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CFD Investigation and Analysis of Multiphase Flow to Understand the Flow Behavior at Different Pipe Junctions

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Abstract

Multiphase immiscible flow through various kinds of pipe junctions in different flow domains has been studied. A 3D numerical multiphase VOF model available in fluent 12.0 is used. The model solves the continuity equation for the volume fraction equation for the secondary phase. Transport equations were also solved for turbulence parameters of the secondary fluid phase. Gravitational force is included. Composite meshing scheme like multizone method was used for meshing near junction hexa dominant with growth rate 1 and maximum layer 3. Maximum size of the mesh elements is limited to 5e-4. Grid independency was checked and found ok for the mesh geometry. The analysis was studied as a function of the characteristic diameter, density, velocity and pressure of the fluid. The volume fraction at the interface was also studied. Multiphase (Water and Crude-Oil) flow has been studied for different junctions of pipe flow and velocity, VOF, and pressure contours were studied around the pipe junction and showed a regular pattern in line with many researchers. The flows for two different immiscible fluids were maintained separately considering water flows around the wall boundary and crude oil flows at the center.

Keywords
Mixture Flow, Immiscible Flow, CFD Simulation, Flow Separation, Multiphase Flow.