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Intelligent Systems for Process Hazards Analysis of ComplexChemical Plants: Challenges and Emerging Trends

Professor Venkat Venkatasubramanian
Laboratory for Intelligent Process Systems
School of Chemical Engineering
Purdue University
W. Lafayette, Indiana 47907

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ABSTRACT

Process safety, occupational health, and environmental issues are ever increasing in importance in response to heightening public concerns and the resultant tightening of regulations. The process industries are addressing these concerns with a systematic and thorough process hazards analysis (PHA) of their existing as well as new facilities.

Given the enormous amounts of time, effort, and money involved in performing the PHA reviews, there exists considerable incentive for automating the process hazards analysis of chemical process plants. An intelligent system that can reduce the time, effort, and expense involved in a PHA review, make the review more thorough and detailed, minimize human errors, and free the team to concentrate on the more complex aspects of the analysis which are unique and difficult to automate is needed. Also, an intelligent PHA system can be

integrated with CAD systems and used during early stages of design, to identify and decrease the potential for hazardous configurations in later design phases where making changes could be economically prohibitive. It would facilitate automatic documentation of the results of the analysis for regulatory compliance. Also these PHA results can be made available online to assist plant operators during diagnosis of process disturbances.

Despite the obvious importance of this area, there has only been limited work on developing intelligent systems for automating PHA of process plants. In this paper, we will review the important approaches towards the automation of PHA from the perspective of intelligent systems, identifying the challenges, and outlining the emerging trends. In particular, we will discuss the promising potential of the HAZOPexpert, Batch HAZOPexpert, and PHAzer systems developed at Purdue University. The substantial progress that has been made in the HAZOPexpert project in the U.S. and the STOPHAZ project in Europe suggests that the technology is now well beyond proof of concept and is ready for industrial applications and commercial exploitation. This progress has promising implications for inherently safer design, operator training, and real-time fault diagnosis.

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