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PEOPLE'S REPUBLIC OF CHINA**

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Modal analysis for spacecraft

航天器模态计算方法

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Foreword

This standard was drafted in accordance with GB/T 1.1-2009 given rules. The standard proposed by China Aerospace Science and Technology Corporation. This standard by the National Aerospace Technology and Application of Standardization Technical Committee (SAC/TC425) centralized. This standard drafting unit. China Academy of Space Technology Master unit. The main drafters of this standard. Chaihong You, Qian Ying.

This standard belongs to China Aerospace national standards. China Aerospace national standards applicable to national standards in the field of aerospace and revision Management, covering the management of space, space technology, space applications and services of the three fields, is to guide spacecraft and launch vehicle project management, engineering research System, space launch services, in-orbit satellite applications based activities. With the rapid development of China's aerospace industry, long life, high reliability, complex spacecraft emerging. Spacecraft structures provided Design and verification process, the spacecraft modal requirements (natural frequency requirements) is the most important requirement for the structural design of the spacecraft. aerospace Structure modal analysis is an important part of the spacecraft structural analysis plays an important role in the development process of the spacecraft structure. This standard is to obtain a reasonable, accurate and reliable spacecraft modal results provide evidence and guidance, modal analysis of a spacecraft model Establishing, model checking and Modal analysis for a unified standard, the purpose is to ensure that modal analysis of the process of development of spacecraft engineering Accuracy. Spacecraft Modal computing plays an important role in spacecraft development process, such as to avoid the resonance frequency caused by coupling spacecraft Configuration scheme selection, dynamic environment of structural failure diagnosis, equipment and so has heralded a significant impact. Current aerospace industry at home and abroad The rapid development of various types of spacecraft are close research and development process, it is necessary to process spacecraft modal system were calculated A provision to ensure that calculation, the validity of the analysis process standardization and results. Spacecraft Modal Calculation

1 Scope

China's national standard for the modal analysis of spacecraft. It specifies the methods for computing the modal characteristics of a spacecraft structure - the natural frequencies and mode shapes - and the requirements for carrying out and reporting that analysis. The modal requirement is the first requirement a spacecraft structure has to meet. A launch vehicle imposes a dynamic environment on its payload, and the payload's natural frequencies must be kept above stated values so that they do not coincide with the vehicle's own low-frequency modes. If they do, the two couple: the vehicle drives the spacecraft at its resonance, the loads amplify, and the structure sees forces far beyond what a static analysis predicted. Every launch vehicle user manual states minimum lateral and axial frequencies for the payload, and a spacecraft that does not meet them is not flown until it is stiffened. That is why the introduction calls the modal requirement the most important requirement in spacecraft structural design: it is a constraint imposed from outside the programme, it is verified before flight, and it drives the structural configuration more than the strength requirements do. The analysis is therefore carried out from the earliest design stage and repeated as the configuration evolves, on a finite element model that has to represent the mass distribution, the stiffness and the boundary conditions correctly - and the boundary condition, being the interface to the launch vehicle adapter, is where models most often go wrong. The standard specifies the modelling requirements, the analysis methods, the treatment of the appendages and of liquid propellant, the correlation of the model against modal survey test results, and the reporting. Issued on 31 December 2012 and in force since 1 July 2013.

This standard specifies the method of calculation of modal spacecraft. Calculation generalized stiffness matrix and generalized mass matrix is applicable to the calculation of spacecraft and spacecraft modal interface. Cabin, assembly Modal can be calculated with reference to use.

2 Terms and definitions

The following terms and definitions apply to this document.

2.1 Statically determinate interface *statically determinate interface* When the motion can be regarded as a rigid body structure interface.

Note. The structure through the interface connected to other structures, for static interface simply by a fixed reference point for the freedom of all interfaces can be expressed freedom movement.

2.2 Idealized structure *structural idealization* The actual structure can be transformed into a performance characteristic geometric structure and connection relationship, and can effectively reflect the structure and mechanical properties into Mechanical Analysis row in

the form of process.

Note. If the member has a certain geometric features abstracted as point, line, area or volume, thereby simplifying the structure of particle mechanics, springs, rods, beams, plates and shells, and the like.

3 Spacecraft modal calculation step

Spacecraft Modal computing general procedure shown in Figure 1. 1 spacecraft modal calculation step FIG.