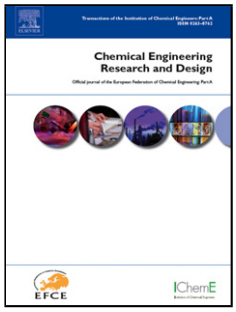

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On Integration of Feedback Control and Safety Systems: Analyzing Two Chemical Process Applications

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Abstract

This work focuses on two case studies and attempts to elucidate the dynamic interaction between feedback control and safety systems in the context of both model-based and classical control systems. In the first case study, the interaction of a model predictive control (MPC) system with a safety system is studied in the context of the methyl isocyanate (MIC) hydrolysis reaction in a continuous stirred tank reactor (CSTR) to avoid thermal runaway. We develop a fixed action for the MPC to take when the safety system is activated due to significant feed disturbances that lead to thermal runaway conditions. In the second case study, we focus on a high-pressure flash drum separator for which the temperature, level, and pressure can be regulated using proportional-integral (PI) controllers. Using an large-scale dynamic process simulator, we demonstrate that modifying the tuning parameters of one of these PI controllers based on the safety system being on or off leads to improved closed-loop performance compared to the case in which the tuning parameters of the PI controller remain the same regardless of the state of the safety system.

Key words: Model predictive control; Process control; Process safety; Reaction thermal runaway; High-pressure flash drum separator

1. Introduction

The continued occurrence of incidents in the chemical process industries, despite efforts to prevent them Center for Chemical Process Safety (2008); AIChE (1994a,b), is testament to the

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