

Selected Answers from Homework 2

$$4.13 \quad \left(\frac{J}{R_2^2} + m\right)\ddot{x} + b\frac{R_1^2}{R_2^2}\dot{x} = mg$$

$$4.23 \quad \left(\frac{J}{R^2} + m\right)\ddot{x} + b\dot{x} = b\dot{y}$$

$$4.53 \quad (J + mR^2)\ddot{\theta} + b\dot{\theta} = \tau - mgR$$

$$4.54 \quad I\ddot{\theta} + (cL_2^2 + bL_3^2)\dot{\theta} \cos^2 \theta = FL_1 \cos \theta$$

$$4.65 \quad (J + mR^2)\ddot{\theta} + (b + cR^2)\dot{\theta} = \tau$$

$$1a) \omega(t) = \omega_0 e^{\frac{-b}{J}t}$$

$$1d) \theta_f = \frac{J}{b} \omega_0$$

$$2) v_p(t) = \frac{F_0}{\sqrt{(m\omega_{in})^2 + b^2}} \sin\left(\omega_{in}t - \tan^{-1}\left(\frac{m\omega_{in}}{b}\right)\right) = \frac{F_0}{b^2 + (m\omega_{in})^2} (b \sin(\omega_{in}t) - m\omega_{in} \cos(\omega_{in}t))$$

Supplemental problems

$$4.14) \quad J\ddot{\theta} + b(D_2 \cos \theta)^2 \dot{\theta} = mgD_1 \cos \theta$$

Note: $J = mD_1^2$

$$4.58) \quad \text{EOM:} \quad (J + mR^2)\ddot{\theta} + (b + c)(R + B \cos \theta)^2 \dot{\theta} = 0$$

$$\text{Linearized (SAA) EOM:} \quad (J + mR^2)\ddot{\theta} + (b + c)(R + B)^2 \dot{\theta} = 0$$

Note: B refers to the distance between point O and point P, b refers to the damping rate of the damper which replaced the spring, and $J = \frac{1}{2}mR^2$

$$4.66) (I_1 N^2 + I_2)\dot{\omega}_3 + c_T \omega_3 = NT_1$$

4.79) The problem is 2 DOF so it is optional for now. DO NOT SUM MOMENTS AT THE PIN!