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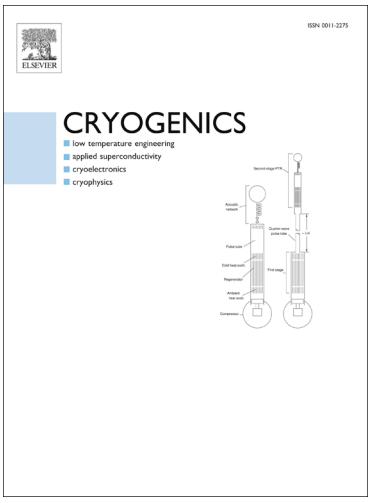

Validation of Two-Phase CFD Models for Propellant Tank Self-Pressurization: Crossing Fluid Types, Scales, and Gravity Levels

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Cryogenics

Validation of Two-Phase CFD Models for Propellant Tank Self-Pressurization: Crossing Fluid Types, Scales, and Gravity Levels[+]

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Storage Tank Model Validation: Crossing Scales - Kassemi, Kartuzova, Hylton

Highlights

1. 2D & 3D CFD storage tank models developed for 1g & microgravity application.
2. CFD predictions of tank pressurization compared to 3 classes of experiments.
3. Simulations in good agreement with moderate Ra simulant fluid experimental results at both high and low Bo.
4. Crossing scales and fluids to high Ra numbers LH2 experiments introduces computational challenges.
5. More profound understanding of turbulence transport and interfacial mass transfer is needed for cryogenic fluids.

July 17, 2017

Abstract

This paper examines our computational ability to capture the transport and phase change phenomena that govern cryogenic storage tank pressurization and underscores our strengths and weaknesses in this area in terms of three computational-experimental validation case studies. In the first study, 1g pressurization of a simulant low-boiling point fluid in a small scale transparent tank is considered in the context of the Zero-Boil-Off Tank (ZBOT) Experiment to showcase the relatively strong capability that we have developed in modelling the coupling between the