Chapter VIII

Discrete Event Simulation Process Validation, Verification, and Testing

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Abstract

This chapter introduces validation, verification, and testing tools and techniques pertaining to discrete event simulation. The chapter distinguishes between validation and verification within the context of discrete event simulation. Then, we will show the importance of such topic by revealing the amount research done in simulation validation and verification. The chapter subsequently discusses the reasons why simulation projects fail and the sources of simulation inaccuracies. Next, the chapter gives different taxonomies for validation, verification, and testing techniques (VV&T) for both types of simulation systems: object-oriented-based and algorithmic-based. Therefore, the chapter will present a translation of thirteen software-engineering practices suggested for simulation projects. Notwithstanding the significance of providing an objective assessment platform, as such, the chapter will shed light on the independence of VV&T pertaining to simulation systems.
Introduction

Simulation software systems have certain characteristics that make them different from other software systems, consequently, and due to the special nature of simulation-software systems; VV&T techniques of simulation systems must be looked at closely. First, the chapter makes the distinction between validation and verification pertaining to simulation systems. Then, the chapter shows the motivation for VV&T in simulation through two ways: First is the different nature of the VV&T in simulation-software systems. The second is showing the amount of research done in VV&T of simulation-software systems, which only emphasizes the importance of such topic. The chapter subsequently discusses the why simulation projects fail and the sources of simulation inaccuracies. Thus, the chapter gives different taxonomies for VV&T for both types of simulation systems: object-oriented-based and algorithmic-based. Therefore, the chapter will present a translation of thirteen software-engineering practices suggested for simulation projects. Notwithstanding the significance of providing an objective assessment platform, as such, the chapter will shed light on the aspect of the independence of VV&T pertaining to simulation. Finally, the chapter highlights some future trends in the automation of VV&T.

V&V Definition and Distinction

In order to be able to discuss V&V, they must first be based on their original definition, which fully comprehends the true denotation of V&V as related to simulation systems. Sommerville (2001) defines validation by raising the question “are we building the right product?” (p. 420), while defining verification by raising another question “are we building the product right?” (p. 420). This comes from a pure software-engineering point of view, noting that the simulation perspective on the definitions of V&V are similar yet not the same. On another note, Pidd (1998) defines validation as “a process whereby we assess the degree to which the lumped model input: output relation map onto those real systems” (p. 157).

Likewise, Pidd (1998) distinguishes validation from verification by referring to verification as “a process by which we try to assure ourselves that the lumped model is properly released in the computer program. The Lumped model is defined as an explicit and simplified version of the base model and is the one which will be used in management science” (p. 157). While Smith (1998) paraphrases validation as answering the question “Are we building the right product?” (p. 806) and verification as answering the question, “Are we building the product right?” (p. 806), Balci, (1995, 2003), Banks (1999), and Kleignen, Bettonvil, and Gmenendahl (1996) define model validation as follows:

Model validation is substantiating that the model, within its domain of applicability, behaves with satisfactory accuracy consistent with the study objectives. Model validation deals with building the right model. It is conducted by running the model under the “same” input conditions that drive the system and by comparing model behavior with the system behavior. (Balci, 1995, p. 147)