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INTER-SATELLITE COMMUNICATION SYSTEM AND EMULATION FOR FLYING-AROUND SMALL SATELLITE FORMATION

Abstract

A long-term stable inter-satellite link of two small satellites formation is proposed in this paper for the flying around formation on the background of InSAR mission. The one- way inter-satellite communication system is composed by a transmitter, a receiver and a set of antenna array. The primary satellite flying around its companion on the same orbit during the mission period, by analyzing the special relative motion of the two satellites the geometric model of the inter –satellite link is constructed. The mutual projection relationship of the two satellites is analyzed for the kind of flying around formation, so the antenna array scheme of the inter-satellite link is designed, and the layout and the installation position of antenna array are determined by RM test. The antenna unit structure is determined according to the antenna pattern characteristics and its radiation coverage. The inter-satellite transmitter power and the receiver performance are determined according to the link requirements of different formation stage from follow flying to flying around. Which guarantees the establishment of inter-satellite communication when the two satellites are 35 kilometers apart, at the same time also ensures the normal communication when close to the range of one kilometer. Considering the change of distance and pointing of the inter-satellite link on the each stage of formation flying and the influence of the Doppler factors, it is necessary to establish the inter-satellite link estimation model to calculate the link margin. An omni-antenna is obtained by combing two antennas both are right hand circular polarization, the influence of the interference areas in the part of combination must be considered. At last, a STK simulation of the formation satellite communication system and inter-satellite link is carried out. The concave point of interference area which may cause communication interruption can be avoided by adjusting the antenna layout according to the simulation result. So the constant communication link in each stage of formation flying can be established. And the consistency of on-orbit test and simulation proved the feasibility of the system.