

Aero 421 Final Project Discussion

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Thrusters:

Three cold gas thrusters by MOOG were chosen to detumble the spacecraft. The three thrusters were chosen based on how much torque would need to be applied about the x, y, and z body axes of the spacecraft in order to stabilize it. Using these thrusters it was determined that the amount of fuel each thruster uses is 0.000074, 0.000135, and 0.000443 kg and the total amount of fuel used by the thrusters is 0.000651 kg. See far left thruster in the link below for data specifications.

http://www.moog.com/content/dam/moog/literature/Space_Defense/Spacecraft/Propulsion/ColdGasThrusters_0717.pdf

Reaction Wheels:

Reaction wheels were used on the spacecraft in order to counteract the various disturbance torques it encounters during orbit. Spinning wheels on a spacecraft make the inertia about each spin axis appear more oblate, making it harder for disturbances to influence the spacecraft's attitude. Additionally whenever the spacecraft attitude diverged from within 2% of nominal, the reaction wheels were accelerated in order to reorient the vehicle. This gradual accumulation of angular momentum eventually needs to be "dumped" due to the wheel's limited angular velocity. Although this maximum value was not reached during the 5 periods we modeled, momenting dumping can be achieved through the use of the previously mentioned cold-gas thrusters.

Three RW1 reaction wheels by Blue Canyon Technologies were chosen keep the spacecraft sensor pointing nadir. These wheels were chosen based on angular momentum each wheel would need to counteract in order to achieve a desired attitude of the spacecraft in order to maintain a nadir pointing orientation. Based on simulated reaction wheel angular momentum plots, it was determined that the maximum amount of angular momentum experience about any axis was approximately .85 Nms and the maximum absolute angular momentum accumulated by all wheels was approximately 1.4 Nms. Each wheel is capable of providing 1.5Nms of angular momentum, making them sufficient to maneuver this spacecraft. See link below for reaction wheel data specifications.

