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STRUCTURAL DYNAMIC ANALYSIS OF THE LOX/KEROSENE ROCKET ENGINE BASED ON SYNTHETIC TECHNOLOGY FOR SUBSTRUCTURE TEST MODEL

Abstract

The LOX/Kerosene rocket engine is not only the development orientation of aerospace main power system, but also the power foundation of important aerospace activities such as manned lunar project and deep space explorations. It will greatly improve the launching capability of China, and will ultimately meet the requirements of future space activities. However, the structure of LOX/Kerosene rocket engine is very complicated. It is difficult to establish the model of the actual structure of the engine. Regardless of the calculation analysis or the test analysis is a very arduous task. In order to get the precise modal parameters of LOX/Kerosene rocket engine, a new synthetic technology for substructure test model was proposed for modal analysis of the four parallel connected LOX/Kerosene rocket engines. Firstly this paper systematically reviewed and summed up the development and process of the substructure modal synthetic technology. And by considering the material differences between the inner and outer wall of the nozzle, the precise nozzle finite element model was established using the principles of mass and stiffness equivalence. Then the whole rocket engine model was established using the method of distributed parameters. The results show that the error of the substructure model of the single engine model is less than 1.35%. The error of the whole model of four parallel connected engines is less than 2.19%. The predicted modes are very consistent with the ones obtained from the practical modal test. Finally, the feasibility and the reliability of this substructure test synthetic technology for modal analysis of rocket engine were proved. And this method can improve the precision and efficiency of structural numerical simulation.