The application of predictive fuzzy logic controller in temperature control of phenol-formaldehyde manufacturing - Using MATLAB-SIMULINK methodology

Abstract

In polymer industries, the automation and control of reactors due to the progress in the areas of fuzzy control, neural networks, genetic algorithms, and expert systems lead to more secured and stable operation. When phenol and formaldehyde are mixed together, sudden heat is produced by the nonlinear exothermal reaction. Since sudden heat is liberated, polymerisation process requires precise temperature control to avoid temperature run-away and the consequent damage to expensive materials. In practice, human involvement has been a source of errors that affects the quality of the product. This research proposes a design methodology for a sensor based computer control system. The duration of ON and OFF time of the relays is the parameters to be controlled in order to keep the exothermic reaction under control. This paper discusses a detailed simulation study of this exothermal process using MATLAB-SIMULINK-Fuzzy Logic toolbox. The model for the simulation study is derived from the constructed thermal system and responses are obtained. A predictive FLC structure is developed and compared to a classical PID control structure. Simulation results are obtained to ensure that the predictive FLC is better in controlling the reaction temperature.