AA279c Project Report: Modeling the ISS

Toby J. Buckley

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testing

1 Problem Set 8 - Implement Actuators and Controllers

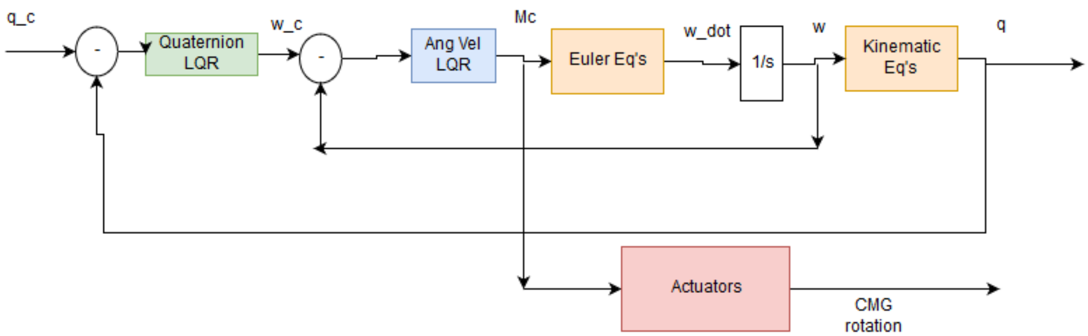

Figure 1: Block diagram for the controller used onboard the satellite. Two LQR's are utilized, one for attitude and the other for a lower-level ang. vel. controller.

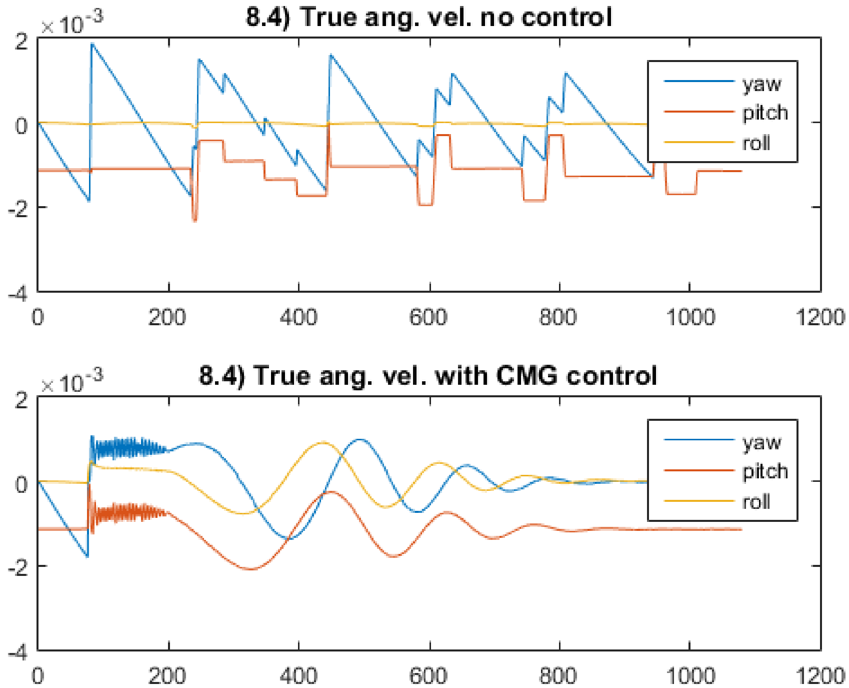

Figure 2: Angular velocity while de-tumbling.

