J Adv Chem Eng 2018, Volume 8
DOI: 10.4172/2090-4568-C3-012

Fuzzy induced counter propagation neural network (CPNN) for the control of reactive distillation column

Vakhtang Barbakadze
Manipal Academy of Higher Education (MAHE), UAE

Reactive distillation is a combination of reaction and separation in a single column. It is beneficial for the reversible reactions in which equilibrium limits the conversion. This process is economical as two processes occurring simultaneously. But this combination makes it highly nonlinear and interacting in nature. Composition measurement using online composition analyzers is not economical as well as it requires frequent calibrations. Thus, measurement and control of product composition of reactive distillation is a challenging task. Performance of conventional controllers for such a complex and highly nonlinear process is sluggish and produces large error. The use of soft computing techniques can efficiently overcome these difficulties. In this research work, neural network based soft sensor as intelligent controllers are designed and implemented to enhance the performance of reactive distillation column. Fuzzy competitive learning-based counter propagation neural network is developed for methyl acetate reactive distillation column. Dynamical mathematical models are developed and considered for simulation study. Simulation is performed in MATLAB environment using MATLAB (2013b). In case of methyl acetate reactive distillation column, temperature profile of the column is used as secondary process variable. This temperature profile is controlled by manipulating the two feed flow rates to control product composition. Two sensitive tray temperatures by manipulating two feed flow rates are identified using gain analysis. These two sensitive tray temperatures are controlled using two PID controllers. The response of the PID controllers shows sluggish behavior and thus these PID controllers are then replaced by Fuzzy Competitive Learning based Counter Propagation Neural Network (FCPN) controller. Two more intelligent controllers namely; Dynamic Network (DN) and Back Propagation Neural Network (BPN) are also trained and tested in place of conventional PID controllers. All these controllers i.e. FCPN, DN & BPN are then compared and it is found from the result that FCPN gives superior performance.

vssakhre@gmail.com