

A Comparison of Computational and Experimental Data to Investigate the Influence of the Tangential Velocity of Inner Rotating Wall on Axial Velocity Profile of Flow through Vertical Annular Pipe with Rotating Inner Surface

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Abstract : In the oil and gas industries, one of the most important issues in drilling wells is understanding the behavior of a flow through an annulus gap in a vertical position, whose outer wall is stationary whilst the inner wall rotates. The main emphasis is placed on a comparison of experimental and computational investigations into the effects of the rotation speed of the inner pipe on the axial velocity profiles. The computational investigations were carried out by employing CFD software, and Gambit and Fluent. Three turbulence models were used: standard, RNG with enhanced wall treatment, and SST model. The profiles of the axial velocity had investigated at different rotation speeds of the inner pipe with three different volumetric flow rates. The comparison results showed that the calculations satisfactorily predict the qualitative features of the axial and swirl velocity profiles and the RNG model performs the best results.

Keywords : computational fluid dynamics (CFD), SST $k-\omega$ shear-stress transport ($k-\omega$ mode variant), RNG $k-\epsilon$ renormalisation group ($k-\epsilon$ mode variant), $y+$ dimensionless distance from wall

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