

## Artificial Sun synchronous frozen orbit control scheme design based on J2 perturbation

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Abstract

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**Abstract** Sun synchronous orbit and frozen orbit formed due to  $J_2$  perturbation have very strict constraints on orbital parameters, which have restricted the application a lot. In this paper, several control strategies were illustrated to realize Sun synchronous frozen orbit with arbitrary orbital elements using continuous low-thrust. Firstly, according to mean element method, the averaged rate of change of the orbital elements, originating from disturbing constant accelerations over one orbital period, was derived from Gauss' variation of parameters equations. Then, we proposed that binormal acceleration could be used to realize Sun synchronous orbit, and radial or transverse acceleration could be adopted to eliminate the rotation of the argument of the perigee. Finally, amending methods on the control strategies mentioned above were presented to eliminate the residual secular growth. Simulation results showed that the control strategies illustrated in this paper could realize Sun synchronous frozen orbit with arbitrary orbital elements, and can save much more energy than the schemes presented in previous studies, and have no side effect on other orbital parameters' secular motion.

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