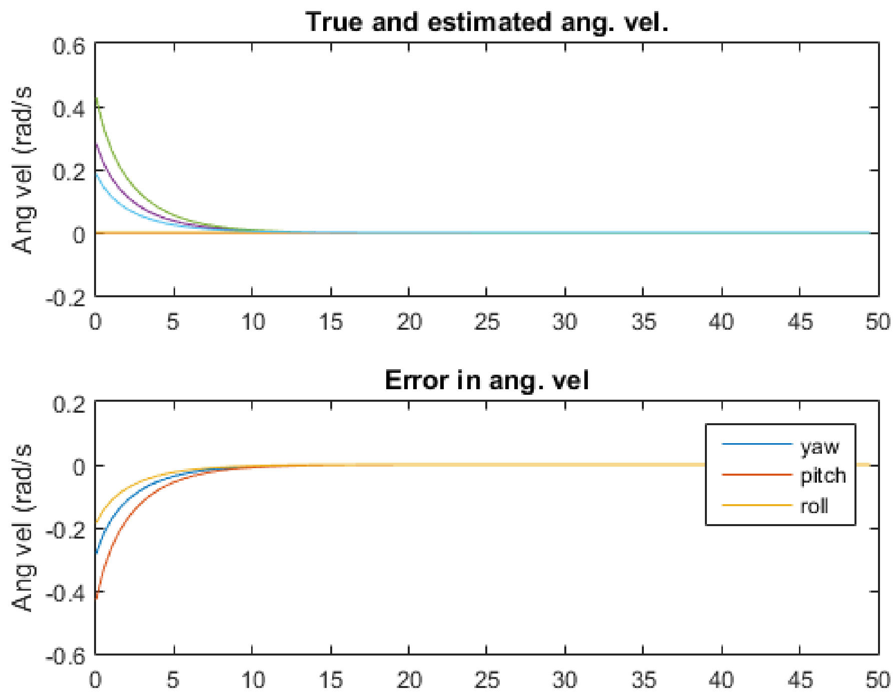

Figure 3: Angular velocity while de-tumbling.

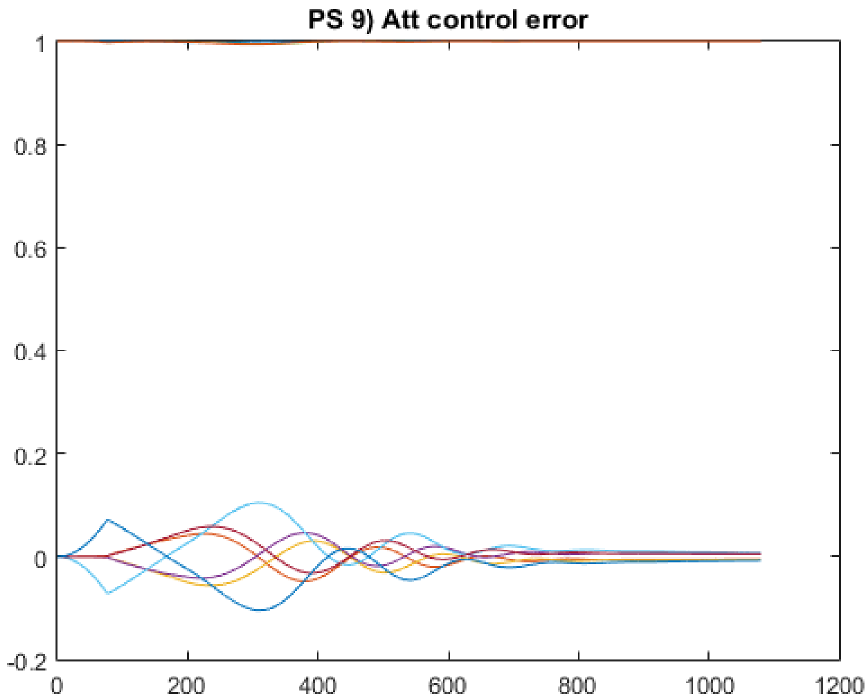

Figure 4: Angular velocity while de-tumbling.

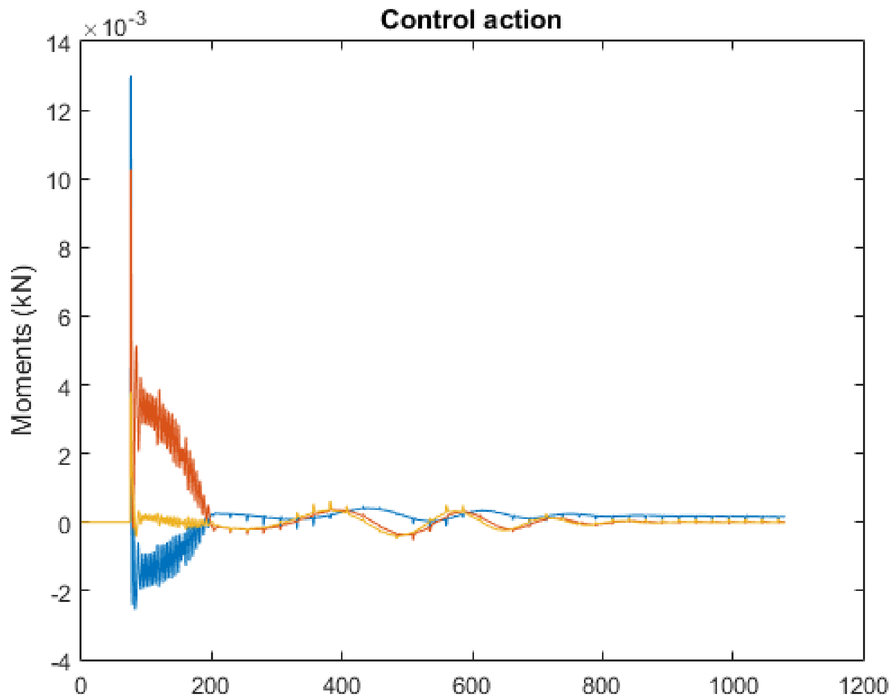

Figure 5: Angular velocity while de-tumbling.

