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Investigation of Two-Phase Flow Behavior Across a 90 Degree Horizontal Bend: CFD Simulation and Gamma Computer Tomography Validation

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Investigation of two-phase (gas-liquid) flows is of vital importance due to their numerous applications in process industry. In the era of high speed and high capacity computers, such process engineering investigations are carried out using the Computational Fluid Dynamics (CFD) simulation. But there is always a need to validate fascinating CFD simulation results with experimental technique. Gamma Computer Tomography (CT) provides a means for validation of CFD results. In this technique, transmission property of gamma rays is used to exploit density distribution of materials in the process under investigation. This procedure is carried out by obtaining several radiographic projections of the process followed by image reconstruction using various image reconstruction algorithms. Two-phase flow regimes in straight pipes are well established and reported in literature but a little has been focused to define these flow regimes across bends. This paper presents investigation of two-phase (air-water) flow behaviour across a 90 degree horizontal bend for a range of superficial velocities of phases using CFD and gamma CT techniques. Simulation of the system is carried out using the software FLUENT 6.3.26 while computational grid was generated using the pre-processor GAMBIT 2.4.6. Euler-Euler multiphase model is used while turbulence is incorporated using the Standard K-Epsilon model. Validation of simulation results is carried out using the First generation Gamma CT system GORBIT. The 90 degree horizontal bend is scanned at various cross-sections for this purpose. Stratified flow patterns with major portion of void at the upper section of bend have been observed on the inlet and outlet of bend on the studied operating parameters. However, the void has been noticed to move towards the inner curvature of bend at the central location.

Key Words: Two-phase flow, Computational Fluid Dynamics, Gamma computer tomography, bends

Country/Organization invited to participate

Pakistan

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