CS 6420: DISTRIBUTED SIMULATION

Course 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.

Course Syllabus

- **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

- **Optimistic Synchronization Method**
  - Time Warp
    - Rolling Back & 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
• Distributed Simulation Standards
  o Distributed Virtual Environment
  o High Level Architecture, HLA
  
  *Overview, Rules, Object Model, Run-Time Infrastructure, Communication Issues*

Laboratory and Project Component

This course includes a major term project and 3 small simulation laboratory assignments.