

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Future Space Transportation Systems Technologies (5)

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OPTIMIZATION ANALYSIS OF SELF-PRESSURIZATION PROCESS FOR LIQUID OXYGEN TANK
OF LIQUID ROCKET

Abstract

Optimization analysis of tank pressurization process is of great importance for tank design. It is difficult to conduct the optimization analysis by experimental method. Therefore, simulating calculation has become a very important way. View from the existing literature, zero-dimensional integrated model and one-dimensional stratification model were adopted to analyze the pressurization process. However, those models don't provide any predictions of radial and local distribution for physical quantities. Then computational fluid dynamics (CFD) make up for the deficiencies of those models. In this paper, a two-dimensional axisymmetrical model based on VOF (volume of fluid) method was set up to solve the unsteady process of liquid oxygen tank. The model was used to simulate the tank pressurization process. The validity of model was tested through the comparison with the experimental data. The simulated results provided the distributions of the ullage pressure, ullage temperature and wall temperature of tank. And the optimization analysis of wall thickness and temperature, pressurization gas temperature and rate of flow, and their working principle were conducted.