The development and application of dynamic operational risk assessment in oil/gas and chemical process industry

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ABSTRACT

A methodology of dynamic operational risk assessment (DORA) is proposed for operational risk analysis in oil/gas and chemical industries. The methodology is introduced comprehensively starting from the conceptual framework design to mathematical modeling and to decision making based on cost–benefit analysis. The probabilistic modeling part of DORA integrates stochastic modeling and process dynamics modeling to evaluate operational risk. The stochastic system-state trajectory is modeled according to the abnormal behavior or failure of each component. For each of the possible system-state trajectories, a process dynamics evaluation is carried out to check whether process variables, e.g., level, flow rate, temperature, pressure, or chemical concentration, remain in their desirable regions. Component testing/inspection intervals and repair times are critical parameters to define the system-state configuration, and play an important role for evaluating the probability of operational failure. This methodology not only provides a framework to evaluate the dynamic operational risk in oil/gas and chemical industries, but also guides the process design and further optimization. To illustrate the probabilistic study, we present a case-study of a level control in an oil/gas separator at an offshore plant.

Keywords: Dynamic operational risk assessment; Discrete event simulation; Probabilistic simulation; Dynamic simulation; Stochastic model; Process dynamics model