A Singular Adaptive Attitude Control with active disturbance rejection

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A Singular Adaptive Attitude Control with active disturbance rejection

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Abstract

This paper develops a quaternion attitude tracking control with an adaptive gains parameter that can be tuned to compensate for disturbances with known bound. The adaptive gain is described by a simple, but singular, differential equation and the corresponding adaptive control is shown to asymptotically track a reference attitude. However, this control requires the bound on the disturbance torque to be known in order to appropriately tune the controller to compensate for it. Using a linear state observer to estimate the disturbance torque and compensating for the disturbance at each sampling period the adaptive control can achieve asymptotic tracking in the presence of an unknown disturbance torque. In this case the error in the estimation, rather than the entire disturbance, is compensated for by the adaptive gain at each sampling period. Simulations demonstrate that an improved tracking performance can be achieved when compared to standard quaternion tracking controls.

Keywords: Nano-spacecraft, Inverse Control, Quaternion Feedback Control, Linear Extended State Observer, Singular Quaternion Feedback Control

1. Introduction

Attitude stabilization and tracking in the presence of disturbance torques is an active area of research due to the increased pointing and tracking

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