

Verification, Validation and Calibration of Simulation Model

Lecture # 31 & 32

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V&V

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- The goal of the validation process is two-fold:
 1. To produce a model that represents true system behavior closely enough for the model to be used as a substitute for the actual system for the purpose of experimenting with the system, analyzing, system behavior, and predicting system performance; and
 2. To increase the credibility of model to an acceptable level, so that the model will be used by managers and other decision makers.



Verification

- Verification is concerned with building the model correctly. It proceeds by the comparison of the conceptual model to the computer representation that implements that conception.
- It asks the questions:
 - Is the model implemented correctly in the simulation software?
 - Are the input parameters and logical structure of the model represented correctly?

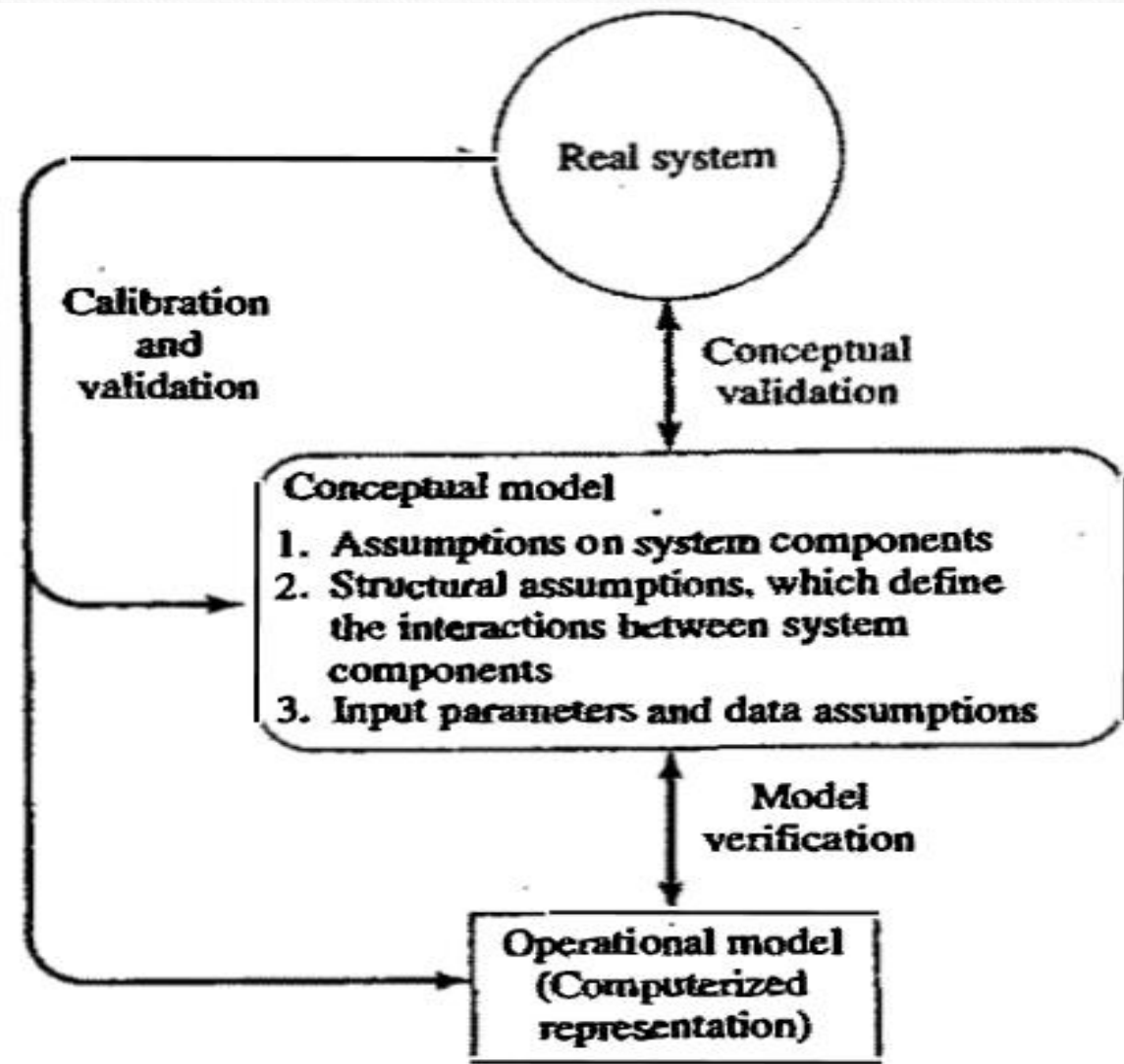


Validation

- Validation is an integral part of model development.
- Validation is concerned with building the correct model. It attempts to confirm that a model is an accurate representation of the real system.
- Validation is usually achieved through the calibration of the model, an iterative process of comparing the model to actual system behavior and using the discrepancies between the two, and the insights gained, to improve the model. This process is repeated until model accuracy is judged to be acceptable



Model Building, Verification and Validation



Techniques to perform Verification of Simulation Model

- Use good programming practice
- Use structured walkthroughs
- Use a trace
- Check simulation output for reasonableness
- Animate
- Compare final simulation output with analytical results

