Introduction to Modeling and Simulation

1. Introduction

Simulation modeling has been used in a wide range of physical and social sciences and engineering fields, ranging from nuclear fusion to economic forecast to space shuttle design. For different types of situations and systems, different types of models are used. In classifying simulations, there are important distinctions among the types of models that are being simulated, and among the types of program structures that are used to carry out the simulation.

2. Definitions

» A system is a group of objects that are joined together in some regular interaction toward the accomplishment of some purpose.
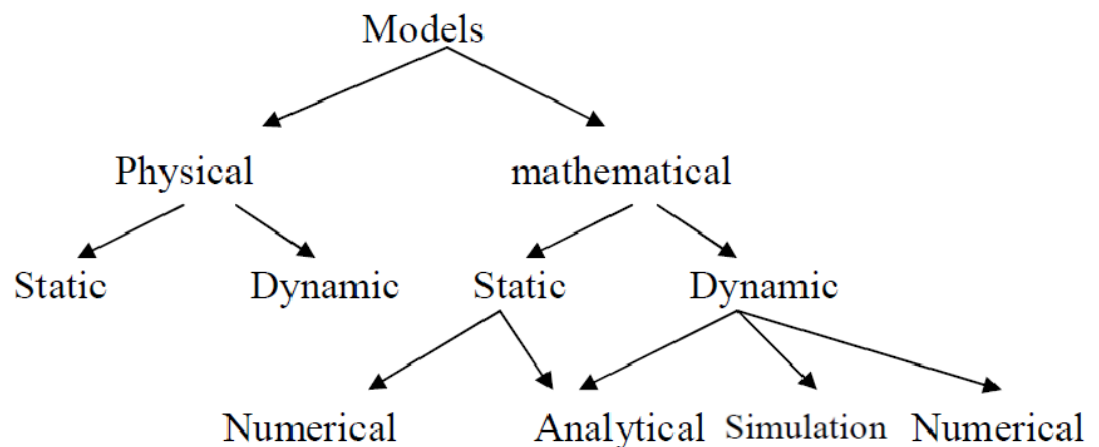
» A process is a Sequence of events ordered on time.

» A Model is a representation of an object, a system, or an idea in some form other than that of the entity itself.

Types of Models:
1. Physical
2. Mathematical

3. The Simulation

A Simulation of a system is the operation of a model which is a representation of that system.

Applications of Simulation

1. Designing and analyzing manufacturing systems
2. Evaluating H/Wand S/W requirements for a computer system.
3. Designing or Evaluating a new system.

Types of simulation models

1. In a **deterministic simulation**, all of the events and relationships among the variables are governed entirely by a combination of known, but possibly complicated, rules.
2. In a **stochastic simulation**, are included in the model to represent the influence of factors that are unpredictable, or unknown.

The cost of simulation

There are actually at least three components to the cost of simulation:

1. Purchase price of the software
2. Programmer/ Analyst time
3. Timeline of Results

Simulation Tools

1. a general purpose language

Advantages:

    a) Little or no additional software cost

    b) Universally available

    c) No additional training

Disadvantages:

    a) Every model starts from scratch

    b) Very little reusable code

    c) Long development cycle for each model

2. a general simulation language

Advantages:

    a) Standardized features often needed in modeling

    b) Shorter development cycle for each model

    c) Very readable code

Disadvantages:

    a) Higher software cost

    b) Additional training required

    c) Limited portability

3. a special purpose simulation package

Advantages

    a) Very quick development of complex models

    b) Short learning cycle

    c) No programming

Disadvantages

    a) High cost of software

    b) Limited scope of applicability

    c) Limited flexibility