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NUMERICAL MODELING OF CAVITATION IN CRYOGENIC FLUIDS USING OPENFOAM AND CFX

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Content :

Cavitation is a two-phase malevolent process of rupturing the liquid, formation of voids by a decrease of pressure followed by violent condensation collapse, may alter the flow pattern with steep density variations. It occurs in a wide variety of cryogenic fluid systems operating closer to the critical temperature of the working fluid. It may reduce the efficiencies of pumping machinery, reduce the precision of flow measuring devices and can cause severe erosion damages to the flow handling equipment due to intense localized pressure waves.
Cavitation in cryogens is governed by the thermodynamics and kinetics of the phase change process, and it generates substantial localized cooling effects and significant variation in fluid properties which in turn alter the cavity characteristics. Investigating and quantifying these thermal effects are most vital step during the design optimization process of cryogenic fluid systems.
Numerical modeling of cavitation in cryogenic fluids to understand the pertinent aspects of different thermophysical properties is challenging. In this paper, numerical simulation has been performed using open source CFD code OpenFOAM and Ansys-CFX solvers to compare their capabilities to model cryogenic cavitating flows. The results show that the cavitation characteristics for cryogenic fluids are different from the room temperature fluids.

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