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Generic Technologies for Nano/Pico Platforms (6B)

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STANDARDIZED MODULAR ASSEMBLY TECHNOLOGY FOR CUBESAT

Abstract

Cubesats are Nano and Pico size satellites having standard cubic sizes. To improve assembly efficiency and reduce assembly costs, the functional modular assembly CubeSat having easy manipulability and accessibility is proposed to replace the traditional board-level assembly CubeSat using standard PC104 dimensions and CSKB cards. The new modular assembly CubeSats include limited number of functional subsystem blocks and standardized interfaces suitable for assembly between different blocks. The modular subsystem blocks are divided into specific functional cubic units, such as attitude determine and control system (ADCS), electrical power system (EPS) and so on. Each subsystem block has physical independence and functional independence. The size of subsystem block is only standard 1U, 2U, and up to 3U based on their internal components. A whole CubeSat can be assembled by selecting several different functional subsystem blocks combined with standard interfaces. Different from Androgynous interfaces in IBOSS project which are complicated and large size, the symmetrically arranged female-male-female standard interfaces are used to realize flexible assembly between adjacent blocks. The male interfaces are independent coupling multi-functional 4-in-1 elements including mechanical, electrical, data and thermal interfaces for mechanical coupling, power and data transmission and thermal interconnection. The thermal interface is circular and located in the centre of the 4-in-1 interfaces, which is not affected by the installation direction since its rotational characteristics. The electrical and data interfaces are arranged centre symmetrically with 4 sets of identical elastic plugs, which can ensure the reliable contact and meet the requirements of diverse assembly directions. The mechanical interfaces adopt 4 independent standard connector-pins in rectangular distribution as the coupling elements for reliable connection. The female interfaces are only placed on the frame and surface in the block according to the layout of 4-in-1 male interfaces and without any bumps. Since the 4-in-1 female interfaces in the modular CubeSat subsystem blocks are the same and centre symmetrical, any two blocks can be assembled via male interfaces in multiple directions to meet the flexibility of assembly. The modular assembly CubeSat are compatible with the traditional CubeSat and don't occupy its internal space, so the CubeSat building systems are upgraded from board-level modular assembly to functional modular assembly. The functional tests of prototype are carried out and the assembly technology provides much needed flexibility to the CubeSat designers during the system integration phase in ground assembly or on-orbit assembly.