Dynamic Modeling IV

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6:14 PM

Add dynamic coupling to lateral Axis

Equation of Motion with Dynamic Coupling

$$\ddot{\theta}_L I_{Tot,L} = \Sigma M_L + \cos(\theta_L)\cdot(L_L + \sin(\theta_L)L)\cdot L\cdot m\,\dot{\theta}_V^2$$

Solve for $\ddot{\theta}_L$:

$$\ddot{\theta}_L = \frac{\Sigma M_L}{I_{Tot,L}} + \frac{\cos(\theta_L)\cdot(L_L + \sin(\theta_L)L)\cdot L\cdot m\,\dot{\theta}_V^2}{I_{Tot,L}}$$

$$\mathcal{L}\{\cos(\theta_L)\cdot(L_L + \sin(\theta_L)L)\cdot L\cdot m\,\dot{\theta}_V^2\}$$

$$= \frac{L_L\dot{\theta}_V^2\cdot L\cdot m}{s^2+1}s + \frac{\dot{\theta}_V^2\cdot L^2 m}{s^2+4}$$

Update Transfer Function

$$\theta(s)_L = \frac{T_M(s)}{I_{Tot}s^2 + sC_F} + \frac{1}{I_{Tot,L}}\cdot\frac{L\cdot m(L_L s^3 + 4L_L s + Ls^2 + L)\,\dot{\theta}_V^2}{s^4 + 5s^2 + 4}$$

$$\theta(s)_L = \frac{T_M(s)}{I_{Tot,L}s^2 + sC_F} + \frac{L\cdot m(L_L s^3 + Ls^2 + 4L_L s + L)\,\dot{\theta}_V^2}{I_{Tot,L}}$$

Solve for $\frac{\theta(s)_L}{T_M(s)}$: Can't do this!