Satellite constellations: properties and applications

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SUMMARY

Satellite constellations are groups of satellites working cooperatively and following the same goal. In this work, we recall different ways to design satellite constellations. First, we present the Flower Constellations theory (cf. [1]). Second, we introduce the 2D-Lattice Flower Constellation theory (cf. [2]), which represents an improvement of the original theory since its formulation is simpler and has a physical meaning. Third, we show how the use of necklaces to determine the reference orbit of the constellation opens new design possibilities and brings what we named Necklace Flower Constellations (cf. [3]). Finally, we introduce a time distribution methodology (cf. [4]) to generate constellations whose satellites share a set of relative trajectories, and maintain that property over time without orbit corrections.

The initial distribution of a 2D-Lattice Flower Constellation and its symmetries disappear when some perturbations are considered. Thus, in this work we deal with the study of the orbital manoeuvring strategies and the required velocity changes that must be applied to the constellation of satellites in order to have an absolute station-keeping.

Finally, we show different satellite constellations with particular properties, that can be obtained thanks to the time distribution methodology.

Keywords: Satellite constellations, Flower Constellations, Station-keeping.

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