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Comparative Simulation of PI and Fuzzy Control for Fluid Catalytic Cracking Unit

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Abstract
Author keywords
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Abstract

The fluid catalytic cracking unit converts heavy feedstocks into more valuable gasoline and oil products, representing an essential component in refineries. The variables, including gas oil supply temperature (T_f), gas oil supply flow rate (F_f), and air temperature (T_a), are controlled and manipulated by this unit, which poses a significant challenge due to its complex interactions. To address these complexities, this study investigates the control of riser and regenerator temperatures (T_R, T_G) in an industrial Universal Oil Products (UOP) fluid catalytic cracking unit using proportional-integral and fuzzy logic controllers. The fuzzy logic controller, with five fuzzy sets generating 25 rules, is implemented through MATLAB simulation. The simulation program is formulated based on the principles of mass and energy balance of the unit. The performance of the controllers, including PI and fuzzy logic controllers, is evaluated and compared by introducing disturbances in the gas oil supply temperature, gas oil supply flow rate, and air temperature. The results show that the fuzzy logic controller outperforms the PI controller, exhibiting a lower integral absolute error. Compared to the PI controller, the fuzzy logic controller demonstrates improved

performance, characterized by stable responses and shorter settling times. These findings highlight the effectiveness of the fuzzy logic controller in achieving better control performance for Fluid Catalytic Cracking Units (FCCU).

Author keywords

Fuzzy controller; MATLAB simulation; Proportional Integral Controller (PID); Regenerator; Riser

Sustainable Development Goals

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