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Numerical Investigation of a Cavitating Mixing Layer of Liquefied Natural Gas (LNG) Behind a Flat Plate Splitter SAEED RAHBARIMANESH, JOSHUA BRINKERHOFF, University of British Columbia — The mutual interaction of shear layer instabilities and phase change in a two-dimensional cryogenic cavitating mixing layer is investigated using a numerical model. The developed model employs the homogeneous equilibrium mixture (HEM) approach in a density-based framework to compute the temperature-dependent cavitation field for liquefied natural gas (LNG). Thermal and baroclinic effects are captured via iterative coupled solution of the governing equations with dynamic thermophysical models that accurately capture the properties of LNG. The mixing layer is simulated for vorticity-thickness Reynolds numbers of 44 to 215 and cavitation numbers of 0.1 to 1.1. Attached cavity structures develop on the splitter plate followed by roll-up of the separated shear layer via the well-known Kelvin-Helmholtz mode, leading to streamwise accumulation of vorticity and eventual shedding of discrete vortices. Cavitation occurs as vapor cavities nucleate and grow from the low-pressure cores in the rolled-up vortices. Thermal effects and baroclinic vorticity production are found to have significant impacts on the mixing layer instability and cavitation processes.

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