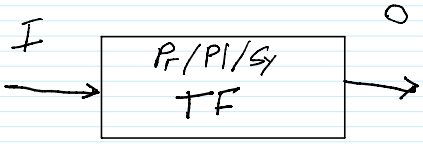
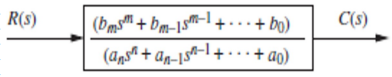
Transfer Function

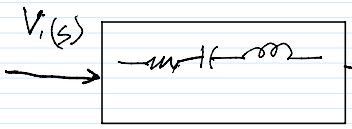
Monday, September 14, 2020 8:28 AM

S domain

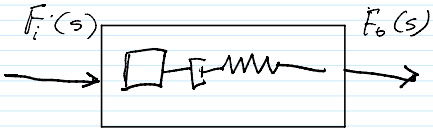


$$\frac{C(s)}{R(s)} = G(s) = TF = \frac{\text{Output}}{\text{Input}}$$

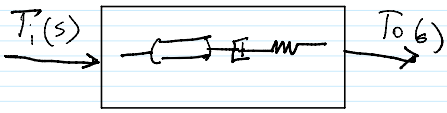




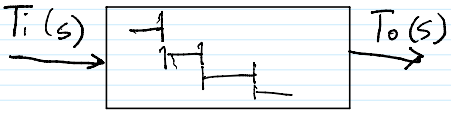
$$G(s) = \frac{V_o(s)}{V_i(s)}$$



$$G(s) = \frac{F_o(s)}{F_i(s)}$$

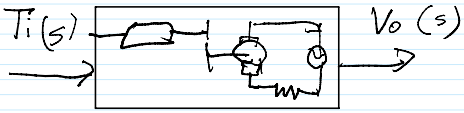


$$G(s) = \frac{T_o(s)}{T_i(s)}$$



$$G(s) = \frac{T_o(s)}{T_i(s)}$$

$$G(s) = \frac{T_o(s)}{V_i(s)}$$



$$G(s) = \frac{V_o(s)}{T_i(s)}$$

Note: Always assume initial conditions are zero.

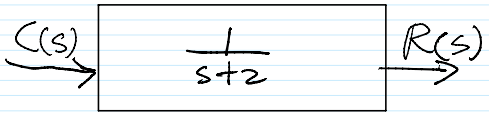
$$\frac{dc(t)}{dt} + 2c(t) = r(t)$$

$$sC(s) + 2C(s) = R(s)$$

$$\frac{1}{R(s)} \frac{1}{(s+2)} \{C(s)[s+2] = R(s)\} \cdot \frac{1}{R(s)} \frac{1}{s+2}$$

$$\frac{C(s)}{R(s)} = \frac{1}{s+2} = G(s)$$

$$G(s) = \frac{C(s)}{R(s)}$$



$$s^3Y(s)+3s^2Y(s)+5sY(s)+Y(s)=s^3X(s)+4s^2X(s)+6sX(s)+8X(s)$$

$$\{Y(s)[s^3+3s^2+5s+1]=X(s)[s^3+4s^2+6s+8]\}\ \frac{1}{X(s)}\cdot\frac{1}{s^3+3s^2+5s+1}$$

$$\frac{d^3y}{dt^3}+3\frac{d^2y}{dt^2}+5\frac{dy}{dt}+y=\frac{d^3x}{dt^3}+4\frac{d^2x}{dt^2}+6\frac{dx}{dt}+8x$$

$$\frac{Y(s)}{X(s)}=\frac{s^3+4s^2+6s+8}{s^3+3s^2+5s+1}=G(s)$$

$Y(s)/X(s)$

$$\mathcal{L}^{-}\ X(s)\ \boxed{\frac{s^3+4s^2+6s+8}{s^3+3s^2+5s+1}}\ Y(s)$$

$$\{Y(s)[s^3+3s^2+5s+1]=X(s)[s^3+4s^2+6s+8]\}$$

$$\mathcal{L}\{s^3Y(s)+3s^2Y(s)+5sY(s)+Y(s)=s^3X(s)+4s^2X(s)+6sX(s)+8X(s)\}$$

$$\frac{d^3y}{dt^3}+3\frac{d^2y}{dt^2}+5\frac{dy}{dt}+y=\frac{d^3x}{dt^3}+4\frac{d^2x}{dt^2}+6\frac{dx}{dt}+8x$$