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Author: Dr. Mao Li

Beijing Institute of Aerospace Testing Technology, China

Ms. Ruimin Liu

China

CFD MODELING ACTIVITIES ON TESTING TECHNOLOGY OF LIQUID ROCKET ENGINE

Abstract

With the development of space technology, Computational Fluid Dynamics (CFD) technology plays an important role in the spacecraft testing. The development and applications of the CFD technology on testing technologies in Beijing Institute of Aerospace Testing Technology were introduced here. The investigations include several fields as follows: a) Delivery of the high pressure oxygen. The dynamic compression effect which caused the high temperature of the gas instantaneously in the filling process was studied. This kind of phenomenon is easy to occur at the position of the bend or blind line. It is used to analyze the ablation of the lines. b) Pressurization in the liquid hydrogen and liquid oxygen cryogenic tank. The differences of the heat and mass transfer in different working stage of the tank were investigated. The simulation results can be used to analyze the abnormal phenomena in the pressurization process. And the tank levels of the parallel tanks were studied, too. The levels among several tanks are influenced by the layout of the tanks. c) Simulation of the high altitude simulation test. The start process and optimization of the active ejector were discussed. d) Analysis of the exhaust plume for large rocket engine. The methods, models, and results were introduced. They were used for the thermal protection design of the test stage and the exhaust plume guide groove. These simulation results all matched the test data well. The applications of CFD technology improve the test efficiency and reduced the test cost. Besides, it plays an important role in impulse the developments of the virtual test technology and test process optimization in Beijing Institute of Aerospace Testing Technology.