http://bluecanyontech.com/wp-content/uploads/2018/01/DataSheet_RW_07_F.pdf

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421 Final Project

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Body parameters

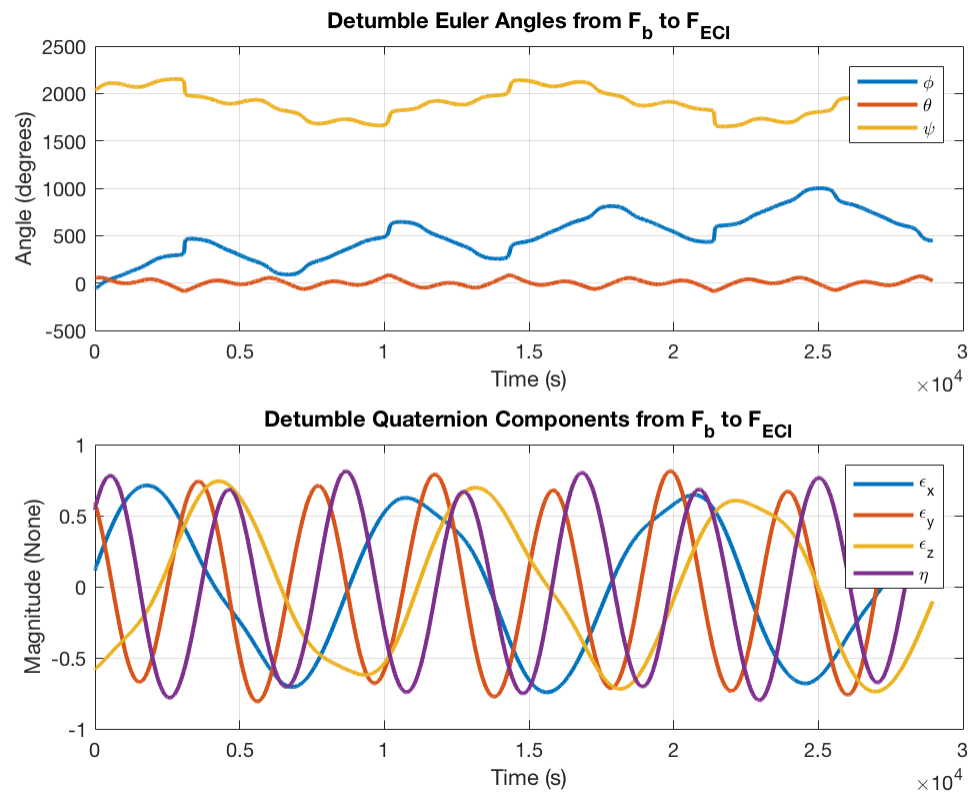
