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APPLICATION OF PLUG-AND-PLAY INTEGRATED MICRO-PROPULSION SYSTEM FOR MICRO-SATELLITE BASED ON ADDITIVE MATERIAL MANUFACTURING

Abstract

Micro-satellite is explosively growing with the application demand. The “more, fast, better, cheaper” developing mode of micro-satellite is explored for the application of satellite clusters. Application technology based on additive material manufacturing plug-and-play micro-propulsion system is proposed for miro-satellite. The design evaluation criteria and design optimization methods of the plug-and-play micro-propulsion system are studied in according to the period efficiency-cost ratio as evaluating guide line. With the high-performance, low-cost, short-period characteristics of additive material manufacturing technology, the “embedded” and “shelf” standardized “plug and play” common modes are established. “On-link and on-use” mode based on on-board network is used for the micro-propulsion system. The requirements of fast mission adaptability, system robustness, ease of use, rapid task design, rapid assembly and testing, fast launch, fast test on orbit of small satellite are meet. The performance of the satellite platform is enhanced. The fast batch and efficient characteristics of “industrial production design” are achieved. The micro-propulsion system based on additive material manufacturing technology is changed from the traditional satellite framework. The “embedded” technology is adopted. A topological optimization method of micro-propulsion system based on increasing material manufacturing technology is established. The modularized design of the integrated propulsion system is proposed. “Package” at the system design level is implemented using increasing material manufacturing technology. The complexity of the system is encapsulated within the system. The complex operations are simplified. The standard modular interface is designed. Interchangeability between the same satellite platform and different payload is achieved. The flexibility of the task of the satellite platform is increased. Finally, a comprehensive evaluation method and standard system for the function, performance, manufacturing effect and cost of the micro-propulsion system based on additive material manufacturing is established.