عنوان مقاله:

Numerical Modeling of the Cavitation Flow in Throttle Geometry

محل انتشار:

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خلاصه مقاله:

The modern fuel injectors work with ultra-high injection pressure with a micro-size nozzle, which inevitably triggers the cavitation flow inside the nozzle. The formation of vapor bubbles and their development inside the nozzle is difficult to characterize due to its highly fluctuating spatial and temporal parameters. The numerical models can predict the temporal behavior of cavitating flow with the real-size nozzle geometry, which is fairly expensive with the experiments. A systematic study has been carried out using throttle geometry to characterize the cavitation flow. The different turbulence, multiphase, and cavitation models are extensively evaluated and validated with experimental data. A combination of numerical models has been proposed to predict the cavitation flow more accurately with low computational time. The results obtained with the k-ω SST (Shear Stress Transport) turbulence model and the ZGB (Zwart-Gerber-Belamri) cavitation model are more consistent with the experimental results. The overall structure of cavitation is well captured with both the VOF (Volume of Fluid) and the Mixture multiphase models. Although, the smaller structures like bubble formation and ligament breakup are only captured with the VOF (Volume of Fluid) tuned with the sharp interface method. The effect of pressure difference on the cavitation flow has been estimated with diesel and bio-diesel fuel. The effect of nozzle conicity on cavitation phenomena has also been reported.

کلمات کلیدی:

Cavitation, Fuel injection, Nozzle, Two-phase flow, CFD