-- Initial COM & I calcs

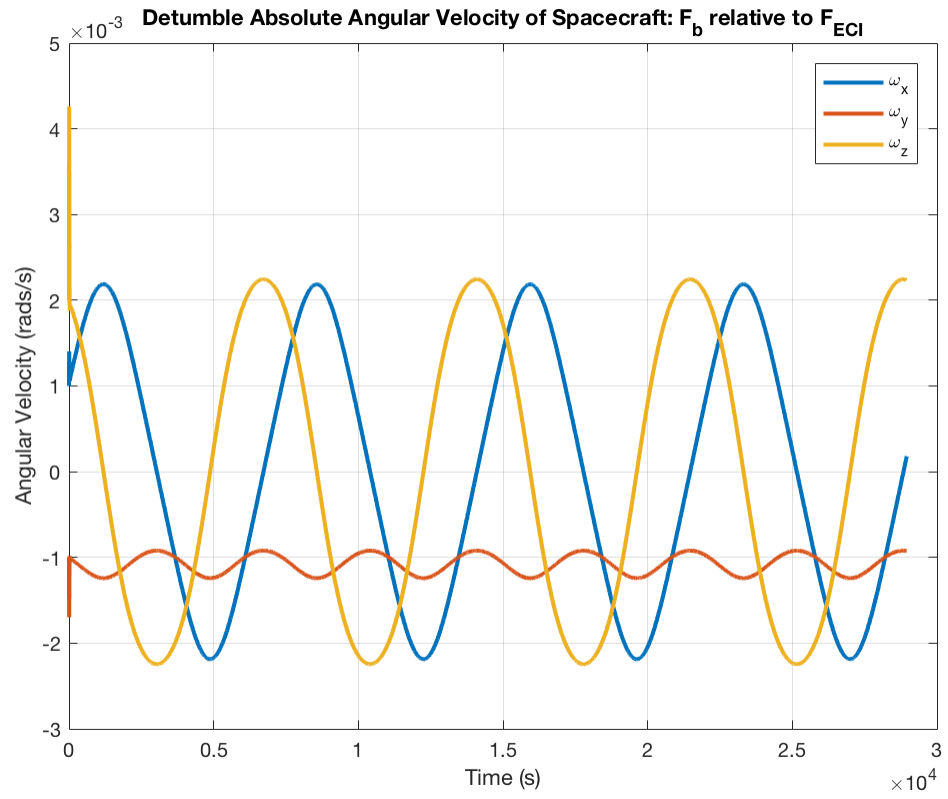
Orbital parameters

rigid body prop

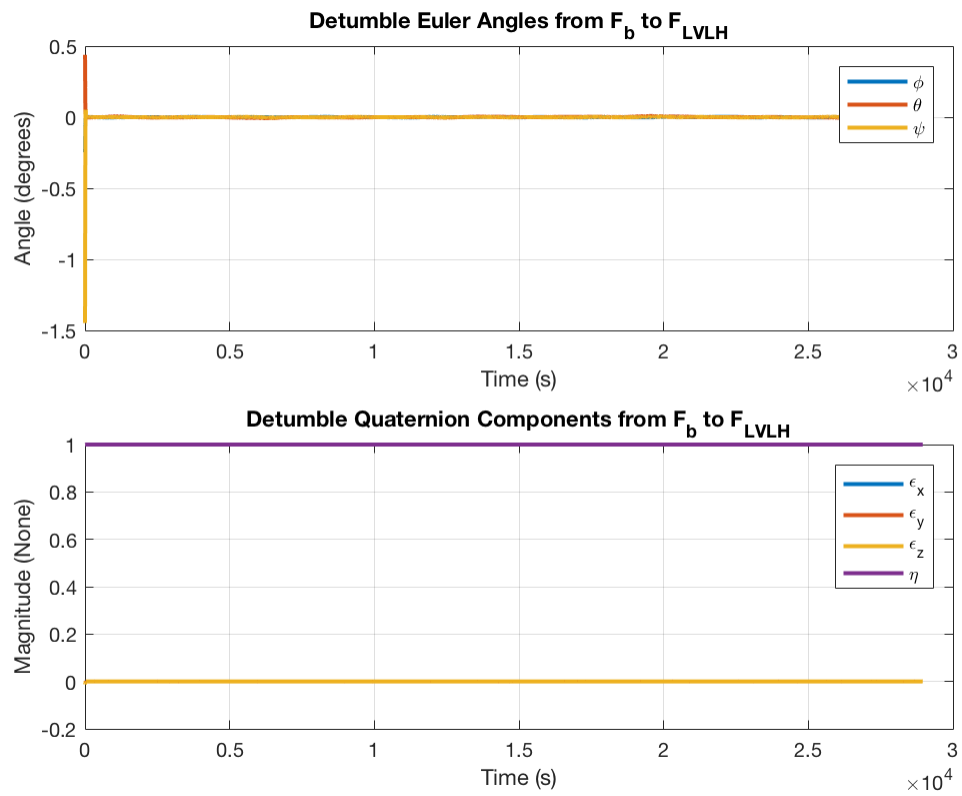
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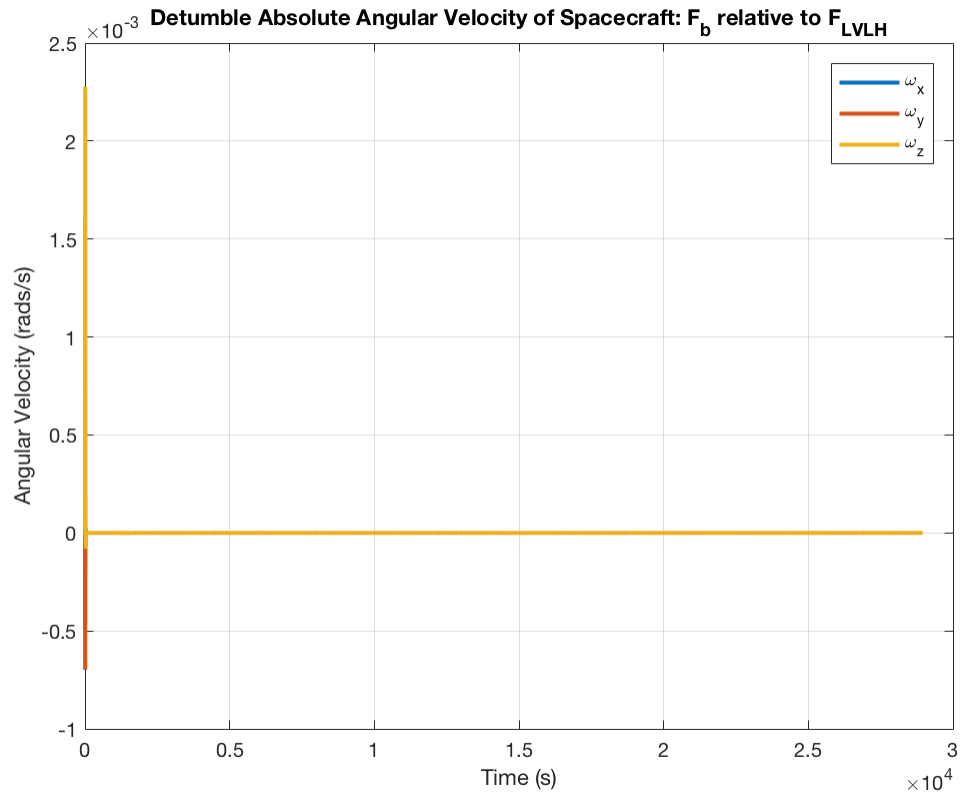
Body Relative to ECI Plots





