Process Risk Assessment using Dynamic Simulation of Scenarios - DTU Orbit (08/11/2017)

Process Risk Assessment using Dynamic Simulation of Scenarios

Process plants may be very complex and may combine various processes in close proximity. Hence, the response to accidents may easily grow complex. Traditionally, after gathering and getting acquainted with the plant's technical information, risk is analysed in prescribed steps starting with hazard identification, description of accident scenarios and using the conventional approach to develop static event trees for events following a loss of containment. Modelling the impacts and consequences needs models to describe the release, dispersion and effect of the hazardous material, as well as models for predicting the egress time of people, response times of detectors and other safety equipment. A common assumption is the independence of these models and their sequential treatment, but often the consequences and effects are mutually dependent. The prediction of the consequences and effects are deterministic assignments applying simplified engineering models with averaged/expected values as input to account for the characteristics of the system, e.g. describing the physical and environmental phenomena and workers responses. The size of the release and dispersion depends on technical and environmental parameters. Ignition sources may be permanent or temporarily present at various locations near the release. The response times of detectors may be dependent on the velocity of cloud spread. The available save egression time depends on these parameters. Such dynamics are easily modelled using Discrete Event Simulation (DES) of the scenarios, which is a Monte Carlo type method.
The paper describes the application of DES to conduct the analysis part of a risk assessment that enables better time resolution in the modelling of the specific scenarios, simulate the interactions between concurrent chains of events under the hazardous scenarios, and produce probabilistic risk measures. The outcome provides possibilities to structure the results in a comprehensive way. Scenarios with severe consequences can be ‘played back’ to learn from them and can be animated, which apart from the learning effect provides a new way of validation.

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