EARTH OBSERVATION SYMPOSIUM (B1)
Future Earth Observation Systems (2)

Author: Mr. Binglei SUN
Shanghai Institute of Spaceflight Control Technology, China, eric_sun1992@163.com

Mr. Fei Han
Shanghai Key Laboratory of Aerospace Intelligent Control Technology, China, shanquan_5836@163.com
Mr. Wu Pengfei
Shanghai Institute of Spaceflight Control Technology, China, 411766730@qq.com
Ms. He Jin
Shanghai Institute of Spaceflight Control Technology, China, 13621946541@163.com
Mrs. liu lu
Shanghai Institute of Spaceflight Contol Technology, China, 17321016406@163.com

NANO-SATELLITES CLUSTER SYSTEM DESIGN FOR FREE RECONFIGURATION AND INTELLIGENT SYNERGY EARTH OBSERVATION

Abstract

For the requirement of Earth observation mission, an Earth observation system of four nano-satellites was designed, called I-Trans, short for Intelligent Transformer. I-Trans is an intelligent and reconfigurable Earth observation system consisting of four nano-satellites, which switches between two states (dispersive state and aggregate state). In dispersive state, five observation modes under three formations can be achieved by cooperation of four nano-satellites, including multi-target observation, vertical/along–track joint field of view (FOV) observation, relay staring observation and multi-angle observation. In aggregate state, the combination of four nano-satellites is reconfigurable by rendezvous and docking (RVD), resulting in joint or overlapping FOV. The controllability of I-Trans system was proved by numerical simulation. The capacity of synergy in the dispersive state and reconfiguration in the aggregate state improve the mission flexibility of I-Trans, making it adapt to wide-field observation and data fusion. The innovation of I-Trans includes three aspects, which are concept innovation, docking mechanism and relative navigation. Firstly, working modes of I-Trans is flexible because of the multiple types of cooperation and combination of four nano-satellites. Secondly, docking mechanism based on electromagnetism was applied in I-Trans, where relative attitude between four nano-satellites could be adjusted by the gear-rotation angle. Finally, monocular visual navigator and cooperative LEDs distributed with different elevation were used to measure relative position and angle with high precision, which played an important role during RVD phases with distance among 0.05 5m.