

IAF SPACE PROPULSION SYMPOSIUM (C4)  
Liquid Propulsion (2) (2)Author: Dr. Feiping Du  
Xi'an Aerospace Propulsion Institute, ChinaDYNAMIC CHARACTERISTICS OF TURBOPUMP ROTOR SYSTEM FOR HIGH THRUST  
LOX-KEROSENE ENGINE**Abstract**

LOX-KEROSENE rocket engine is a power system operating under extreme physical conditions (high temperature, high pressure, high speed and high energy density release). The dynamic characteristics of the turbopump rotor system directly affect the performance of the engine, and there is cryogenic liquid oxygen in the operating medium. If the vibration is not appropriate, it will easily lead to the catastrophic accident of fire and explosion. Therefore, it is very important to study the structural dynamics of turbopump rotor system in LOX-KEROSENE engine. With the increase of the thrust of LOX-KEROSENE engine, the pressure and speed of the turbopump increase continuously. The reasonable configuration of the critical speed of the turbopump rotor system is an important premise and foundation to ensure the safe and reliable operation of the liquid rocket engine. With the further study on the dynamic characteristics of the turbopump rotor system, the bearing stiffness and the additional stiffness and damping produced by the fluid seal have a significant impact on the dynamic characteristics of the rotor system. According to the Bulk-flow theory model and Childs finite length seal model, the dynamic characteristic parameters of the annular seal are calculated and compared with the experimental values. A complete finite element model of the turbopump rotor system of LOX-KEROSENE engine is established, and the transient response of the rotor system is obtained by using the unconditionally stable numerical integration algorithm. Compared with the experimental data, the accuracy of the rotor system model is verified, so as to further obtain the critical speed variation law, transient response and unbalance response of the turbopump rotor system of LOX-KEROSENE engine under different influence factors. Based on MATLAB numerical calculation platform and graphics processing function, an integrated simulation platform for dynamic characteristics of rotor system is developed, which can quickly carry out the finite element modeling of rotor system and the simulation of transient response, critical speed and mode shape, unbalance response and parameter identification.