EE 345 Modeling and Simulation

Syllabus

1. Introduction
    - Course Logistics
    - Definitions of Modeling and Simulation
    - When to Apply These Techniques
    - Applications
    - Terminology & Components
    - Discrete vs. Continuous Time
    - Process Flow in Simulation Study

2. Simulation Examples
    - Queuing Systems
    - Control Systems
    - Robotic Systems

3. General Principles
    - Event-driven Simulation
    - World Views
    - List Processing

4. Simulation Software
    - History
    - Selection Process
    - Simulation in High Level Language (C, C++, Pascal, Fortran)
    - Simulation Packages (Matlab/Simulink)
    - Robot Simulation Tools
        - Robotics Toolbox for Matlab (for robot manipulators)
        - Webots from Cyberbotics Ltd. (for mobile robots)
    - Interpreted vs. Compiled Simulators

5. Statistical Models
    - Terminology and Concepts
    - Useful statistical Models
    - Distributions

6. Queuing Models
    - Characteristics
    - Performance Measures
    - Steady-State Behavior
    - Networks of Queues

7. Control System Models

- State Space Models
- Transfer Function Models
- Frequency Response Methods
- DC Motor Control Systems

8. Robotic System Models
    - Robot Kinematics and Dynamics
    - Vision-based Mobile Robot Localization and Navigation

9. Random Number Generation
    - Properties of Random Numbers
    - Generation of Pseudo-Random Numbers
    - Testing for Randomness
    - Pitfalls

10. Input Modeling
    - Collecting Data
    - Identifying Distribution
    - Histograms
    - Parameter Estimation
    - Goodness-of-Fit
    - Selecting Input Model without Data

11. Verification and Validation of Simulation Models
    - Model Building, Verification, and Validation
    - Verification of Simulation Models
    - Calibration and Validation of Models

12. Output Analysis
    - Types of Simulations with Respect to Output Analysis
    - Stochastic Nature of Output Data
    - Measures of Performance
    - Output Analysis for Termination Simulations
    - Output Analysis for Steady-State Simulations