The Treatment of Model Uncertainties under the Presence of Parametric Uncertainty Sources in Risk and Reliability Analysis

K.I. Ahn, J.E. Yang
Korea Atomic Energy Research Institute
P.O. Box 105, Yusong-ku, Dukjin-dong, Taejon,

Abstract

Analyses for complex real-world systems inevitably involve many uncertainties and their analysis is one of the essential processes to address our state-of-knowledge in evaluating performance of these systems. In this point, primary concerns of the uncertainty analysis are to understand why uncertainties arise, and to evaluate how they impact the results of the analysis. In recent times, the uncertainty analysis has focused on parameters of the logical or physical models being used in PSA. As the field of PSA matures, more attention is paid to the explicit treatment of uncertainty sources that are addressed in the models themselves and the accuracy of the models. When the model uncertainties are incorporated into a formal framework of uncertainty analysis, the primary step for evaluating impacts of these uncertainties is to determine sources and types of uncertainty to be addressed in an underlying model itself and in turn model parameters. Depending on the states of knowledge involved in the subject of interest and available evidence, we can choose either a deterministic model or an aleatory model. In addition, uncertainties addressed in parameters of the underlying model can be modeled in a different way, e.g., epistemic, aleatory, or both of them. The foregoing classification of uncertainty sources is related to important practical aspects of modeling for complex technological systems and we have clear advantages of the separation in real applications. The main objective of this paper is to clarify various sources of uncertainty that would often be encountered in the modeling process for the risk and reliability analysis and introduce underlying approaches for handling them quantitatively.