Computing Thermal Effects of Cavitation in Cryogenic Liquids

A computer program implements a numerical model of thermal effects of cavitation in cryogenic fluids. The model and program were developed for use in designing and predicting the performances of turbopumps for cryogenic fluids. Prior numerical models used for this purpose do not account for either the variability of properties of cryogenic fluids or the thermal effects (especially, evaporative cooling) involved in cavitation. It is important to account for both because in a cryogenic fluid, the thermal effects of cavitation are substantial, and the cavitation characteristics are altered by coupling between the variable fluid properties and the phase changes involved in cavitation. The present model accounts for both thermal effects and variability of properties by incorporating a generalized representation of the properties of cryogenic fluids into a generalized compressible-fluid formulation for a cavitation pump. The model has been extensively validated for liquid nitrogen and liquid hydrogen. Using the available data on the properties of these fluids, the model has been shown to predict accurate temperature-depression values.

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GUI for Computational Simulation of a Propellant Mixer

Control Panel is a computer program that generates a graphical user interface (GUI) for computational simulation of a rocket-test-stand propellant mixer in which gaseous hydrogen (GH₂) is injected into flowing liquid hydrogen (LH₂) to obtain a combined flow having desired thermodynamic properties. The GUI is used in conjunction with software that models the mixer as a system having three inputs (the positions of the GH₂ and LH₂ inlet valves and an outlet valve) and three outputs (the pressure inside the mixer and the outlet flow temperature and flow rate). The user can specify valve characteristics and thermodynamic properties of the input fluids via user-friendly dialog boxes. The user can enter temporally varying input values or temporally varying desired output values. The GUI provides (1) a set-point calculator function for determining fixed valve positions that yield desired output values and (2) simulation functions that predict the response of the mixer to variations in the properties of the LH₂ and GH₂ and manual- or feedback-control variations in valve positions. The GUI enables scheduling of a sequence of operations that includes switching from manual to feedback control when a certain event occurs.

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SQL-RAMS

SQL-RAMS (where “SQL” signifies Structured Query Language and “RAMS” signifies Rocketdyne Automated Management System) is a succes-