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Modeling of thermodynamic non-equilibrium flows around cylinders and in channels[1] AVICK SINHA, SHIVA GOPALAKRISHNAN, Indian Institute of Technology Bombay — Numerical simulations for two different types of flash-boiling flows, namely shear flow (flow through a de-Laval nozzle) and free shear flow (flow past a cylinder) are carried out in the present study. The Homogenous Relaxation Model (HRM) is used to model the thermodynamic non-equilibrium process. It was observed that the vaporization of the fluid stream, which was initially maintained at a sub-cooled state, originates at the nozzle throat. This is because the fluid accelerates at the vena-contracta and subsequently the pressure falls below the saturation vapor pressure, generating a two-phase mixture in the diverging section of the nozzle. The mass flow rate at the nozzle was found to decrease with the increase in fluid inlet temperature. A similar phenomenon also occurs for the free shear case due to boundary layer separation, causing a drop in pressure behind the cylinder. The mass fraction of vapor is maximum at rear end of the cylinder, where the size of the wake is highest. As the back pressure is reduced, severe flashing behavior was observed. The numerical simulations were validated against available experimental data.

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Avick Sinha
Indian Institute of Technology Bombay

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