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Numerical Study on the Interface Evolution of the Unsteady Supercavity Flows with a Strong Gas Jet

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Abstract **-** Artificial supercavition is one of the most prospective technique for underwater drag reduction, but it still faces some unsolved roadblocks, like cavity stability, noise, power etc. Jet propulsion could provide enough thrust for underwater vehicle. However, it could simultaneously shrink effective cavity volume, and cause cavity interface deform and fluctuate. This article aims at investigating the instability of cavity with the strong jet impingement, and analyzing jet behavior in restricted space. Besides jet intensity, the distance between nozzle exit and cavity closure is considered as a very important parameter in jet/supercavity interaction. As the relative position varies, it will lead to diverse cavity surface evolution and different jet entrainment effect in cavity. In this paper, a multiphase model using coupled VOF and level set method is adopted to capture gas-liquid interface. Simulation for a supercavitating case without jet will be firstly carried out under different ventilation flow rate and comparison will be carried out with the experimental data to validate the numerical model. Then, by changing the position of jet nozzle exit, a series of numerical simulations of supercavitation flows is performed. A non-dimensional distance parameter is proposed to define the interaction schemes between jet and cavity.

Keywords: Jet, Supercavity, Instability, Relative position, CLSVOF.