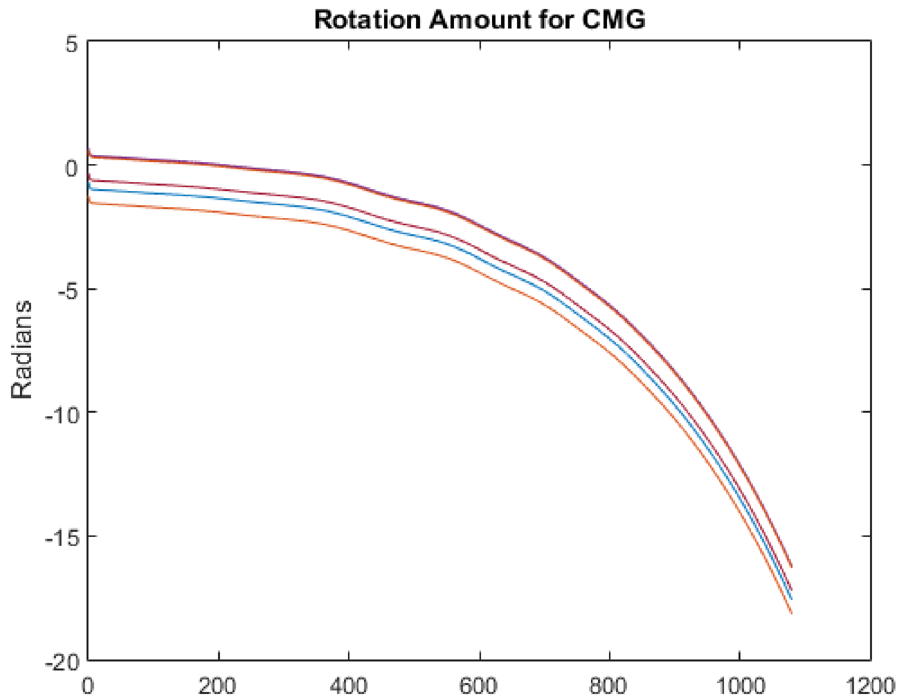

Figure 6: Angular velocity while de-tumbling.

2 Problem Set 9 - Define and Execute a Slew Maneuver

A problem all satellites deal with is de-tumbling. When launched into orbit the satellite is harshly ejected from its rocket into a target orbit and must immediately begin to align itself into its nominal position. I've simulated a tumbling environment by setting $w0 = rand(3,1)$ and allowing the dynamics and controller to stabilize the system naturally. The target attitude for the de-tumble is the earth-facing RTN frame.

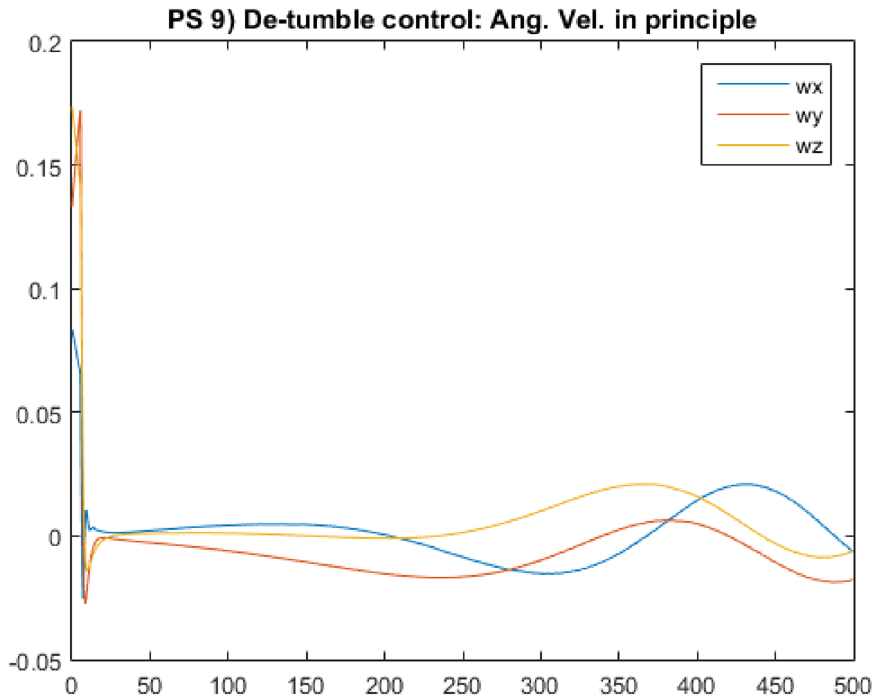

Figure 7: Angular velocity while de-tumbling.

