A Symplectic Approach for Attitude Optimal Control

of Spacecraft Solar Array Deployment

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Abstract

In aerospace engineering, the computational efficiency, reliability, accuracy and robustness of constraint nonlinear optimal control have been required strictly. The symplectic approach not only has the advantage of high computation efficiency and enough precision, but also has the excellent robust stability. Quasi-linearization method is used in this algorithm so that a nonlinear optimal control problem with state or control constraints transforms into a sequence of constraint linear quadratic(LQ) optimal control problems. Then variational method and the symplectic discretization are utilized, the problem is finally turned into a standard linear complementary problem and the optimal solution can be obtained by iteration. Based on this algorithm, the spacecraft attitude optimal control problems considering the state and control with constraints have been solved . It is found that the algorithm performs well and the optimal solution of the nonlinear dynamical system can be obtained within a few iteration steps and the solution can converge to high accuracy, as well as ,it is not sensitive to the initial value and has a good robustness.

Keyword:Nonlinear Optimal Control; Inequality Constraint; Variational Principle; Symplectic Conservation

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