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Fully Actuated System Theory Based Intelligent Attitude Maneuvering Control of Rigid Spacecraft

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Introduction

The attitude control system is one of the key systems that ensures the smooth operation of the spacecraft and has received a great deal of attention over the last few decades. It is noted that spacecraft attitude control systems are typically second-order fully actuated non-linear systems and that many non-linear control methods have been successfully applied to these systems. However, traditional non-linear control methods, such as fuzzy control and sliding mode control, may have issues such as loss of accuracy or strict stabilization conditions; therefore, a non-linear method that guarantees accuracy and stability is particularly necessary.

Methodologies

Fully actuated system parameterization approach
Modified Rodriguez parameters

Vantage points

The vantage points of fully actuated system parameterization approach are as follows:

1) Simple design
2) High precision

Research Question

The issue of spacecraft attitude control.

Research Process

Model spacecraft attitude motion in the form of Euler-Lagrange general equations.

Design a feedback control term based on the fully actuated system approach which addresses the effect of the nonlinear characteristics of the dynamic model, which leads to a constant linear closed-loop system.

Further design a robust adaptive control law for the linear closed-loop system.

Propose a parameter optimization method based on reinforcement learning.

Finally, numerical simulations are performed.

Conclusion

Numerical simulation results indicate the effectiveness of the proposed intelligent controller.