Fig. 7 shows the angular velocity while de-tumbling. Because of the high priority on matching w to $w_{desired}$ the velocities stabilize quickly. After that all changes are due to the attitude controller commanding certain angular velocity in order to align itself with the RTN frame.

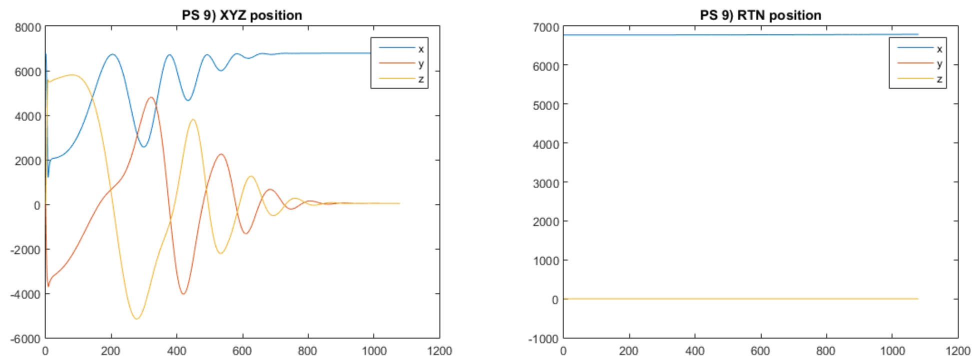

Figure 8: The position during a de-tumble. The Target is earth-facing in the RTN frame.

Fig. 8 shows how the principle axes aligns itself with the RTN frame over time. Oscillations are present due to the sinusoidal dynamics of the rotation cosine matrices.

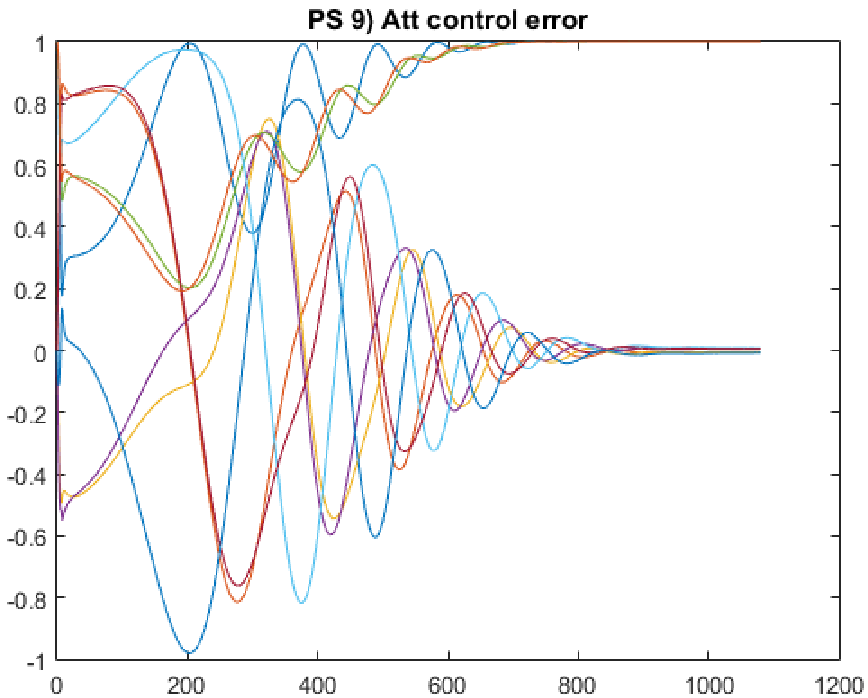

Figure 9: Attitude control error until convergence.

Fig 9 shows the evolution of the attitude control error over time. It's clear the the tumbling has a huge effect on the relative alignment of the principle axes with the desired RTN frame. But this problem is overcome within 800 seconds of ejection with the satellite's onboard controller.