Modeling and Simulation

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Concepts

- **Model:** A simplified representation of a system, entity, phenomenon, or process.
- **Simulation:** The process of running the model over time to understand the behavior of the real system.
- **Abstraction:** The process of focusing on the essential features of the system while ignoring irrelevant details.

Classification of Simulation Systems

- **Static vs. Dynamic:**
  - Static models represent a system at a specific point in time.
  - Dynamic models capture the system's behavior over time.
- **Deterministic vs. Stochastic:**
  - Deterministic models have a predictable outcome for a given set of inputs.
  - Stochastic models involve randomness, leading to a range of possible outcomes for the same input.
- **Discrete vs. Continuous:**
  - Discrete models represent systems that change in distinct steps or jumps.
  - Continuous models represent systems that change smoothly and continuously over time.

Steps of a Simulation Study

- **Problem Formulation:** Clearly define the problem or question you want to answer using the simulation.
- **Model Development:** Choose the appropriate type of model (static/dynamic, deterministic/stochastic, discrete/continuous) and build the model based on the system's characteristics.
- **Experimentation:** Design and run simulations, varying the input parameters to observe the model's behavior.
- **Analysis and Interpretation:** Analyze the simulation results, draw conclusions, and interpret the findings in the context of the original problem.