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Author: Prof. Shen Chibing
National University of Defense Technology, China, cbshen@nudt.edu.cn

Mr. Song Zhibing
National University of Defense Technology, China, 13707486448@139.com
Mr. yuan lei
National University of Defense Technology, China, yuanleistone@sina.cn
Mr. Wu Dong
National University of Defence Technology, China, perfectwu@126.com

NUMERICAL SIMULATION STUDY ON COMBUSTION PERFORMANCE OF LOW THRUST LOX/METHANE ROCKET ENGINE

Abstract

LOX/methane has been being considered as one combination of the green propellants. The advantages of LOX/methane include high performance, non-toxic, low cost propellant, easier and safer to handle. There are some cases for small thrusters including orbit maneuvering system (OMS) and reaction control system (RCS) by use of LOX/methane in some countries. In this paper, a preliminary design of 150N thrust LOX/methane engine is performed. The engine's injector is designed with some unlike-impinging elements and peripheral orifices for providing injection of coolant film toward the combustion chamber wall. The processes of bipropellant flow, atomization, vaporization, mixing and combustion are considered by the simulation model. Several simulation conditions are assigned with the different coolant film mass fraction of the total propellant mass. By comparing the temperature distribution and the thrust performance of combustion chamber, the reasonable range of the coolant film mass fraction is obtained. By comparing the effects of the three kinds of different lengths of the combustion chambers on the temperature field, liquid phase mass fraction and methane volumetric fraction, it is found that the characteristic length of the chamber has some influences on the combustion flow field. So, suitable characteristic length of the combustion chamber can be chosen. This work is valuable for optimizing the design of the low thrust LOX/methane engine.