

Overview



Hui Chen, Ph.D.
Dept. of Engineering & Computer Science
Virginia State University
Petersburg, VA 23806

Outline

- ❑ Syllabus
- ❑ Reading
 - Reading
 - Q & A
- ❑ Model and Simulation
- ❑ Discrete Event Simulation

Syllabus

- ❑ Instructor's contact and office hours
- ❑ Content to cover
 - Discrete event simulation (based on the textbook by Leemis and Park)
 - Discrete event simulation with NS-3 (<http://www.nsnam.org/>)
- ❑ Grading

Reading

- Which Is The Fastest Check-Out Lane At The Grocery Store?

Discussion

- ❑ How to answer the question asked in the article?
- ❑ How is it relevant to computer science?

Model and Simulation

□ Model

- Construct a conceptual framework that describes a system

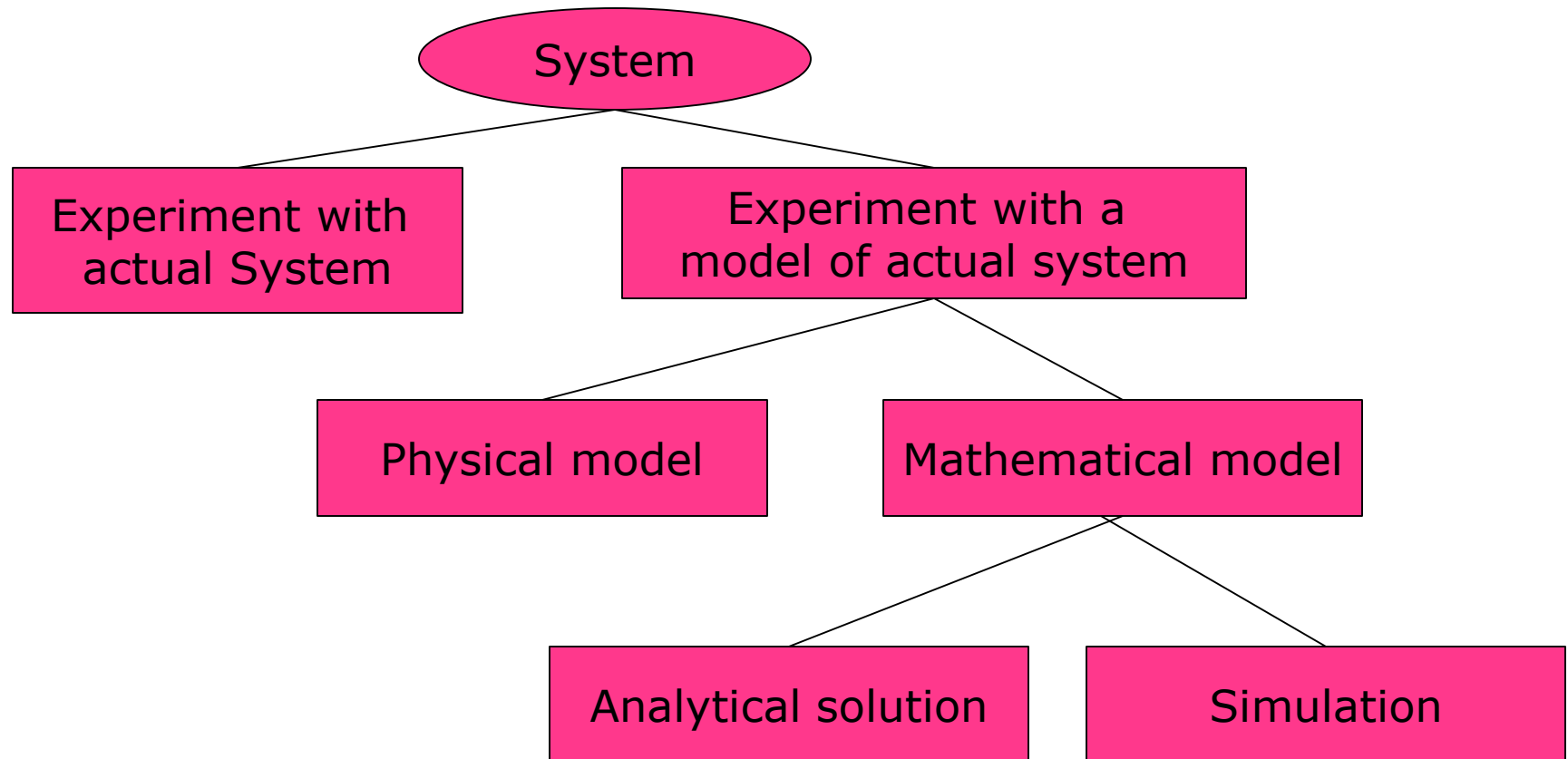
□ Simulate

- Experiment using computer implementation of a model

□ Analyze

- Draw conclusion and aid decision making

How to study a system?



Why Simulate?

