Chapter 4
Verification and Validation of Simulation Models

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ABSTRACT

*Unfortunately, cost and time are always restraints; the impact of simulation models to study the dynamic system performance is always rising. Also, with admiration of raising the network security models, the complexity of real model applications is rising too. As a result, the complexity of simulation models applications is also rising and the necessary demand for designing a suitable verification and validation systems to ensure the system reliability and integrality is very important. The key requirement to study the system integrity is to verify the system accuracy and to validate its legality regarding to pre-specified applications causes and validly principles. This needs different plans, and application phases of simulation models to be properly identified, and the output of every part is properly documented. This chapter discusses validation and verification of simulation models. The different approaches to deciding model validity are presented; how **model validation** and verification relate to the **model development process** are discussed; various **validation techniques** are defined; **conceptual model validity**, **model verification**, **operational validity**, and **data validity**; superior verification and validation technique for simulation models relied on a **multistage approach** are described; ways to **document** results are given; and a recommended procedure is presented.*

INTRODUCTION

Regarding rigorous analysis of divers current ideas for verification and validation of simulation models,

the specialists impression of model development and their knowledge in verification and validation of simulation models in organizations (Brade and Lehmann, 2002), within the topics of the Symposium in 2002 a developed structured verification and validation method, also denoted to as verification

and validation triangle (Brade, 2003). This method deal with the following key points of successful verification and validation:

*   Using the structured and **stepwise technique**
*   Reengineering verification and validation throughout **model development**
*   Testing intermediate results
*   Constructing a chain of facts relied on verification and validation results
*   supplying templates for **documentation** of verification and validation activities and findings
*   Accomplish verification and validation activities separately.

To perform this aim, the standard **verification and validation triangle** provides:

*   An outline of fault types that are probably is concealed in the intermediate result on which the verification and validation activities are concentrated.
*   **Verification and validation stages** to measure the accuracy and validity of every intermediate result separately.
*   **Verification and validation sub stages** with generic verification and validation goals to investigate the possible test of certain types of intermediate results and outside information.
*   Guide point to implement verification and validation methods and to reuse formerly generated verification and validation results.
*   Outline the dependence between various verification and validation goals and the effect of cyclic test on the integrity of the simulation model.

Simulation models are increasingly employed these days in solving difficulty and in decision making. Thus, a developers and consumers of these models, the decision makers with data resulting from a findings of the systems, and individuals affected via decisions relied on such systems are accurately concerned if the system and its finding are accurate. This matter is addressed during **model validation and verification**. Model validation is generally defined a corroboration that a computerized model with its area of applicability possesses an acceptable range of accuracy reliable with the planned use of a model and is a definition employed. Model verification is often defined as ensuring that a program of a computerized system and its performance are accurate, and is a definition accepted. The system becomes accredited during model accreditation. The system accreditation concludes if the system satisfies specified model accreditation measures consistent with the particular process. The related issue is system reliability. The system reliability is concerned with developing a confidence wanted via possible users in the system and in a data resulting from a system that they are eager to employ a system and a resulting data.

The model must be developed for a specific aim and its validity fixed with respect to that aim. When the aim of the system is to solve a selection of questions, a validity of a system wants to be fixed with respect to every question. Many collection of **experimental status** are usually needed to define the area of system **intended applicability**. The system can be valid for one collection of experimental status and invalid for another. The model is measured valid for a collection of experimental status when its precision is within its satisfactory range that is the amount of precision needed for a system intended aim. This usually needs the system result variables of interest that is a system variables employed in solving the questions that a system is being developed to answer is specified and that their needed amount of precision is specified. The amount of precision needed must be identified before to beginning the **development of a system** for each early in the system development process. When the variables

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