ANALYSIS OF THERMAL AND CATALYTIC CRACKING UNITS USING COMPUTATIONAL FLUID DYNAMICS

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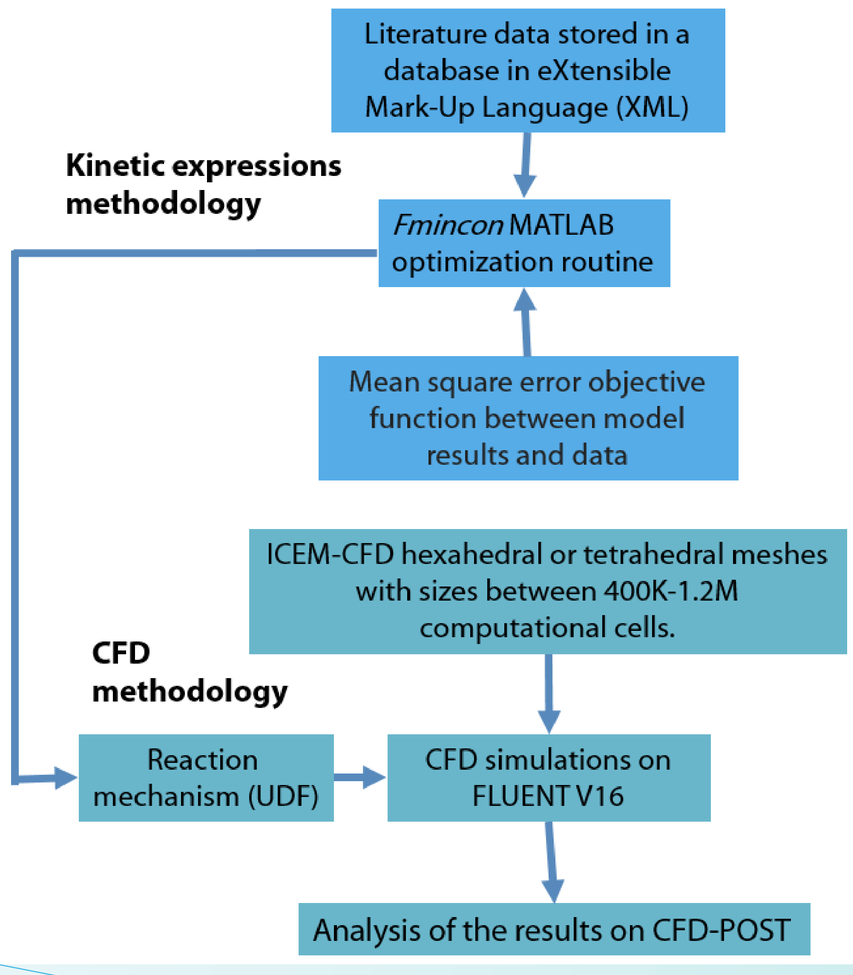
This poster presents an overview of the advances of a research project that aims to analyze and improve the performance of three refine processes with Computational Fluid Dynamic (CFD) which use is mandatory to complex reactor analysis and design.

Methodology



FCC results

In Fig. 3A shows a simulation of the downer reactor where the solids have a wavy behavior that may lead to a higher probability of particle clustering and by this way also to a hampered performance of the downer.

The Fig 3B highlights the well-documented existence of two different regions: a dense and a dilute zone in the bottom and the top of the combustor, respectively.

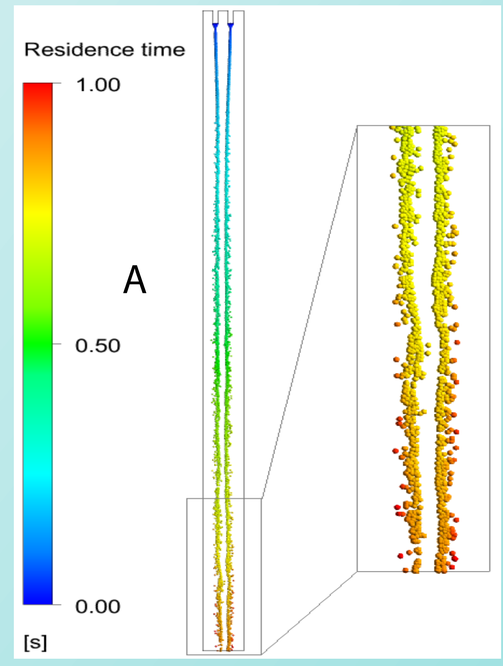


Figure 3A. Particles wavy behavior in a two-entrance downer. 3B . Volume fraction of the solid phase in combustor regenerator