Body Relative to LVLH Plots

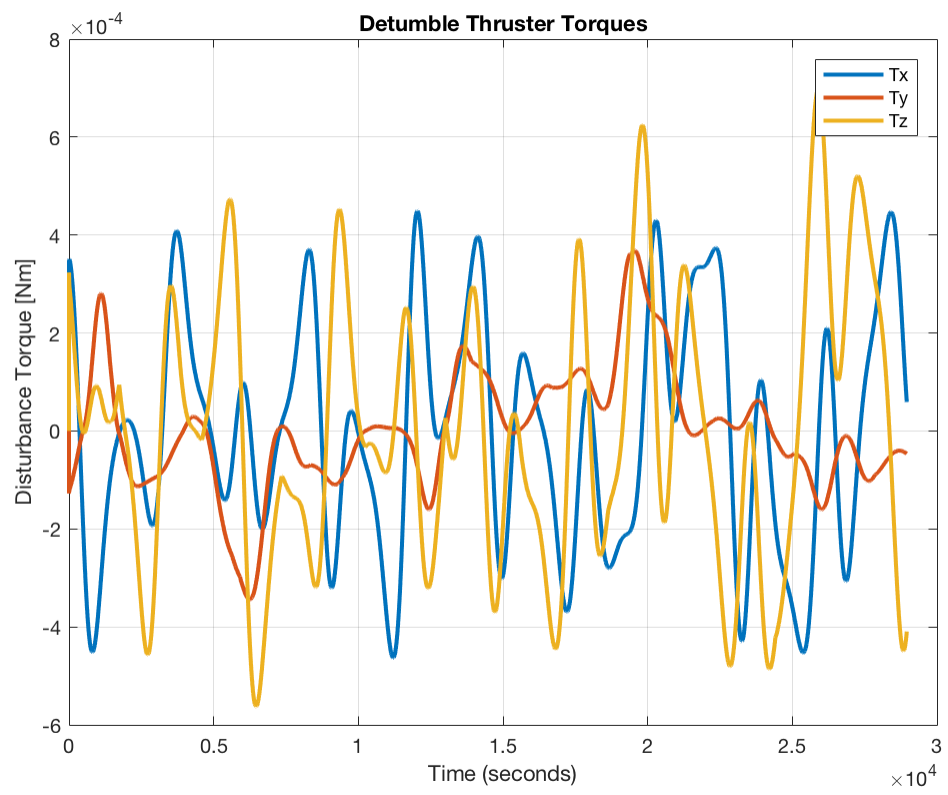




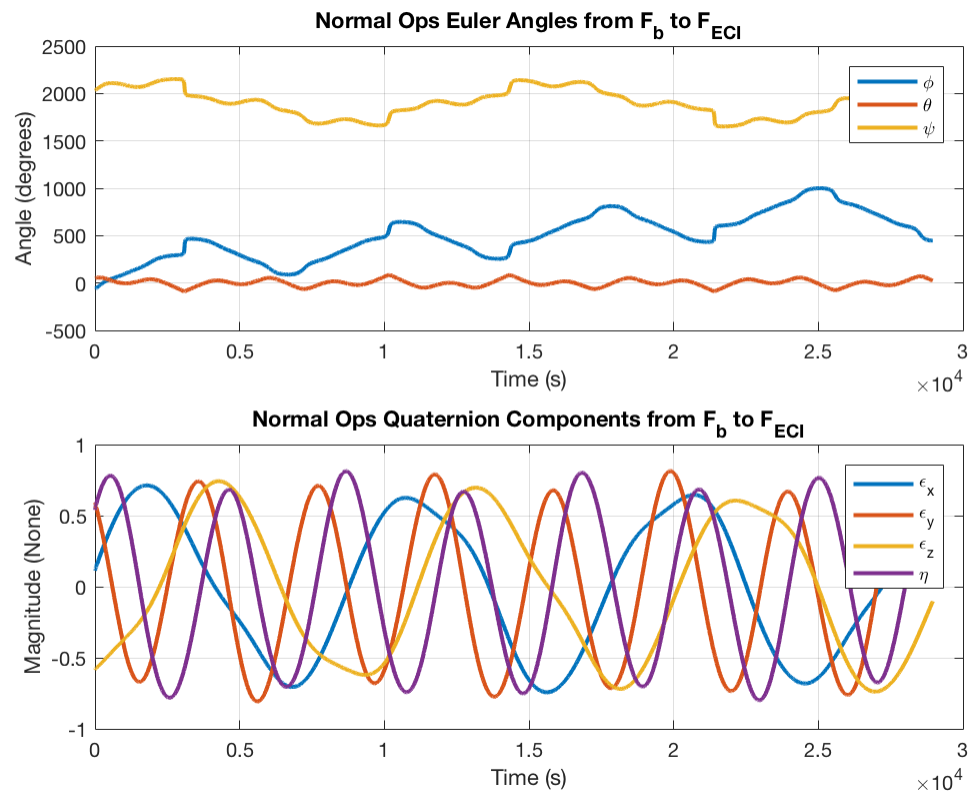
Total Torque

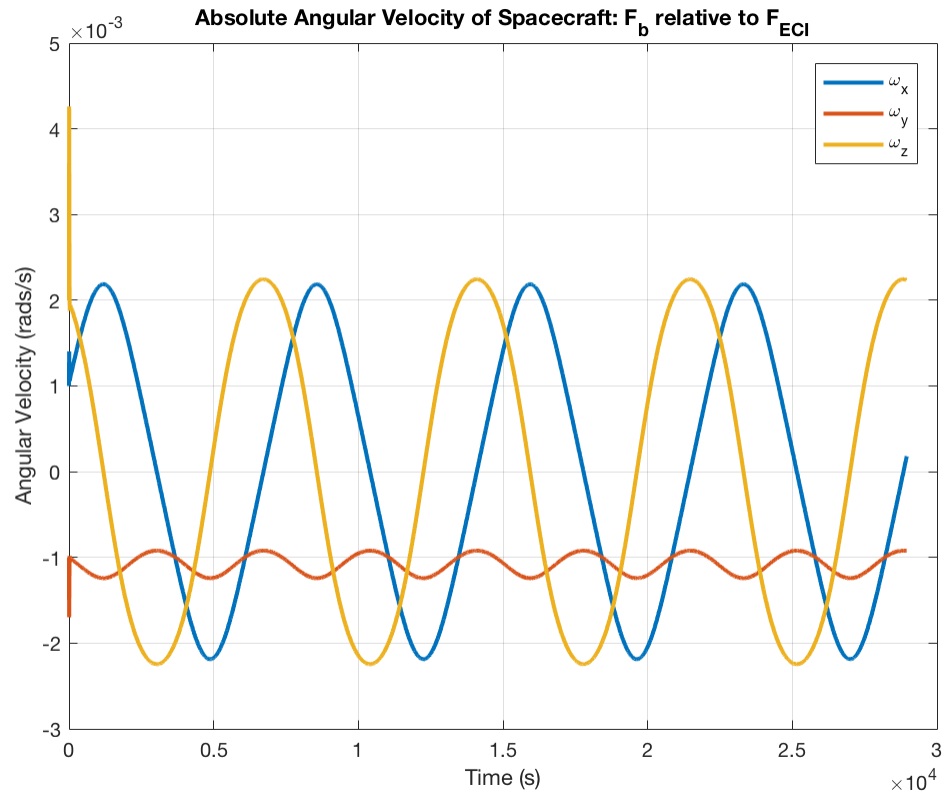
The amount of mass each thruster uses is 0.009404, 0.004387, and 0.010769 kg.

