Student Satellite Project
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Website: www.aero.iitb.ac.in/satlab

Readme file for dynamics.py

Attitude Determination and Control Subsystem

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x_dot_BO( )

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Input: Satellite object, time, state vector
Output : Derivative of error vector w.r.t. time

1. Obtain the total torque acting on satellite. There are two types of torques, control torque and disturbance torque. These are accessed from satellite object `sat` using methods `getControl_b()` and `getDisturbance_b()` respectively. The torque vector is expressed in body frame.

2. First four components of (1×7) state vector form quaternion q_{BO} and last three components form angular velocity of body frame w.r.t. orbit frame expressed in body frame.

3. $\dot{q}_{BO} = \frac{1}{2}\begin{bmatrix} -\vec{v}^T\omega_{BOB} \\ s\omega_{BOB} + \vec{v} \times \omega_{BOB} \end{bmatrix}$
where ω_{BOB} is the angular velocity of body wrt orbit frame, $\vec{v}$ is vector part of q_{BO}, s is scalar part of q_{BO}.

4. $J\dot{\omega}_{BOB} = -\omega \times J\omega + \tau - J[R(\omega_{BOB} \times \omega_d + \dot{\omega}_d)]))$
where J is moment of inertia and τ is total torque. ω is the angular velocity of body wrt ECI frame, ω_d is the angular velocity of orbit wrt inertial frame. R is the rotation matrix corresponding to q_{BO}.