Experimental setups

Also two experimental setups are in development, a fiber optic probe to capture the instantaneous velocity and concentration of the catalyst along the axial and radial directions of a cool flow downer reactor and a lab-scale system for the analysis of catalytic cracking reactions

Other CFD results

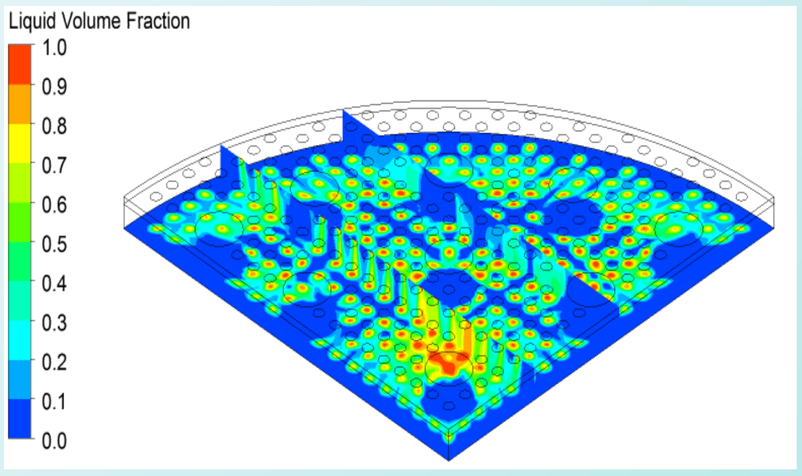


Figure 1. Volume fraction of liquid fraction at the inlet of the HC.

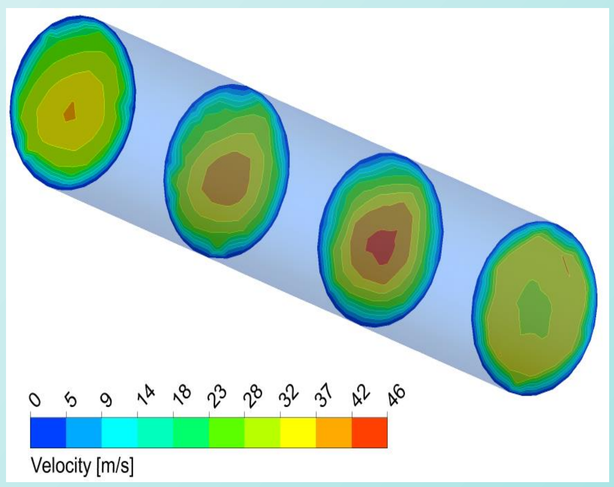


Figure 2. Velocity iso-contours in the vapor line of coke drum.

The CFD simulations show promising results for the analysis of fouling on the product line in the DC unit (Fig. 2), and the liquid-gas flow in the HC unit (Fig.1) where there is a perceptible non-uniform liquid distribution over the top of the catalyst bed.

Kinetic parameters

The CFD simulations involved kinetic expressions based on a wide range of experimental data available in the literature. A state-of-the-art optimization process and uncertainty analysis coupled with XML databases guaranteed more universal kinetics ideal for CFD analysis and spare the rather expensive experimental process for kinetic parameter evaluation.

Conclusions

The CFD simulations show promising results fundamental in the analysis of fouling on the product line in a DC unit , the complex solid flow in a FCC downer, the distribution of solids in a regenerator and of the liquid-gas flow in a HC unit.

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