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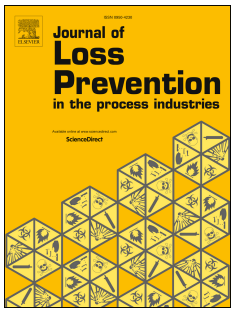

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Availability Analysis of Safety Critical Systems Using Advanced Fault Tree and Stochastic Petri Net Formalisms

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Abstract

Failure scenarios analysis constitutes one of the cornerstones of risk assessment and availability analysis. After a detailed review of available methods, this paper identified two distinct formalisms to analyse failure scenarios and systems' availability: generalized stochastic Petri nets (GSPN) and Fault tree driven Markov processes (FTDMP). The FTDMP formalism is a combination of the Markov process and the fault tree. This aims to overcome fault tree limitations while maintaining the use of deductive logic. The GSPN is a Petri net with probabilistic analysis using Monte Carlo simulation. The effectiveness of both methods is studied through an emergency flare system including a knockout drum. It is observed that GSPN provides a robust and reliable mechanism for accident scenario analysis. It provides additional information such as events' frequencies at operating and failing modes and expected occurrence timing and durations resulting from different complex sequences. Even for multi-state variables which could be used to design a safety management system. Although FTDMP is a powerful formalism, it provides limited information.

Keywords: Stochastic Petri nets, fault tree, Multi-Phase Markov Model, Safety Analysis, Monte Carlo simulation