

CSE 411

SIMULATION AND MODELING

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Reading Material



- **Discrete-Event System Solution**

 - **Fifth Edition** is latest, is it available in bd market ?

 - Jerry Banks, John Carson II, Barry Nelson, David Nicol

- **Simulation Modeling and Analysis**

 - Third Edition

 - Averill M. Law, W. David Kelton

- **Some soft materials, I'll provide from time to time**

Course Instructor

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Into the course ...

Simulation and Modeling



Simulation is the imitation of the operation of a real-world process or system over time.

Simulation involves the generation of an artificial history of the system, and the observation of that artificial history to draw inferences concerning the operating characteristics of the real system that is represented.

A **model** is a representation of a real system.

State and Event



An **event** is an occurrence that changes the state of the system.

The **system state variables** are the collection of all information needed to define what is happening within the system to a sufficient level at a given point in time.

Types of System



Discrete

State variables change instantaneously at separate points of time.

Bank : Number of customers 0, 1, 2 ... Discrete Variable

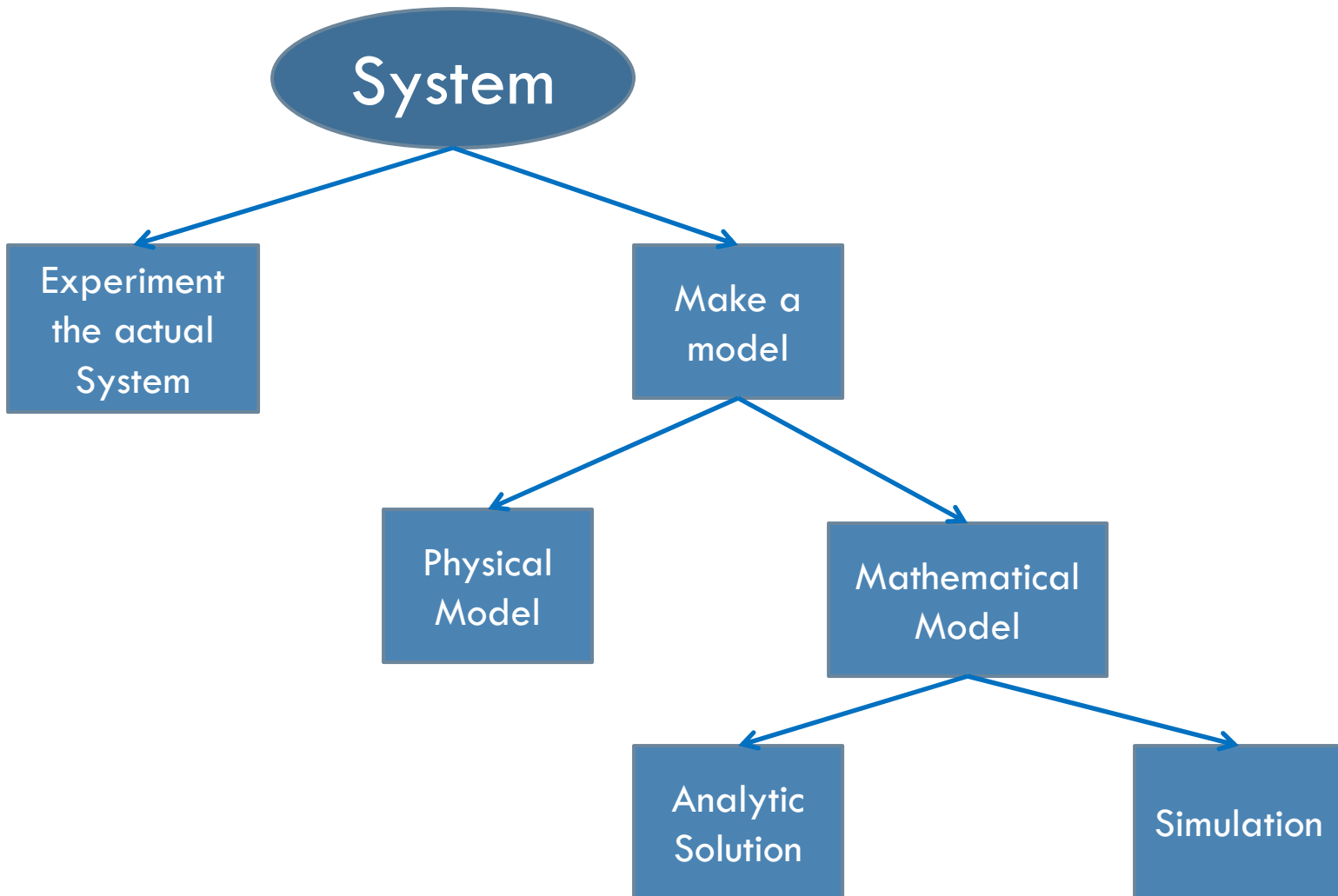
Networking : Number of packets received ... Discrete Variable

