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Evaluation of Turbulence Modelling of Gas-Liquid Two-Phase Flow in a Venturi

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Abstract : A venturi flowmeter is a common device used in multiphase flow rate measurement in the upstream oil and gas industry. Having a robust computational model for multiphase flow in a venturi is desirable for understanding the gas-liquid and fluid-pipe interactions and predicting pressure and phase distributions under various flow conditions. A steady Eulerian-Eulerian framework is used to simulate upward gas-liquid flow in a vertical venturi. The simulation results are compared with experimental measurements of venturi differential pressure and chord-averaged gas holdup in the venturi throat section. The choice of turbulence model is nontrivial in the multiphase flow modelling in a venturi. The performance cross-comparison of the k-ϵ model, Reynolds stress model (RSM) and shear-stress transport (SST) k-ω turbulence model is made in the study. In terms of accuracy and computational cost, the SST k-ω turbulence model is observed to be the most efficient.

Keywords : computational fluid dynamics (CFD), gas-liquid flow, turbulence modelling, venturi
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