

Selected Answers from HW #6

5.2

$$\frac{X(s)}{F(s)} = \frac{10}{s + 13}$$

5.3

$$\frac{X(s)}{F(s)} = \frac{4}{s^2 + 8s + 24}$$

2.45a

$$\frac{X(s)}{F(s)} = \frac{15}{10s + 14}$$

2.45d

$$\frac{X(s)}{F(s)} = \frac{15}{2s^2 + 28s + 98}$$

2.46

$$\frac{X(s)}{F(s)} = \frac{1}{4s^2 + 20s + 17}$$
$$\frac{Y(s)}{F(s)} = \frac{4s}{4s^2 + 20s + 17}$$

2.47

$$\frac{X[s]}{F[s]} = \frac{7}{s^2 + 11s + 45}$$
$$\frac{Y[s]}{F[s]} = \frac{s + 3}{s^2 + 11s + 45}$$

4.13 $m\ddot{x} + k\left(\frac{R_1}{R_2}\right)^2 x = 0$

4.18 $mL_3^2\ddot{\theta} + (k_1L_1^2\cos(\theta) + k_2L_2^2\cos(\theta) + mgL_3)\sin\theta = k_2L_2x\cos(\theta)$

4.22 $I\ddot{\theta} + (k_1 + k_2)\theta = k_1\phi$

4.23 $\left(m + \frac{I}{R^2}\right)\ddot{x} + kx = ky$

4.65 $\left(\frac{I_m}{R^2} + \frac{I_p}{R^2} + m\right)\ddot{x} + c\dot{x} + kx = \frac{\tau}{R}$

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$$6.14 \quad LC\ddot{I} + RC\dot{I} + I = C\dot{V}_s$$

$$6.25 \quad LC_2\ddot{v}_o + RC_2\dot{v}_o + \left(\frac{C_2}{C_1} + 1\right)v_o = v_s$$

Problem #1:

$$\text{a) } \frac{X[s]}{U[s]} = \frac{1}{s^2 + 5s + 5}$$

$$\frac{Y[s]}{U[s]} = \frac{s+2}{s^2 + 5s + 5}$$

$$\text{b) } s^2 + 5s + 5$$

$$\text{c) } \frac{-5 \pm \sqrt{5}}{2}$$

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Supplemental Problems:

$$4.14 \quad mD_1^2\ddot{\theta} + kD_2^2 \sin(\theta) \cos(\theta) = 0$$

$$4.16 \quad (I + m_1R^2)\ddot{x} + kR^2x = 0$$

$$4.30 \quad \left(m + \frac{I}{R^2}\right)\ddot{x} + (k_1 + k_2)x = 0$$

$$4.37 \quad mL_2^2\ddot{\theta} + (2kL_1^2\cos\theta - mgL_2)\sin\theta = 0$$

$$4.53 \quad (I + mR^2)\dot{v} + c_Tv = TR - mgR^2$$

$$v(t) = 443 \left(1 - e^{-\frac{t}{24}}\right)$$

$$4.54 \quad I\ddot{\theta} + cL_2^2\dot{\theta} \cos^2\theta + kL_3^2\sin\theta\cos\theta = fL_1\cos\theta$$

$$4.80 \quad (m_r + m_c)\ddot{x} + m_rL(\ddot{\theta}\cos\theta - \dot{\theta}^2\sin\theta) + kx + c\dot{x} = 0$$

$$m_rL^2\ddot{\theta} - m_rL(\cos\theta)\ddot{x} + m_rg\sin\theta = 0$$

$$4.82 \quad \left(m_1 + \frac{I}{R^2}\right)\ddot{x}_1 + kx_1 = f + \frac{I}{R^2}\ddot{x}_2$$

$$\left(m_1 + \frac{I}{R^2}\right)\ddot{x}_2 + kx_2 - \frac{I}{R^2}\ddot{x}_1 = 0$$

$$6.15 \quad LC\ddot{v}_o + RC\dot{v}_o + v_o = Ri_s$$