The total amount of mass used by the thrusters is 0.024560 kg.

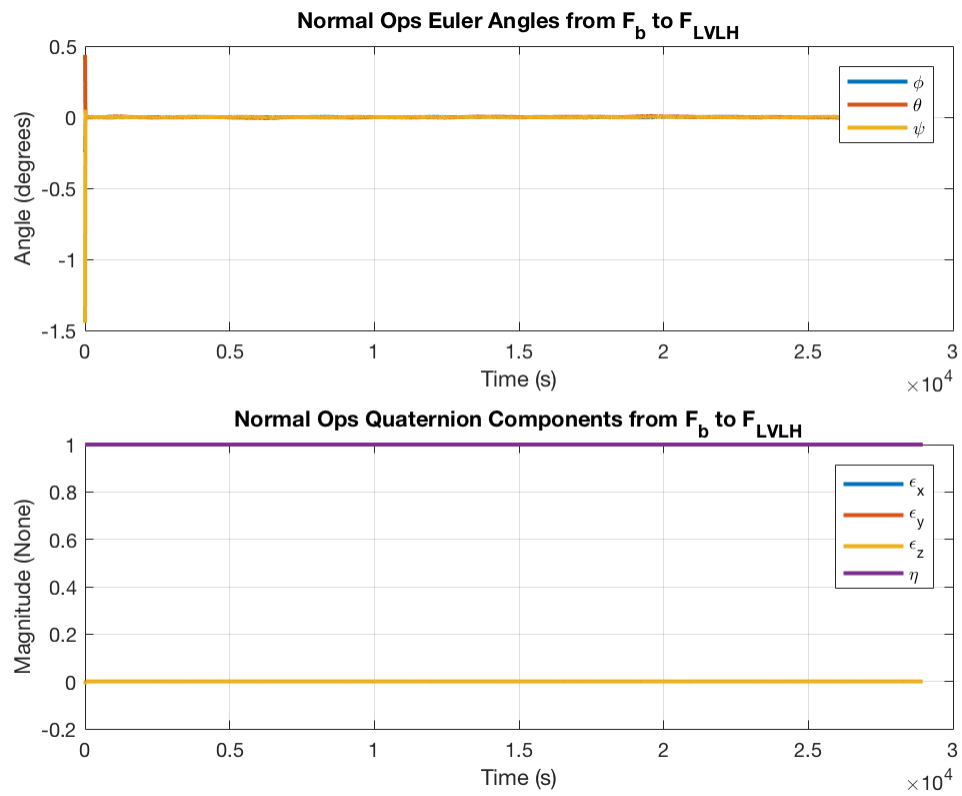


