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