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AN AUTOMATIC MODELING METHOD FOR POGO SYSTEM OF LARGE LIQUID ROCKETS

Abstract

An automatic modeling method for POGO system of large liquid rockets, deriving a system model applicable to both frequency-domain analysis and time-domain simulation, is presented in this paper. The dynamic characteristics of basic physical elements of the liquid propulsion system, such as compressible/uncompressible flow duct, bellows, accumulator, pump, thrust chamber, are firstly studied, and the classifying rules based on the description of independent weight-displacements are proposed. So the propulsion system can be divided into nine basic independent components. And every component can be described by the independent weight-displacements completely. To assemble independent components of the POGO system, the automatic assembly method based on the independent weight-displacement is developed by referring to the set-in-right-position rule of the finite element method. The system equation of POGO system can be then automatically established by assembling all the independent components iteratively. The analysis results of a certain liquid rocket are finally provided to validate the proposed automatic modeling method of POGO system. It should be noted that the dimensions of POGO system equations derived from the automatic modeling method is reduced almost by half comparing with the typical method by Rubin. Furthermore, there is no algebraic equation in the system equations, which can be therefore used in time-domain simulation without any manual modifications. The automatic modeling appears to provide a promising solution for the repetitive analysis and design of large liquid rockets.