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Mathematical Modeling, Simulation, and Analysis for Predicting Improvement Opportunities in the Continuous Catalytic Regeneration Reforming Process

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Abstract: A mathematical model and simulation of the continuous catalytic regeneration reforming process (CCRRP) were developed to identify the key opportunities for predicting the output parameters and improving the process performance. This proposed model was used to monitor the profiles of reformate yield, temperatures and pressures of reactors, octane number, hydrogen yield, and light gases. It includes a description of reforming reactions by using the lumping technique to reduce the complexity of the reactions that occur during the CCRRP. The new network model of various reactions containing 36 lumps and 55 reactions was investigated. The primary reactions included dehydrogenation, dehydrocyclization, isomerization, hydrocracking, and hydrodealkylation of the reforming process. The simulation results of the model have been validated by comparison with plant data. Average absolute deviation (AAD%) of reformate yield, temperatures and pressures of reactors, octane number, hydrogen yield, and light gases reached 2.5%, 1.03%, 2.6%, 1.3%, 0.43%, and 0.93% respectively. The evaluation of the output parameters was within the acceptable limit and a fair agreement.

Keywords:
Kinetic-reactor model, new reaction network, mathematical modeling, simulation, analysis, CCRRP.

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