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AUTONOMOUS COLLOCATION OF GEOSYNCHRONOUS SATELLITES

Abstract

The geostationary orbit constitutes a narrow region in space, and is therefore a finite natural resource. Because of the growing number of geostationary satellites and the limited number of geostationary slots, satellite operators locate several vehicles very close to one another in the same geosynchronous slot, a technique known as collocation. The collocation of two or more satellites in a restricted longitude interval on the geostationary orbit has been under consideration in the past several years. Spacecraft operation requires avoiding physical collisions between the satellites. So, an appropriate strategy for a station-keeping maneuver operation for the collocated satellites is very important. In general an increased fuel requirement is a common consequence of any coordinate collocation strategy to be paid for the additional constraint of excluding or reducing the collision risk. The main approach to collocation is presently based on perigee and plane separation while keeping longitude separation.

The purpose of this work is to present autonomous collocation strategies based on a real time closed loop control law recently developed for geostationary satellites station keeping. The closed loop control implementation requires the knowledge of the actual spacecraft position and velocity in real time with respect to Earth.

In this work different collocation strategies are studied using orbital plane separation, both in inclination and right ascension of the ascending node, as well as longitude separation.

The evolution of the geostationary collocated satellites under gravitational and non-gravitational perturbations when using the closed loop control is tested with a precise numerical orbit propagator. The dynamical model involves the Earth's gravity potential with spherical harmonics up to degree and order 10, luni-solar perturbations and solar radiation pressure. Results of computer simulations of the different strategies will be presented.