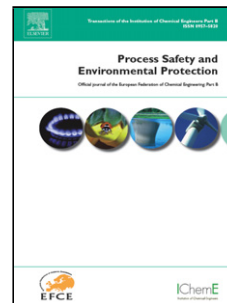


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Authors: Chen Chen, Yabin Yang, Mengtong Wang, Xinmei Zhang



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Characterization and Evolution of Emergency Scenarios Using Hybrid Petri Net

Chen Chen; Yabin Yang; Mengtong Wang;

(School of Economics & Management

China University of Petroleum

Qingdao, China)

Xinmei Zhang

(College of Mechanical & Electronic Engineering

China University of Petroleum

Qingdao, China)

Highlights

- Scenario was characterized from discrete and continuous perspectives by Petri nets.
- Scenario standardized expression was got by knowledge element and hierarchical model.
- Scenario evolution knowledge base can be constructed for emergency decision-making.

ABSTRACT

Accident scenarios are the foundations of emergency responses. Hybrid Petri net is used to model emergency scenarios and responses comprehensively and systematically. Here, both the discrete events of scenarios and their evolution are characterized clearly. Elements of accident scenarios are expressed normatively using a knowledge element model and hierarchical theory, providing standardized descriptions of the different scenario stages. Then, a case study of an oil pipeline leak is examined to verify the logic of the hybrid Petri net and the expressions of attributes using the knowledge element model. The results show objective realizations of the scenario and the evolution of emergent events, enabling a formalized expression of emergency knowledge that can be used to establish an emergency knowledge base.

Keywords: emergency scenario; hybrid Petri net; knowledge element model; characterization

1. Introduction

Emergency scenario is the foundation and starting point of emergency management, especially in “scenario-response” decision paradigm. It is so important to characterize it systematically and comprehensively that the decision-makers can determine the trend of scenarios scientifically and put forward response measures effectively. In many countries, major hazard facilities and other process installations are required by law to not only perform hazard identification before the start of operations but also on a regular, repeating basis such as 5 years for the life of the installation. This requirement signifies the importance of the activity. Missing a scenario and therefore not being prepared to prevent and counter the undesirable outcomes may lead to disaster.

Herman Kahn and Wiener, who first presented the analysis method of scenario, made a systematic explanation of the scenario: scenario is a description of what might happen in the

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