# Notes on Manchester Satellite Simulation

* TVLQR
  + Limits of TVLQR to noise in terms of variances

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q\_omega | Q\_f\_omega | Q\_quat | Q\_f\_quat | R |
| 1e-1 | 1e3 | 1e2 | 1e10 | 2e-2 |

*Simulation Parameters*

* + These were tested qualitatively by varying the variables independently to two significant figures and then observing the TVLQR lose control authority

|  |  |  |  |
| --- | --- | --- | --- |
| Sensor | Magnetometer | Attitude | Rotation |
| Nominal Variances | 1E-5 T | 1 degrees | .38 deg/s |

*Nominal Variances*

|  |  |  |  |
| --- | --- | --- | --- |
| Sensor | Magnetometer | Attitude | Rotation |
| Maximum Variance | 2.7E-3 T | 44 degrees | 5.8 deg/s |

*Maximum Variances*

* + - This seems scary, but consider that this is the variance, so most of the noise is well under this…also the quaternion has much less importance on the dynamics than the rotational velocity
    - **Important** – although the simulation is still stable, the satellite has more and more trouble keeping an attitude when the variance of the noise increases, so this number comes with a qualification
* 90 Degree Slew

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Mass | Moment of Inertia | Max Mag. Moment |
| Value | .75 kg | .00125 kgm2 | .19 Am2 |

*1U Cubesat Specs*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | Mass | Moment of Inertia (Z) | Moment of Inertia (X/Y) | Max Mag. Moment |
| Value | 3.5 kg | .005256 kgm2 | .04939 kgm2 | .19 Am2 |

*3U Cubesat Specs*

* + ISS (i = 51.64 deg), h = 400 km, RAAN = 0, nu = 0
    - 1U Rotated in roughly 90 seconds
    - 3U Rotated in roughly 540 seconds (9 minutes)

Length scaling argument – torque from torque coil squares with area, the inertia squares to the 5th