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Structural stiffness control requirements for space vehicles

空间飞行器结构刚度控制要求

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Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for Standardization Work Part

1.Structure and Drafting Rules of Standardization Documents" Drafting. Please note that some of the contents of this document may involve patents. The issuing agency of this document is not responsible for identifying patents. This document was proposed and managed by the National Aerospace Technology and Application Standardization Technical Committee (SAC/TC425). Drafting organizations of this document. Beijing Institute of Aerospace System Engineering, Beijing Space Vehicle General Design Department, China Aerospace Standardization Institute. The main drafters of this document. Lin Hong, Wang Guohui, Chen Yi, Zhang Xinyu, Peng Huilian, Zhu Jiantao, Zhou Wenyong, Pan Zhongwen, Gao Feng, Liang Dongping, Liu Xin, Wang Xuemei, Xie Xuan, Hu Yong, Li Qing, Xu Yan. Spacecraft structure stiffness control requirements

1 Scope

China's national requirements for controlling the structural stiffness of space vehicles. It specifies the terms and definitions and the general requirements. Stiffness rather than strength is the governing structural requirement for a spacecraft, and the reason is the launch vehicle. The launcher's control system is designed around a payload whose fundamental frequencies lie above a stated minimum; a payload that is too flexible has modes that couple with the vehicle's own control loop and with its structural dynamics, and the coupled system can become unstable. So the launch authority specifies a minimum

lateral and axial frequency, and the spacecraft must meet it before anything else about its structure is settled. On orbit, stiffness governs a second thing: the pointing stability of instruments, which is degraded by every flexible appendage that can be excited by a reaction wheel or a thruster and then takes minutes to damp.

This document specifies the general requirements, control procedures, and control requirements for the rigidity control of the spacecraft structure. This document is applicable to the rigidity control of the spacecraft structure.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. Among them, dated quotations Only the version corresponding to that date is applicable to this document; for undated reference documents, the latest version (including all amendments) is applicable to this document. document.

GB/T 2298 Mechanical vibration, shock and condition monitoring vocabulary

3 Terms and definitions

The following terms and definitions defined in GB/T 2298 apply to this document.

3.1 Stiffness index A technical index describing the stiffness characteristics of the structure.

Note. Generally refers to natural frequency, section stiffness, section flexibility, etc.

3.2 Primarystructure It is used to transmit and bear the main load and determine the cabin section, frame, rod system and other components of the overall modal characteristics of the structure.

3.3 Payload assembly assemblyofpayloads An assembly that connects multiple main structural components and payloads through series, parallel, or series-parallel combinations.

Note. Generally refers to the multi-cabin series combination of the spacecraft, the multi-satellite adapter and satellite combination, the upper stage of the carrier and the satellite combination, etc.

3.4 Sub-structure frequency The overall transverse, longitudinal, and torsional modal frequencies of the payload assembly in the fixed support state.

Note. Generally does not include the breathing mode frequency of the local structure.

4 General requirements

4.1 The rigidity control requirements should be throughout all development stages such as

the plan, the initial sample, and the sample/proper sample, starting with the rigidity control planning in the plan stage. Point, end with the verification of the stiffness index of the sample/correction phase.

4.2 The stiffness distribution control should cover all working sections of the spacecraft, such as the ground operation section, launch section (solar windsurfing panels and large deployable The open parts are in the folded state), the on-orbit operation section (the large expandable parts are in the expanded state), the flight section of reentry into the atmosphere, and so on.

4.3 The stiffness index should be decomposed step by step according to the order of the whole machine/payload combination, compartment, and components, and confirm all levels in all development stages.