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COMBINED LOAD ANALYSIS OF SATELLITE AND ROCKET

Abstract

Spacecraft such as satellite is verified by the results of combined load analysis of the satellite and the rocket. Herein the whole combined finite element model including payload and launch vehicle is used for performing FE analyses. Usually, the finite element models of the launch vehicle and the satellite are substructured and reduced, for example, with the Craig-Bampton method, and then coupled and analyzed. The Craig-Bampton modal model, which consists of the dynamic characteristics: stiffness matrix, mass matrix, load transformation matrix, acceleration transformation matrix and displacement transformation matrix, is transformed from the satellite finite element model by spacecraft structure designer and provided to launch-vehicle supplier coupling with the launch vehicle model. The results of coupled model from analysis under various load cases occurring during launch are assessed and verified by spacecraft structure designer. Currently, STSAT-2(Science and Technology Satellite-2) and KSLV-I(Korea Space Launch Vehicle) are being developed by KARI(Korea Aerospace Research Institute).

This paper is to describe in detail of the coupled load analysis of the satellite and the rocket, especially using the whole combined finite element model instead of the substructured and reduced finite element model, leading the simplification of analysis process and the detailed results. This analysis performed by the highly efficient FE analysis code, IPSAP(Internet Parallel Structural Analysis Program) which is in-house code, because a large number of DOFs are condensed for this combined load analysis. IPSAP has a good efficiency not only in parallel supercomputing system but also small computing system, for instance, workstation and personal computer. Herein, it is executed the analysis of the large size of combined model using 2-cpus workstation computing system. Also, it shows the detailed analysis results and its evaluations for verification coupled load analysis.