Paper ID: 31583
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66th International Astronautical Congress 2015

22nd IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Small Spacecraft for Deep-Space Exploration (8)

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CONCEPTUAL STUDY OF RELAY MIMO NAONOSATELLITE CONSTELLATION AROUND L2 FOR THE LUNAR FAR SIDE MISSION

Abstract

Nowadays the concept of involving nanosatellites in lunar exploration missions is getting increasingly popular and will be possibly realized in the coming decade. Last year, China lunar exploration spacecraft reached the Earth-Moon second Lagrange Point (L2) and returned to the orbit around lunar a few days later. Thus makes it possible for China to deploy a relay satellite at L2 point for the lunar far side mission in the future. This article presents conceptual study of L2 relay communication and tracking nanosatellite constellation for the future lunar far side mission. A relay multiple-input-multiple-output communication and tracking network of nanosatellite would be deployed around the L2 libration point, its primary objectives are to synthesize a large space-based aperture by beam-forming the signals from the individual nanosatellite in phase and to establish a space-based radio interferometry array to support the lunar far side gravity field measuring or soft-landing in the future. This conceptual nanosatellite system would consist of 4 10 sats with inter-satellite link, flying in halo orbits while maintaining node-to-node distances in the range of several hundred kilometers. It's geometric and flying formations and optimizes its configuration are proposed in the article. Different designs and formations of a single or multiple halo orbits will be presented along with stability, orbit sizes, long-term evolution of the constellations. This paper investigates the performance of the relay MIMO communication system under varies signal-to-noise ratio. This paper also presents a multi-step relay Doppler tracking model which based on carrier phase coherent relationship among ground station, relay satellite and user satellite.