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INVESTIGATION OF STRUCTURAL DYNAMICS OF HIGH THRUST LOX/KEROSENE STAGE
COMBUSTION CYCLE ENGINE**Abstract**

Chinese high thrust LOX/Kerosene engine, which is called YF-100, has been successfully developed by Xi'an Aerospace Propulsion Institute for the new generation Launch Vehicles. YF-100 is a 1200kN class oxidizer-rich staged combustion cycle engine used in the booster of CZ-5 and the first stage of CZ-7 individually. It is essential to improve structural dynamics characteristics of the rocket engine owing to the significant effects on the structural reliability and thrust vector control of the whole vehicle. During the swing tests of the rocket engine with the thrust vector control actuator, the low frequency vibration with large amplitude of the rocket engine occurred. From then on, the investigation of structural dynamics characteristics of the whole rocket engine was initiated. In this paper, the research on structural dynamics characteristics of the LOX/Kerosene rocket engine is presented. Firstly, the simplified methods of structural dynamics simulation model of the entire engine system are given based on the extreme complexity of the general configuration of the engine system, which consists of thrust frame, gimbal, combustion chamber, nozzle, turbopump and ducts etc. The simulation model of the engine system is established subsequently. Next, the natural frequencies and mode shapes of the engine system is investigated by finite element analysis (FEA) method. Furthermore, the accuracy and reliability of simulation model and FEA method is verified through comparison with the results of the modal tests. Due to the requirement on the low frequency characteristics of the rocket engine, the structural dynamics characteristics of the LOX/Kerosene engine need to be improved. Thirdly, by developing parametric sensitivity analysis of the finite element model, the effects of different components or parameters on the structural dynamics characteristics of the engine is discussed. Finally, according to the parametric sensitivity analysis results, the modification measurements of the low frequency of the rocket engine are given, which also have been validated by the related modal tests.