Continuous

State variables change continuously with respect to time.

Example : Pressure, Temperature ...

Ways to study a System



Types of Simulation Models



- **Static vs. Dynamic**

- Static : Time frozen
- Dynamic : Over time ...

- **Deterministic vs. Stochastic**

- Deterministic : Does not contain any probabilistic element

- **Continuous vs. Discrete**

- Concerned state variables continuous or discrete

Application of Simulation

Simulation in Computer Science and Engineering

VLSI Circuit Simulation before fabrication

Networking Simulation

NS-2

Glomosim

Opnet

Simulated Operating System

Nachos

Simulation of computer architecture

Simulated machine

Vmware

Simulation : Industrial Engineering



- Analyze manufacturing systems
- Experiment with financial systems
- Simulate inventory systems
- Process simulation

Mainly Queueing systems ...

Stochastic simulations ...

General purpose simulation software GPSS/H, Arena

Simulation : General Science

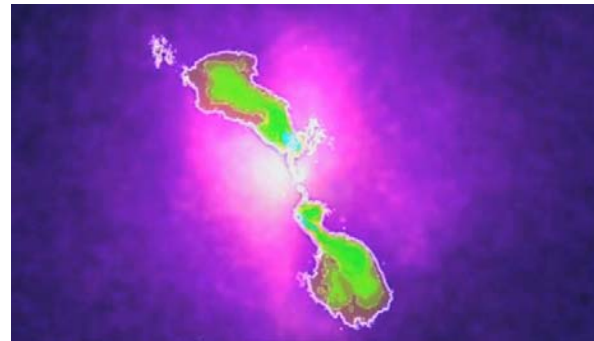
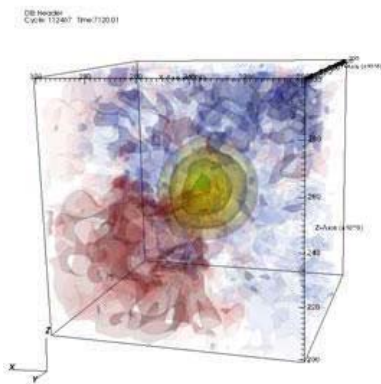
In general continuous simulations ...