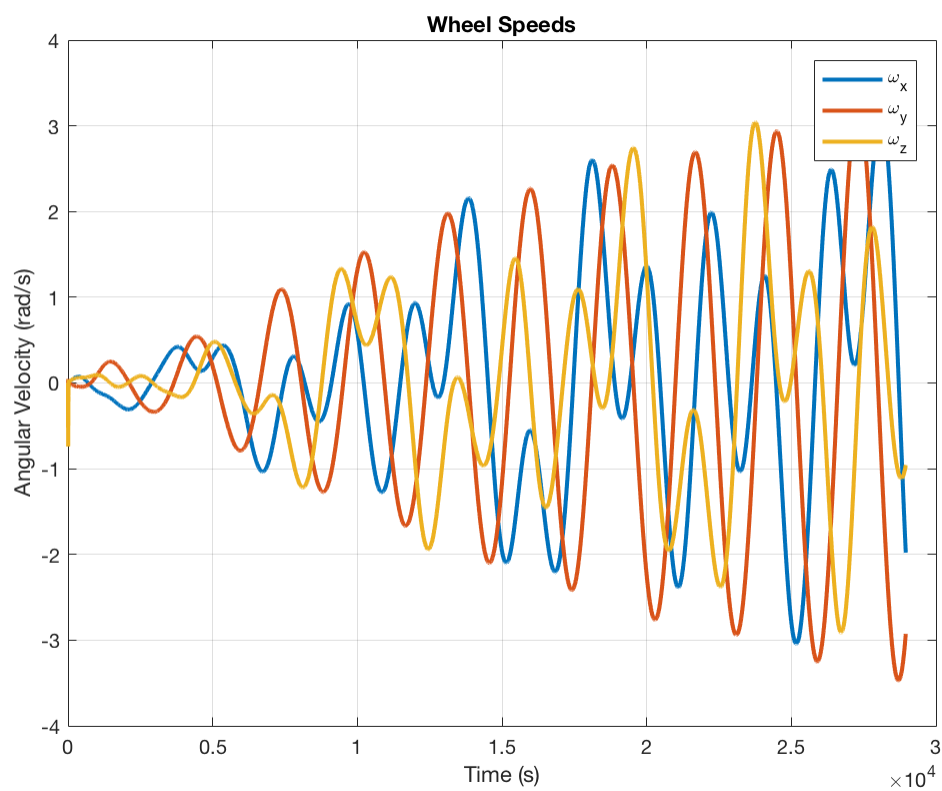
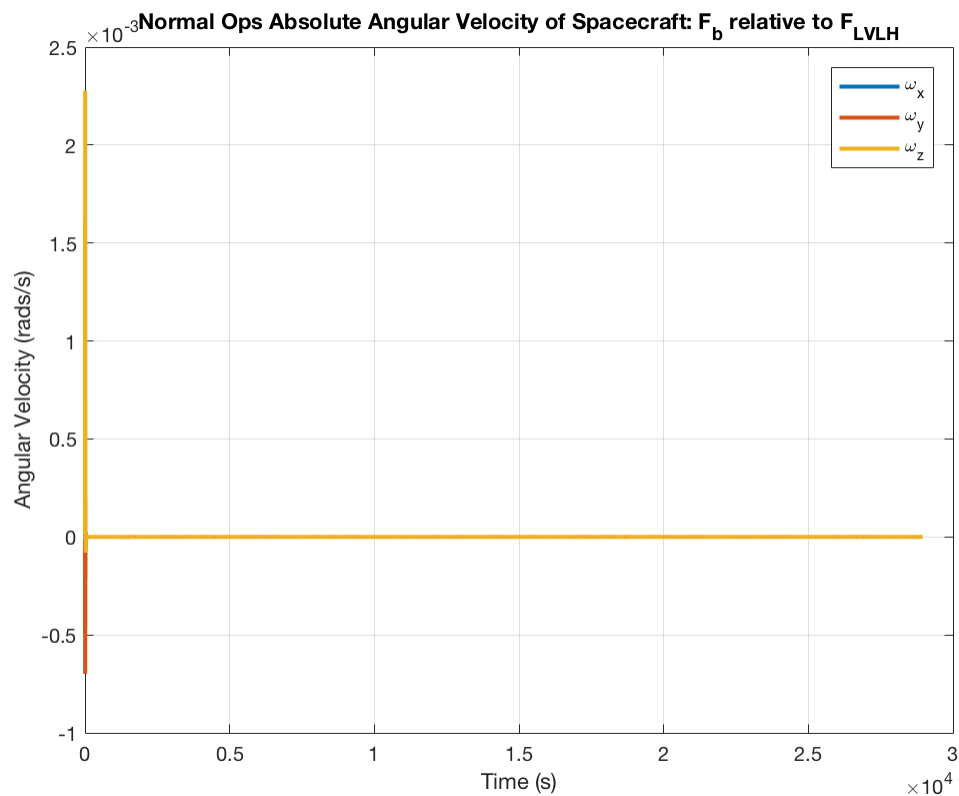
Body Relative to ECI Plots



