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FAMILIES OF PERIODIC ORBITS FOR SOLAR REFLECTORS TO ENHANCE TERRESTRIAL SOLAR POWER

Abstract

The aim of the project is calculating families of periodic orbits for space-based orbiting reflectors in order to increase the electrical output of solar power farms located on Earth. The recent studies on orbiting reflectors recommend mirror array concept which places mirrors in sun-synchronous orbit. A mirror satellite constellation in a dawn-dusk orbit could extend the hours of solar electricity production from 8 to 14 by adding 3 more hours both for the morning and the evening. However, this project will look into new families of heliotropic orbits with optimized orbital parameters that can be used for spaced-based orbiting reflectors to direct the sunlight onto solar power farms, which will allow the generation of electrical energy after local sunset. The heliotropic orbits with optimized orbital parameters will minimize the number of reflectors on orbit, and the launch costs while maximizing the power generation of solar power farms on Earth. The project can be divided in two parts. First part is the investigation of novel families of heliotropic orbits in the vicinity of Earth. Second part is the optimization of the orbital parameters of the calculated orbits under the constraints that are related to the solar power farms and the spaced-based orbiting reflectors. Constraints related to the solar power farms include the geographical location or locations of them and the number of the farms required to maximize the output power. Constraints related to the orbiting reflectors are the launch and the operation costs associated with their orbits. Rigorous numerical tests will be conducted to prove that the new families of heliotropic orbits with optimized orbital parameters of space-based orbiting reflectors are not only feasible but also sustainable to increase the electrical output of solar power farms located on Earth.