- ❑ Study a system
 - Prediction
 - ❑ Predict behavior before building
 - ❑ Predict for future expectations
 - Testing
 - ❑ System characterization
- ❑ Virtualization
- ❑ Your application example

Characterization of Models

- ❑ Deterministic or stochastic?
 - Does the model contain stochastic (random) component?
- ❑ Static or dynamic?
 - Is time a significant variable?
- ❑ Contiguous or discrete?
 - Does system state evolve continuously or only at discrete point in time?
 - Continuous systems
 - ❑ Classical mechanics
 - Discrete systems
 - ❑ Queuing, inventory, machine shop model

Discrete-Event and Monte Carlo Simulations

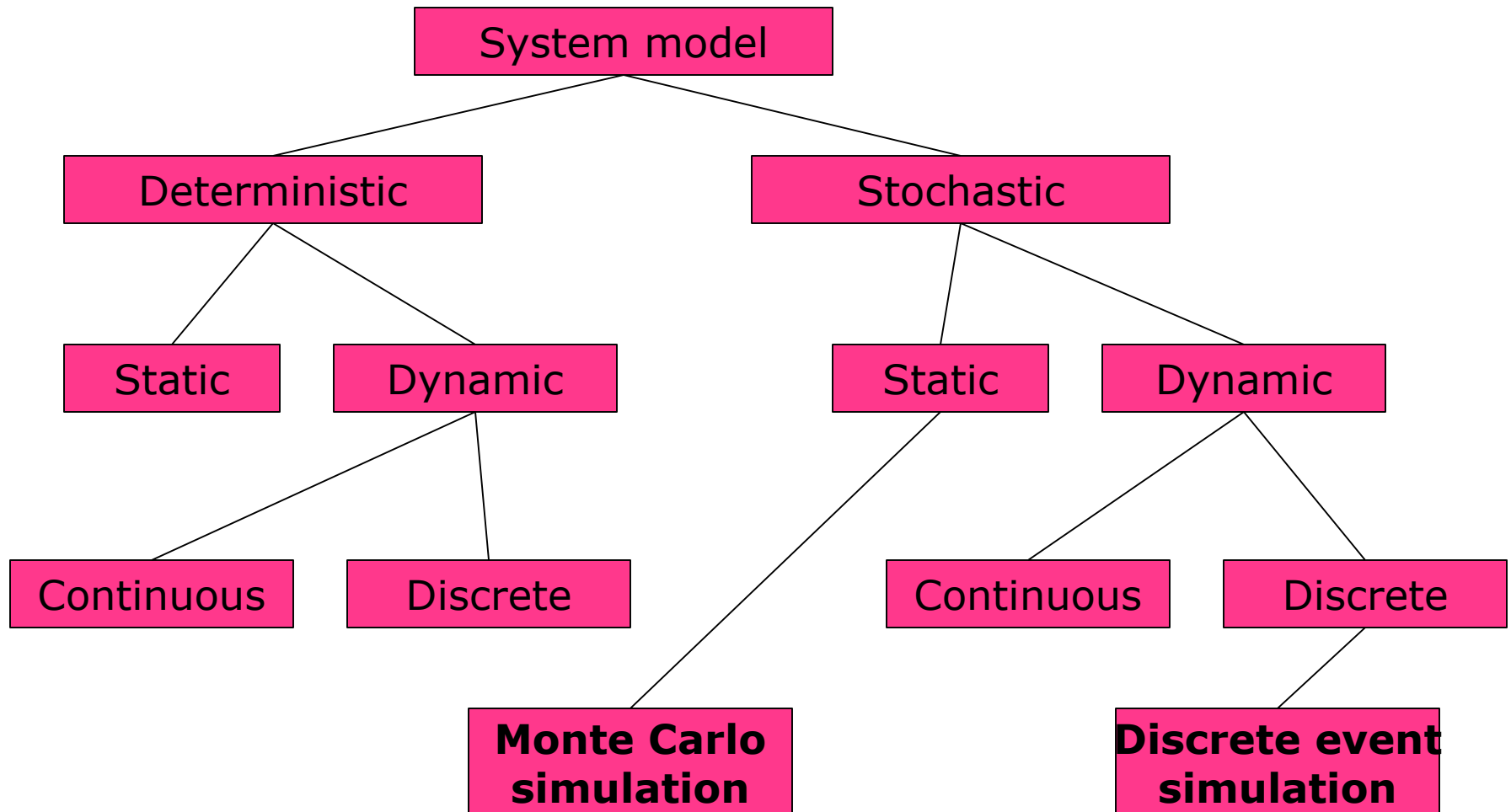
□ Discrete-Event Simulation

- Stochastic
- Discrete
- Dynamic

□ Monte Carlo Simulation

- Stochastic
- Static

Characterization of Models



Building DES Model

- ❑ Algorithm 1.1: How to develop a model?
 - Determine goals and objectives
 - Build a conceptual model
 - Convert into a specification model
 - Convert into a computational model
 - Verify: do we build the model right (do we meet the specification)?
 - Validate: do we build the right model (do we analyze the system to be analyzed)?
- ❑ An iterative process

Building DES Model: Three Levels

□ Conceptual

- How comprehensive should the model be?
- What are the state variables, which are dynamic, which are stochastic, which are important?
- System diagrams

□ Specification

- On paper
- May involve equations, pseudo-code, algorithms, etc
- How will the model receive input, what the output are

□ Computational

- A computer program
- General purpose or simulation programming language?

Building DES Model: Verification vs. Validation

□ Verification

- Did we build the model right?
 - Computational model should be consistent with specification

□ Validation

- Did we building the right model?
 - Computational model should be consistent with the system analyzed
 - Can an expert distinguish simulation output from system output?

Summary

- ❑ Model and simulation: an overview
- ❑ Reading assignment:
 - The machine shop model (section 1.1.1 – 1.1.3 in the textbook)