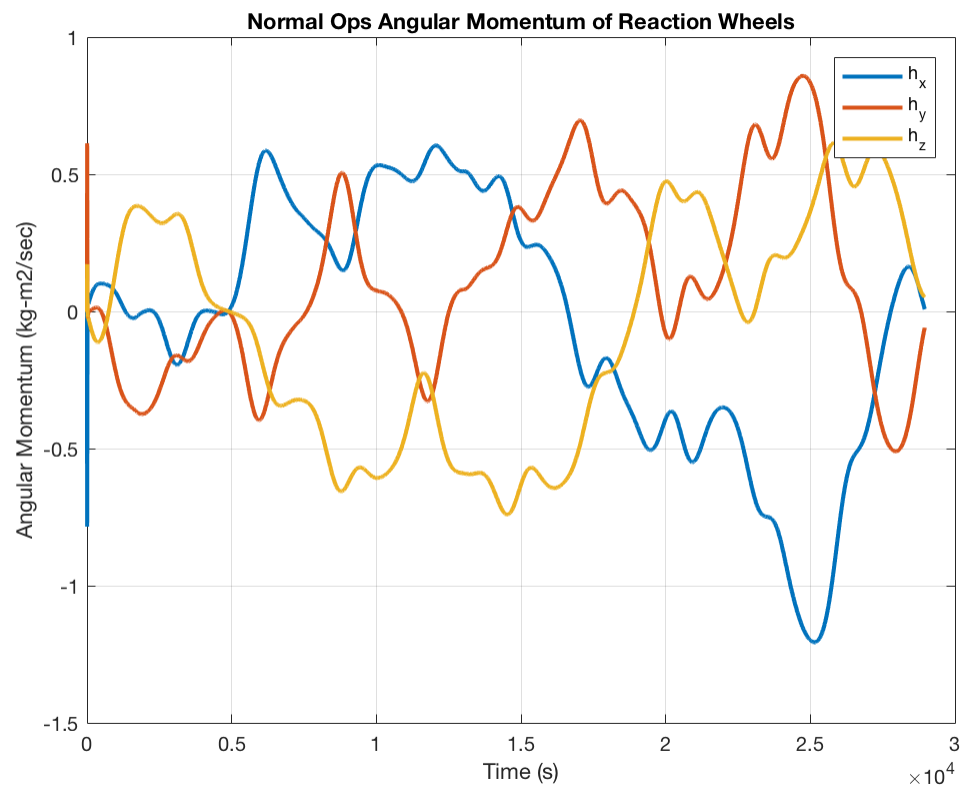


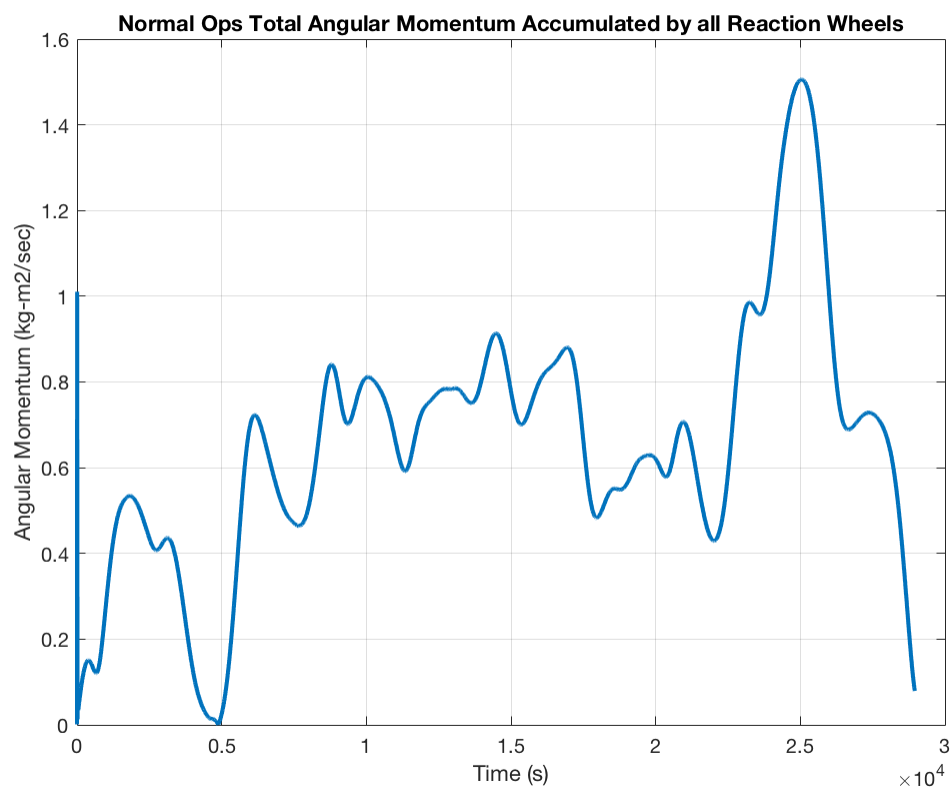
Body Relative to LVLH Plots



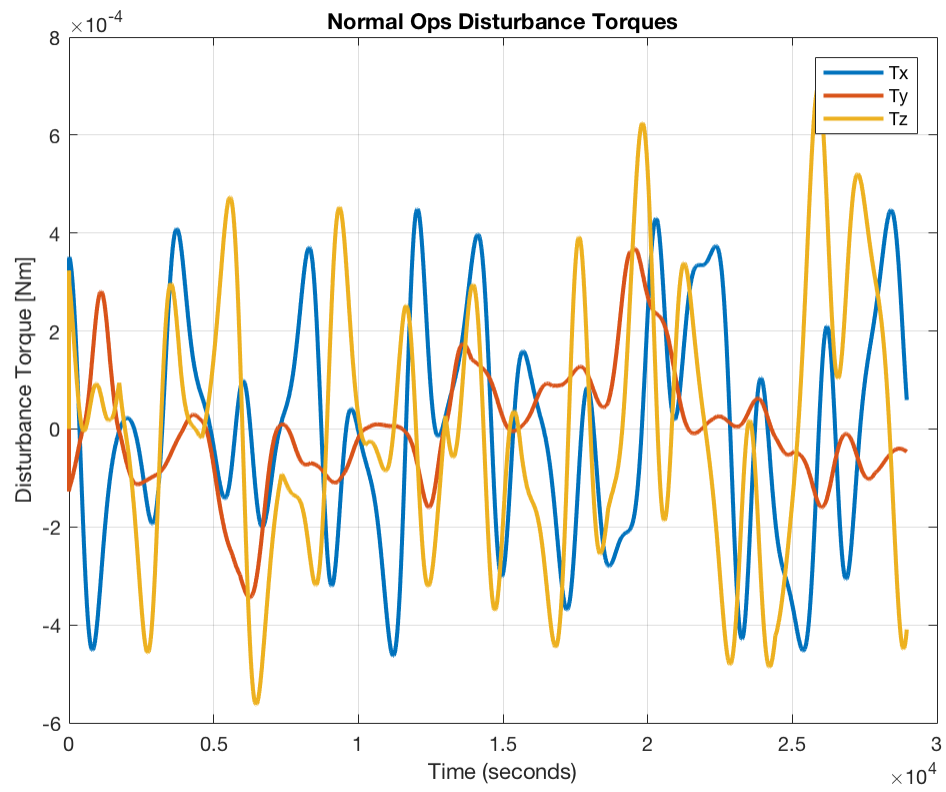


Angular Momentum Accumulated

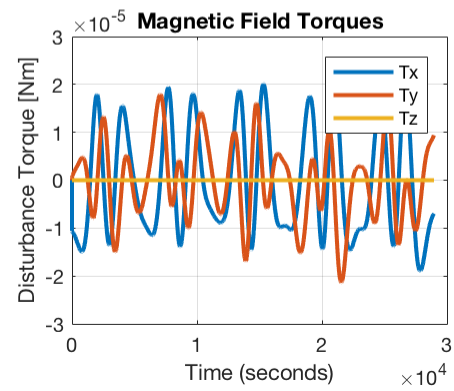
