequisite: CS 3270 or Full Admission to MS in CS Program.

Course type: **ELECTIVE**

SPECIFIC COURSE GOALS

- I can explain why distributed simulation is needed.
- I understand the main differences between two synchronization methods.
- I can describe how the conservative method works.
- I can describe how the optimistic method works.
- I can name hybrid approaches for distributed simulation.
- I can describe the HLA standard overview for simulation.

LIST OF TOPICS COVERED

- Introduction
  - Why simulation
  - Why parallel and distributed simulation
  - Analytic simulation vs virtual environment
  - Typical applications
- Discrete Event Simulation Fundamentals
  - Basic concepts: system attribute, state variables, event list, simulation time
  - Basic mechanisms: time advance, event scheduling, inherent parallelism
  - Modeling issues and logical processes

    - Data model, probability distributions, statistics collection
- Parallel Processing Overview
    - Brief intro to parallel processing
    - Overview of cluster computing with MPI
    - Underlying technologies
    - Concurrent simulation processes
- Conservative Synchronization Algorithms
    - Synchronization problem
    - Deadlock avoidance using null messages
    - Lookahead and the simulation model
    - Deadlock detection and recovery
    - Synchronous execution
    - Barriers Synchronization, Transient Messages, Time Distance between Logical Processes
    - Performance Issues
    - Pros and cons of conservative mechanism
- Optimistic Synchronization Method
    - Time Warp
    - Rolling Back and Error Correction, Global Virtual Time, Memory Management Issues
    - Performance Issues
    - Optimization Techniques
    - Comparing optimistic and conservative synchronization
- Hybrid Protocols
    - Moving time windows
    - Space time simulation
    - Breathing time buckets
    - Local time warp
- Distributed Simulation Standards
    - Distributed virtual environment
    - High level architecture, HLA
    - Overview, Rules, Object Model, Run-Time Infrastructure, Communication Issues