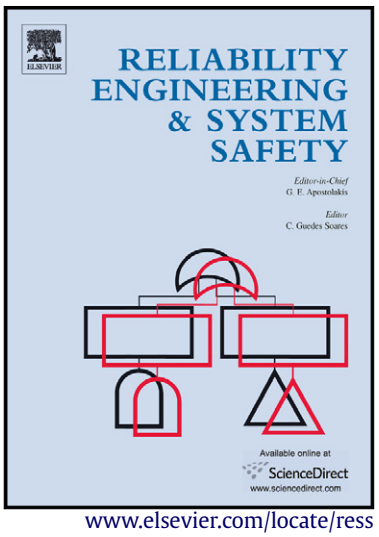

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ADVANCED SURROGATE MODEL AND SENSITIVITY ANALYSIS METHODS FOR SODIUM FAST REACTOR ACCIDENT ASSESSMENT

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Abstract

Within the framework of the generation IV Sodium Fast Reactors, the safety in case of severe accidents is assessed. From this statement, CEA has developed a new physical tool to model the accident initiated by the Total Instantaneous Blockage (TIB) of a sub-assembly. This TIB simulator depends on many uncertain input parameters. This paper aims at proposing a global methodology combining several advanced statistical techniques in order to perform a global sensitivity analysis of this TIB simulator. The objective is to identify the most influential uncertain inputs for the various TIB outputs involved in the safety analysis. The proposed statistical methodology combining several advanced statistical techniques enables to take into account the constraints on the TIB simulator outputs (positivity constraints) and to deal simultaneously with various outputs. To do this, a space-filling design is used and the corresponding TIB model simulations are performed. Based on this learning sample, an efficient constrained Gaussian process metamodel is fitted on each TIB model outputs. Then, using the metamodels, classical sensitivity analyses are made for each TIB output. Multivariate global sensitivity analyses based on aggregated indices are also performed, providing additional valuable information. Main conclusions on the influence of each uncertain input are derived.

Keywords: Physical-probabilistic approach, safety assessment, sensitivity analysis, metamodel, constrained Gaussian process, dependence measures.

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