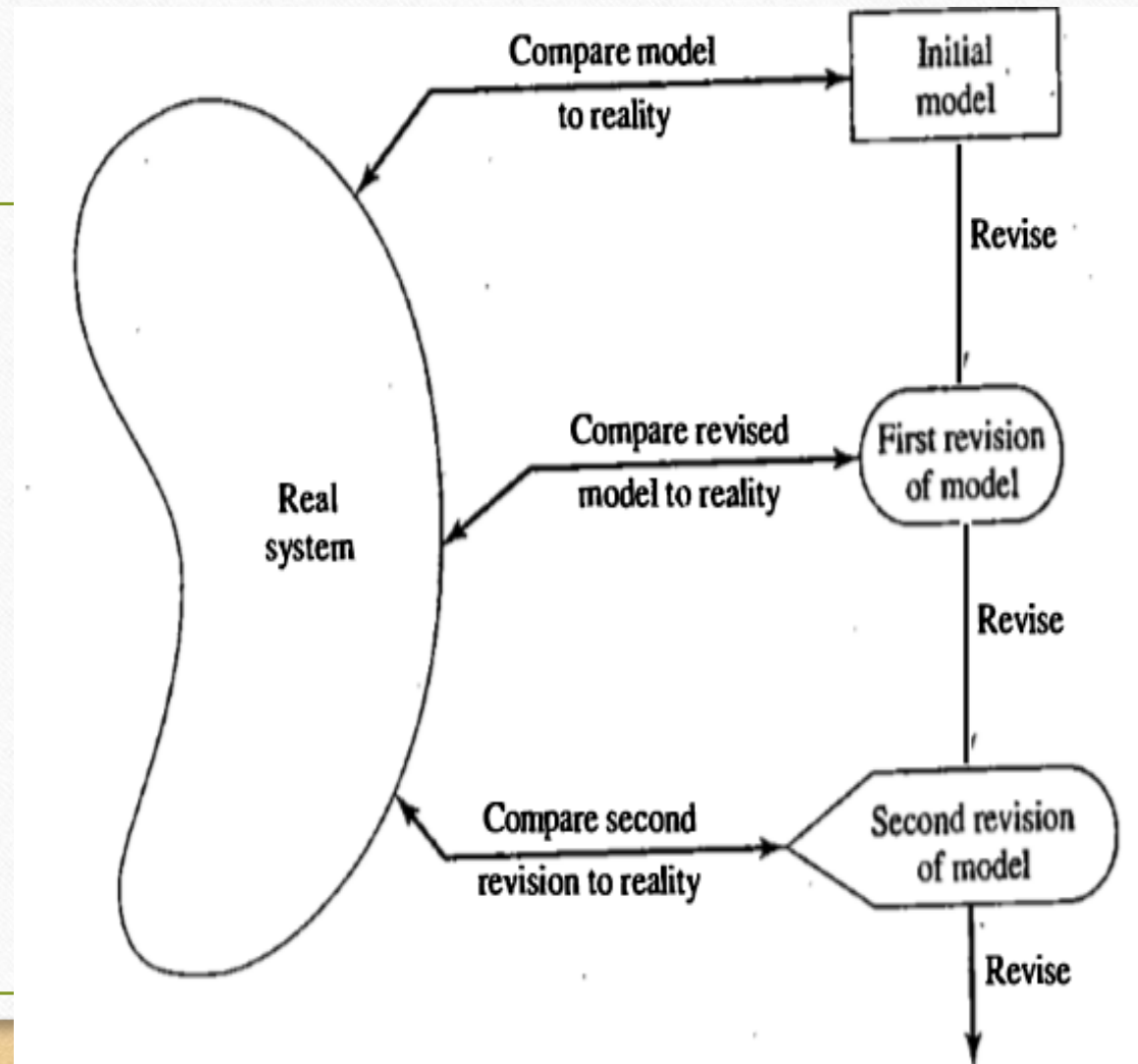


Calibration of Simulation Model

- It is the process of comparing the model to the real system, making adjustments to model, comparing again and so on.
- Comparisons of model to the reality is carried out by variety of test
 - **Subjective tests:** Usually involve people, who are knowledgeable about one or more aspects of the system, making judgments about the model and its output.
 - **Objective tests:** always require data on the system's behavior, plus the corresponding data produced by the model. Then one or more statistical tests are performed to compare some aspect of the system data set with the same aspect of the model data set



Calibration of Simulation Model



Techniques for Validation of Simulation Model

- **3 Step Approach**

1. **Build model that has high face validity**

- Ensure high degree of realism.
- The model must be discussed with system experts while designing.
- The modeler must interact with client throughout the process.
- The output must be supervised by system experts.
- Sensitive analysis can also be used to check model's face validity.



Techniques for Validation of Simulation Model

2. Validation of Model Assumptions

- **Structural assumptions:** involve questions of how the system operates and usually involve simplifications and abstractions of reality.
- **Data assumptions:** should be based on the collection of reliable data and correct statistical analysis of the data.



Techniques for Validation of Simulation Model

3. Validating input-output Transformations:

- Determine how close is the simulation output with real system output
- Statistical models can be used to compare model output with real system output.
- **Validating Existing System**
- **Validating First Time Model:**
 - Subsystem Validity
 - Internal Validity
 - Sensitivity Analysis
 - Face Validity

