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MATERIALS AND STRUCTURES SYMPOSIUM (C2)
Space Structures I - Development and Verification (Space Vehicles and Components) (1)

Author: Mrs. Xin Zhao
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China, zhaoxinbhu@126.com

Prof. Zengyao Han
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China, hanzengyao@hotmail.com
Dr. Yuanjie Zou
China Academy of Space Technology (CAST), China, zyuanjie@yahoo.com.cn
Dr. Jifeng Ding
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China, djfnpu@163.com
Mr. Shigui Zheng
Institute of Spacecraft System Engineering,China Academy of Space Technology (CAST), China, zhengsg@126.com
Mrs. Lisha Zhang
Beijing Institute of Space Mechanics &Electricity(CAST), China, hilarey@163.com

NUMERICAL SIMULATION AND ANALYSIS FOR POINT SEPARATING PYROSHOCK SOURCE AND THE LOAD FORMING MECHANISM OF THE INTERFACE OF SPACECRAFT AND LAUNCH VEHICLE

Abstract

Pyroshock environment of Spacecraft is the severest mechanical environment during launching and flying in orbit. The shock wave and resonant response exited by explosion may cause fatal damage to the equipments which include crystals, ceramics, epoxies, etc. thus cause failure in launching mission. The numerical analysis and quantitative description of pyroshock source is not only the precondition of the response prediction when using analytical methods and numerical methods, but also the base of pyrotechnic shock reducing design.

The method of "Source system—Near field structures"integrated modeling and analyzing is a method use which the complicated spacecraft structures next to pyroshock source can be divided into "pyroshock source system" and "near-field structures", thus the computing model can be exactly and correctly established and simplified. This method use hydrocodes as its basic arithmetic. In this paper, such method of "Source system—Near field structures"integrated modeling and analyzing was used, the work process of a point separating pyrotechnic was simulated. The loading function inside the interface of the spacecraft and launch vehicle is computed. The motion law of the high pressure gas and detonation products inside the hermetic cavity is reciprocating. The key structures' bump triggered the unlocking of the separating nut. The load transfer mechanism inside the separating nut was analyzed, and the forming of the load inside the interface of spacecraft and launch vehicle is decided by the explosion pressure, together with the motion state and the impact of the parts through the transfer paths, and the stress attenuation inside the materials, etc.

The analysis and compute of this paper provides a base to settle the problem of the prediction of the spacecraft pyroshock environment, to study the generalization on pyroshock transmission in spacecraft

structures, and make a foundation to the pyrotechnic shock reducing design.