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Computational modeling of pseudo-cavitation phenomenon in diesel injector nozzles ROHIT MISHRA, DORRIN JARRAHBASHI, Texas A&M, TEXAS A&M TEAM — Cavitation in fuel injectors occurs in the nozzle region where local pressure drops below the fuel saturation pressure. The bubbles formed from cavitation collapse downstream of the flow and potentially damage the nozzle wall; however, they promote turbulence by reducing the effective diameter of the nozzle and contributing to vortex formation. The discrepancies observed in the size of the cavitation zone between the experiment and current model predictions are attributed to pseudo-cavitation, which is, the formation of bubbles of non-condensable gases such as oxygen and nitrogen dissolved in the fuel. A new model has been developed that accounts for the formation of nitrogen bubbles separating from the fluid stream due to the changes in solubility driven by the pressure drop. The volume fraction in the new model has two source terms that account for the main cavitation and pseudo-cavitation. The gas phase is assumed to be a homogenous mixture of nitrogen and vapor. The proposed model improves the prediction of size and location of the bubbles formed in the domain and captures the effects of vortex formation.

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