

## Hydrodynamic Investigation Of Free-Surface Turbulent Vortex Flows with Strong Circulation in a Vortex Chamber

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### Abstract

*The results obtained from analytical, numerical and experimental modelling of free-surface vortex flows are presented. Vortex flow in an open channel flow chamber is simulated using the ANSYS CFX steady Eulerian-Eulerian multiphase flow model with various turbulence closure methods. The water surface and tangential velocity profile are also modelled using the Vatistas ( $n=2$ ) vortex model. These previous techniques are validated using particle tracking velocimetry data obtained from a physical model. Sensitivity analysis carried out on the numerical model presents a case for mesh independence and the results suggest that a structured mesh is essential. Curvature correction makes a significant improvement to the shear stress transport turbulence model. The Reynolds stress model produced the most accurate results; however, it suffers the drawback of computational expense. Errors in the numerical models were found to be in the region of 25% for the water surface and 17% for the tangential velocity. It is concluded that transient modelling is required to further improve the numerical simulation. Comparative results on the water surface and tangential velocity distribution signifies that the Vatistas  $n=2$  model agrees well with physical data.*

### Pour citer cet article

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