H = angular momentum $= I \cdot pqr$

$\dot{H} = \Sigma M$

$\dot{H} = I\,\dot{pqr} = I\,((pqr)' + \text{cross}(pqr, H))$??

$\Rightarrow \dot{pqr} = I^{-1} \Sigma M$

$$\begin{bmatrix} p \\ q \\ r \end{bmatrix} \times \begin{bmatrix} H_1 \\ H_2 \\ H_3 \end{bmatrix} = \begin{bmatrix} qH_3 - rH_2 \\ rH_1 - pH_3 \\ pH_2 - qH_1 \end{bmatrix}$$

Total angular momentum

$H = I_{sat} \cdot pqr + I_{r1B} \cdot \omega_1 \cdot n_1 + I_{r2B} \cdot \omega_2 \cdot n_2 + I_{r3B} \cdot \omega_3 \cdot n_3$

$M_r = \begin{bmatrix} p \\ q \\ r \end{bmatrix}$ = satellite angular velocities

Sat angular accel $= I^{-1}_{\text{total sat}} (-LMN\_Reaction\_wheels - \text{cross}(pqr, H))$

$I = I_s + I_{dRigt} + I_{r2Bgt} + I_{r3Bgt}$

$I_{r1Bg} = I_{r1B} + m_r \cdot (sr3')^2 \cdot sr1$ (principle off-axis distance)

$= \text{skew}(r1)$

$I_{r1B} \cdot T1' \cdot I_{wR} \cdot T1$

$T_1 = Rscrew(a_1)$ → rotation of RW, w/r

$\begin{bmatrix} 0.dof \\ \vdots \end{bmatrix}$ = trans off in x direction from Sat CoM

$\begin{bmatrix} \vdots \end{bmatrix}$ = aligned with x

$I_{r_1}B \cdot \dot{\omega}_1 \cdot n_1 + I_{r_2}B \cdot \dot{\omega}_2 \cdot n_2 + I_{r_3}B \cdot \dot{\omega}_3 \cdot n_3$

inertia of RW in body frame about RW's CoM

'resistive' torque due to changing angular velocity about an axis with angular momentum, I think

?

$$\begin{bmatrix} I_{11} & 0 \\ 0 & I_{22} \; I_{33} \end{bmatrix} \dot{\omega}_1 \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} I_{11} \\ 0 \\ 0 \end{bmatrix} \dot{\omega}_1 \Rightarrow \Sigma \begin{bmatrix} (I_{r_1}B)_{11}\,\dot{\omega}_1 \\ (I_{r_2}B)_{22}\,\dot{\omega}_2 \\ (I_{r_3}B)_{33}\,\dot{\omega}_3 \end{bmatrix} = \begin{bmatrix} (I_{r_1}B)_{11} \\ & (I_{r_2}B)_{22} \\ & & (I_{r_3}B)_{33} \end{bmatrix} \begin{bmatrix} \dot{\omega}_1 \\ \dot{\omega}_2 \\ \dot{\omega}_3 \end{bmatrix}$$