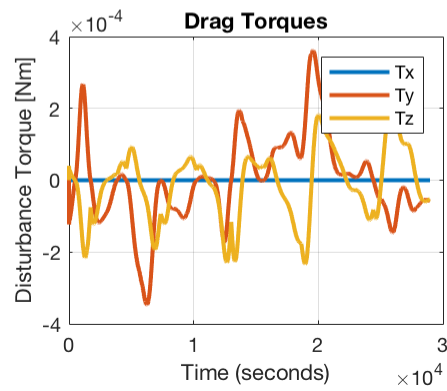
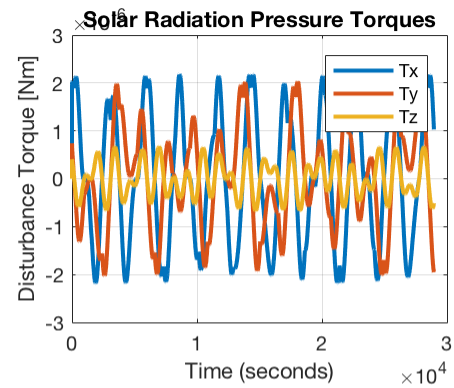
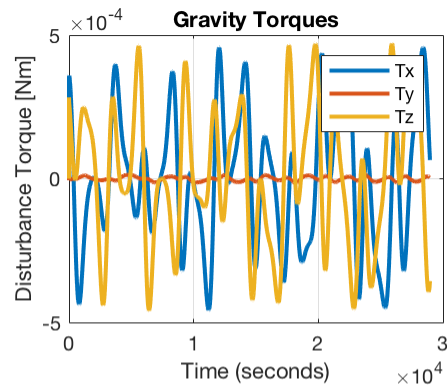




Total Torque



Individual Torques



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