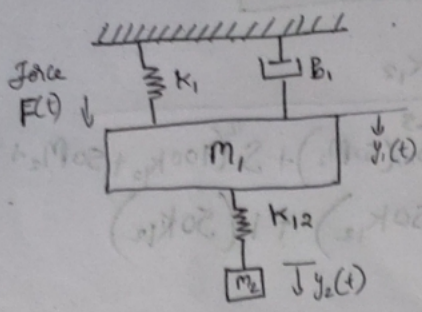
LAP LIFE

MBD_Milestone_Week1

Problem 1



For M_1

$$F(t) = M_1 \frac{d^2y_1}{dt^2} + B_1 \frac{dy_1}{dt} + K_1 y_1 + K_{12}(y_1 - y_2)$$

Taking Laplace Transform

$$F(s) = M_1 S^2 Y_1(s) + B_1 S Y_1(s) + K_1 Y_1(s) + K_{12} Y_1(s) - K_{12} Y_2(s)$$

$$F(s) = Y_1(s)\left[M_1 s^2 + B_1 S + K_1 + K_{12}\right] - Y_2(s)\left[K_{12}\right]$$

For M_2

$$0 = M_2 \frac{d^2y_2}{dt^2} + K_{12} y_2 - K_{12} y_1$$

Taking L.T

$$0 = M_2 S^2 Y_2(s) + K_{12} Y_2(s) - K_{12} Y_1(s)$$

$$0 = Y_2(s)\left[M_2 S^2 + K_{12}\right] - \left[K_{12}\right] Y_1(s)$$

$$Y_1(s) = \frac{Y_2(s)\left[M_2 S^2 + K_{12}\right]}{K_{12}}$$

$$F(s) = \left[M_1 s^2 + B_1 S + K_1 + K_{12}\right] \times \frac{Y_2(s)\left[M_2 S^2 + K_{12}\right]}{K_{12}} - Y_2(s)\left[K_{12}\right]$$

$$F(s) = \frac{\left[M_1 s^2 + B_1 S + K_1 + K_{12}\right] \times Y_2(s)\left[M_2 S^2 + K_{12}\right] - Y_2(s)\left[K_{12}\right]^2}{K_{12}}$$

$$\frac{Y_2(s)}{F(s)} = \frac{K_{12}}{\left(M_2 S^2 + K_{12}\right)\left(M_1 S^2 + B_1 S + K_1 + K_{12}\right)}$$

Given $M_1 = 100$, $K_1 = 50$, $B_1 = 50$

$$\frac{Y_2(s)}{F(s)} = \frac{K_{12}}{S^4(100M_2) + S^3(50M_2) + S^2(100K_{12} + 50M_2 + M_2K_{12}) + S(50K_{12}) + 1(50K_{12})}$$