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SYSTEM FREQUENCY CHARACTERISTICS ANALYSIS FOR A LARGE-THRUST
LOX/KEROSENE STAGED COMBUSTION CYCLE ENGINE

Abstract

The LOX/kerosene staged combustion cycle rocket engine is one of the major propulsion devices for new generation launch vehicles. To study the frequency characteristics is the key to analysis the dynamic characteristics of engine system and POGO stability of liquid rocket. The linear small deviation non-dimensional dynamic transfer matrix model of the engine system is developed by modular modeling method. Based on transfer functions, the frequency characteristics of the engine system are studied. The studied indicated that: (1). The first modal frequency of LOX system is lower than that of the fuel system, so the LOX system is the key to POGO stability analysis. (2). The characteristics of wide frequency range and large phase lag of staged combustion cycle engine have been validated. (3). The dynamic characteristics can be improved by installing a flow regulator in the gas generator fuel path. (4). The oxidizer pump parameters, the flow regulator and gas path entropy wave have important influences on the frequency characteristics of the system. (5). The rotation speed fluctuation of turbo-pump has little influence on the low frequency dynamic characteristics of engine, and the influence of pressure and flow fluctuation of propellant in the entrance of engine on the turbo-pump speed fluctuation can be neglected.