Shahed University
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Robust Multiple Model Adaptive Control of Satellite Attitude

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Abstract

In this thesis, adaptive control of satellite attitude is considered. In particular, the focus is on spacecraft attitude control under angular velocity constraints. A passivity-based output feedback adaptive attitude control is proposed and then by dividing the parameter space of inertia matrix into smaller subspaces a set of model/controller pairs is achieved. The transient response of the proposed controller is significantly improved by switching between pairs based on a performance criteria in term of quaternion error. Asymptotically stability of the non-adaptive case of proposed controller without switching is proved. A spacecraft orbit and attitude simulator is developed and used to evaluate the performance of proposed algorithm. In addition, a robust attitude control law is also proposed which is robust against bounded time-varying disturbances and its stability is proved using Lyapunov second method. The transient response of this control law is also improved utilizing multiple model approach. In contrast to the first algorithm which uses switching to determine the overall control input, this algorithm uses a convex combination of all control inputs as the overall control input to apply to the plant. The performance of this algorithm is also simulated.

Key Words: Satellite Attitude Control, Adaptive Control, Multiple Model, Robust Control, Quaternion