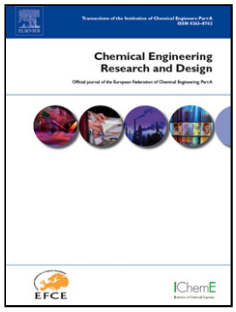

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Dynamic safety analysis of process systems using nonlinear and non-sequential accident model

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Abstract

Analysis of the safety and reliability of complex engineering systems is becoming challenging and highly demanding. In complex engineering systems, accident causation is a function of nonlinear interactions of several accident contributory factors. Traditional accident models normally use a fault and event trees sequential approach to predict cause-consequence relationships, which unable to capture real interaction thus have limited predictability of accident.

This paper presents a new non-sequential barrier-based process accident model. The conditional dependencies among accident contributory factors within prevention barriers are modelled using the Bayesian network with various relaxation strategies, and non-sequential failure of prevention (safety) barriers. The modelling of non-linear interactions in the model led to significant improvement of the predicted probability of an accident when compared with that of sequential technique. This renders valuable information for process safety management. The proposed accident model is tested on a real life case study from the U.S Chemical Safety Board.

Keywords: Sequential accident model, Non-sequential accident model, Accident prediction, Bayesian network analysis, Leaky Noisy-OR Gate