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THE FREE-FLYING SMALL SATELLITE CLUSTER FOR MULTI-APPROACH EARTH OBSERVATION MISSION

Abstract

Current satellite system is often characterized by long-development cycles, cost overspend and changeable requirements. In an effort to reduce costs, rapidly meet with the different or changeable needs of the system's respective users, operationally responsive space (ORS) architectures have been proposed. Then, the fractionated satellites represent one of possible ORS architectures. Generally, fractionated satellites composed of physically independent, free-flying various subsystems modules of conventional satellite. However, there are several technical and non-technical challenges such as wireless energy transfer and sharing force control ect. But, in order to enhance the flexibility and maintainability of conventional large satellite, such as ALOS, we can decompose the conventional multi-functional large satellite into several single-functional small satellites according to the principle of quality decomposition and risk diversification from fractionated satellites.

The multi-approach earth observation small satellite cluster mission is described in this paper, which consists of TDI-CCD satellite, SAR satellite, video satellite, and data processing/relay satellite and other functional rapid response small satellites with free-flying. Each rapid response small satellite has advantage of rapid assembly, rapid launch and rapid application. And each one can be separately maintained, replaced, upgraded and reconfigured, the difficulty of system upgrades and maintenance is significantly reduced compared with conventional multi-functional large satellite. The low-inclination quick access orbit is selected to satisfy the first orbit track access data and multiple coverages per day. Each satellite has a three-axis agility attitude maneuver performance to realize the on-orbit rapid response. Through information fusion from several function satellites, it is enhanced for satellite cluster that the space environment adaptability and the information comprehensive utilization. The imaging data from each earth observation satellite are transmitted to the data processing and relay satellite by inter-satellite links, the data management and hot target real-time processing is completed in data processing and relay satellite. And the all data is quickly distributed into the different users through geostationary relay satellites.

This paper is organized as follows. In section 2, the concept and architecture of is described. Next, satellite cluster flight orbit is designed and analyzed in section 3. The on-orbit workflow of satellite cluster is described in section 4. And finally, the data link characteristics of satellite cluster is put forward in section 5.