An uncertainty and sensitivity analysis of dynamic operational risk assessment model: A case study

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ABSTRACT

In Dynamic Operational Risk Assessment (DORA) models, component repair time is an important parameter to characterize component state and the subsequent system-state trajectory. Specific distributions are fit to the industrial component repair time to be used as the input of Monte Carlo simulation of system-state trajectory. The objective of this study is to propose and apply statistical techniques to characterize the uncertainty and sensitivity on the distribution model selection and the associated parameters determination, in order to study how the DORA output that is the probability of operation out-of-control, can be apportioned by the distribution model selection. In this study, eight distribution fittings for each component are performed. Chi-square test, Kolmogorov–Smirnov test, and Anderson-Darling test are proposed to measure the goodness-of-fit to rank the distribution models for characterizing the component repair time distribution. Sensitivity analysis results show that the selection of distribution model among exponential distribution, gamma distribution, lognormal distribution and Weibull distribution to fit the industrial data has no significant impact on DORA results in the case study.

Keywords: Uncertainty characterization; Sensitivity analysis; Dynamic operational risk assessment; Goodness-of-fit