Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Merging Controls Technology with CFD For Responsive Computing ERIC TURMAN, WAYNE STRASSER, Liberty University — CFD was availed to study an industrial scale multiphase reactor used in the production of low-density polyethylene (LDPE). The reactor is divided up into four zones separated by baffles designed to control mixing and meter the communication among the reactants. Five proportional integral derivative (PID) controllers were designed to independently automate five catalyst feeds throughout the reactor to match thermocouple readings to plant data. The objective of the model is to quickly respond to upset conditions in the plant that can lead to thermal runaway due to the exothermic nature of the radical chemistry within the reactor. Controller settings were tuned independently in each zone based on process art, reaction rates, convective time scales, and the proximity of thermocouples to catalyst ports. This allowed the temperature controller errors to be driven towards zero without user involvement. In addition to the reactor model, a canonical problem was used to tune a turbulence model constant. We, therefore, demonstrate the efficacy of implementing algorithmic PID control as 1) a means of automating dynamic CFD models to match plant-scale behavior and 2) a preamble to using PID methods to facilitate machine learning.

Eric Turman
Liberty University

Date submitted: 03 Aug 2020 Electronic form version 1.4