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# EFFECT OF SIZE AND ORIENTATION OF PANELS ON SATELLITE FORMATION

**Abstract**

The first application of the satellite formation flying was reported by Clohessy and Wiltshire [1] in 1960. Under the assumption of a perfectly spherical earth and a circular satellite orbit, equations were derived for the relative motion of two satellites (HCW equations) assuming the distance between the satellites to be very small (within 100 meter) so as to neglect the nonlinear terms in the gravitational differential acceleration. The atmospheric drag on the satellite was also neglected in the formulation. However, in reality this condition is hardly met for the low Earth orbit satellites. The purpose of this paper is to derive an analytical solution which accommodates the atmospheric drag depending on the size and orientation of the panels, second order nonlinear differential gravity, and the Earth's J2 perturbation in an elliptic orbit. The main purpose of the analytical solution is to look into the effect of the shape, size and orientation of the panels on relative motion of two satellites. For solving the differential equation, a perturbation free solution for an elliptical orbit as given by Carter [2] is considered and then the perturbation forces are added to the solution. A novel approach is also proposed for decoupling the differential equation in the x-y plane which helps in the integration process. To support the consistency of the analytical results, they are compared against the numerical solution.

References

[1] Clohessy, W. H., and Wiltshire, R. S., "Terminal guidance system for satellite rendezvous," Journal of Aerospace Sciences, 27(9), 653-674, 1960.

[2] Carter, T.E., "New form for the optimal rendezvous equations near a Keplerian orbit", Journal of Guidance, Control, and Dynamics, 13(1), 183-186, 1990.