A Reliability Model for Safety Instrumented System

Rachid Ouache[a], Muhammad Nomani Kabir[b], Ali A.J. Adham[c]

[a] Faculty of Engineering Technology, University Malaysia Pahang, 26300, Malaysia

[b] Faculty of Computer Systems & Software Engineering, University Malaysia Pahang, 26300, Malaysia

[c] Faculty of Industrial Management, University Malaysia Pahang, 26300, Malaysia

ABSTRACT

Safety analysis in the companies is an important issue besides the quality, productivity and profitability. Safety integrity function in many industries is based on safety instrumented systems. Uncertainty is the main problem of safety analysis. In this paper, a new mathematical model is developed to compute the probability of failure on demand (PFD) following the three steps. First, KHALFI (Characteristics of Hazard Analysis based on Logic Frequency Initiative) mathematical model is formulated to identify the real PFD at any geographical location considering five intermediate factors: temperature, humidity, pressure, wind speed and time which can affect the PFD. Second, probability binary state (PROBIST) is used to precise the values of PFD. Third, Bowtie method is employed to carry out the safety analysis for examining the safety of some scenarios by determining the PFD of safeguards, where new classification for the safety integrity level is proposed. Finally, Simulink model is developed implementing the proposed model to facilitate the automatic computation and analysis. Results indicate that all the atmospheric elements are significant and need to be taken into consideration to attain the best reliability in the calculation of PFD. The effectiveness of the proposed model gives the opportunity for the analysts to conduct safety analysis at any geographical location.

KEYWORDS: Reliability; Safety Integrity Function (SIF); Atmospheric element; Safety assessment; Probability of failure on demand

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