

عنوان مقاله:

Submerged Vortex Morphology and Pressure Fluctuation Characteristics in Intake Sump

محل انتشار:

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خلاصه مقاله:

This study investigates the characteristics of submerged vortices in an intake sump through a combination of numerical simulations, experimental validations, and advanced modeling techniques. The aim of this study is to gain insights into the complex flow patterns and vortex structures within the sump, focusing on their behavior under varying flow rates. The Shear Stress Transfer (SST)  $k-\omega$  model is utilized to capture turbulence, and the Volume of Fluid (VOF) method is employed to visualize the water-air interface. Model tests are conducted to validate the simulations. The findings suggest that under low flow conditions, the flow beneath the bell mouth becomes highly turbulent, leading to the formation of a complex vortex system with three distinct high-pressure zones. With increasing flow rates, the shape and strength of these high-pressure zones fluctuate, and a quadrupole vortex structure emerges at the sump bottom. This quadrupole vortex plays a pivotal role in the transformation of a floor-attached vortex upward, culminating in a dual vortex column structure. This structure, in turn, generates additional low-amplitude pressure pulsations. Wall-attached vortices are also observed on both sides of the inlet pipe, a result of flow stratification due to velocity disparities. The insights gained from this study contribute to a deeper understanding of intake sump dynamics and offer valuable guidance for designing and optimizing fluid systems to mitigate potential turbulence-related issues.

کلمات کلیدی:

Pump sump, Submerged vortex, Vortex structure, Pressure fluctuation, Helicity, Volume of fluid method

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