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CFD APPLICATION TO LARGE-SCALE INDUSTRIAL MULTIPHASE FLOWS: MIRACLES DO HAPPEN

Wayne Strasser

Associate chemical engineer at Eastman Chemical Company

ABSTRACT

Specialized Eulerian-Eulerian modeling frameworks based in the commercial solver backbones Fluent and CFX are used extensively for reaction engineering within Eastman Chemical Company. Four examples will be elucidated: 1) optimization of a transonic three-stream self-sustaining pulsatile coaxial airblast injector, 2) mitigating thermal runaway in an evaporative trickle bed reactor with an external temperature control loop, 3) improving yield in a slurry bubble column oxidizer in heterogeneous flow with potential oxygen starvation, and 4) identifying mass transfer limitations in a dual-blade bubbly continuous stirred tank reactor. The unit operations involved in these studies represent very large scale process equipment and multi-million dollar annual revenue streams. Additionally, the physiochemical complexities and momentum sources associated with simulating these systems create strong non-linear coupling and stretch the bounds of available numerical recipes. Modeling risks abound; therefore, judicious and validated computational methods are essential. In each of these examples, methods and data used for anchoring CFD to process reality are provided. It is shown that although these models are not designed to incorporate the complete physical picture at all scales, they are capable of guiding designs and providing results that contribute to Eastmans bottom line.