Weather forecast

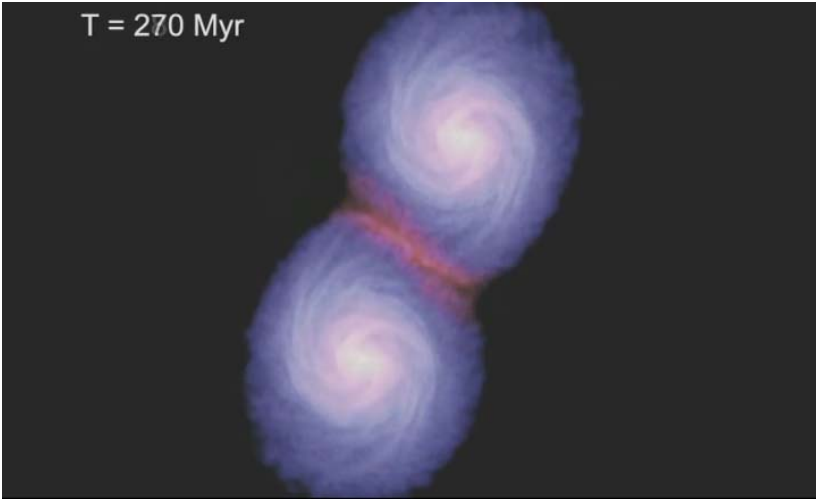
Environmental simulation

Atomic reactor simulation

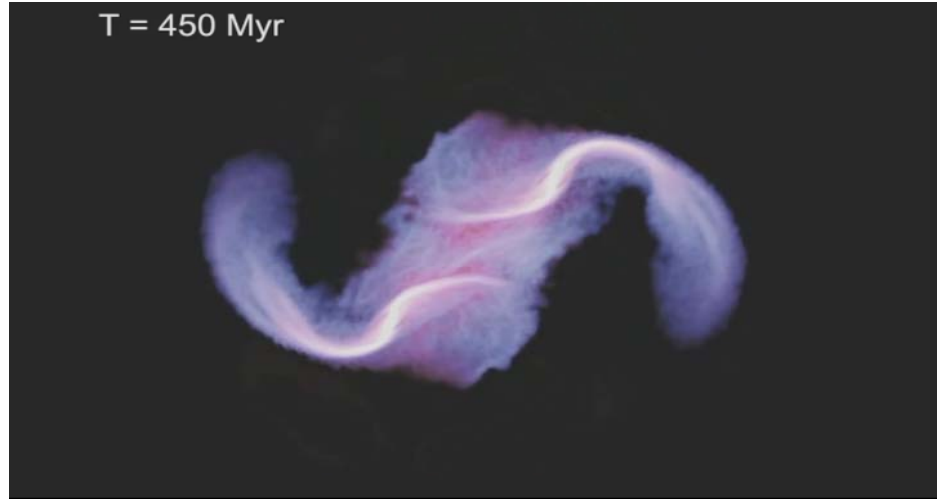
Cosmophysical simulation



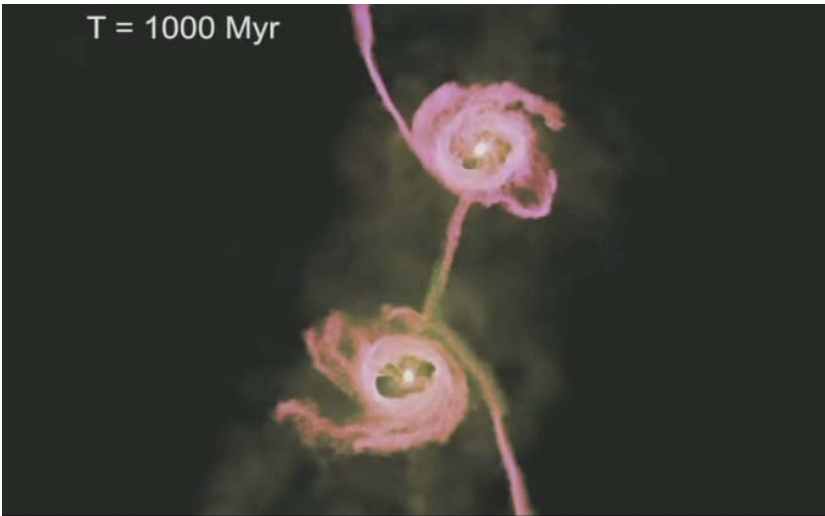
T = 270 Myr



T = 450 Myr



T = 1000 Myr



T = 1340 Myr

