Section 1 per lab
Controls lab 2
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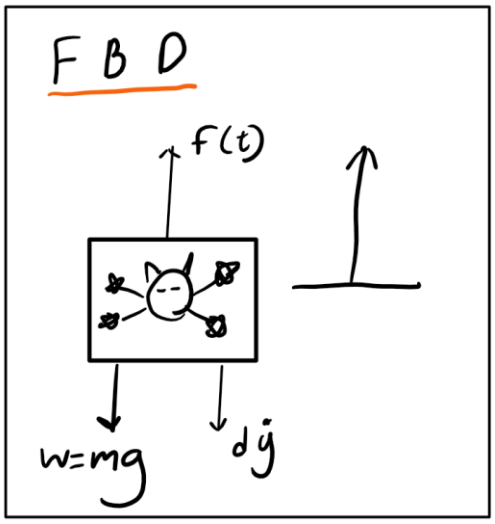
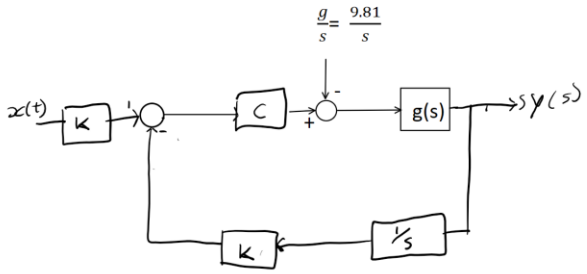


A) Block diagram



k: unit used to convert position to voltage

c: controler constent

B) Diffraction equation

$$\ddot{y(t)} = -d\dot{y(t)} + f(t) - gm$$

$$Y(s)s^2 - sf(0) - \dot{f(0)} = d\big(-Y(s)s + f(0)\big) + F(s) + \frac{gm}{s}$$

$$Y(s)s^2 + dY(s)s = F(s) + \frac{gm}{s}$$

$$Y(S)(s^2 + ds) = F(s) + \frac{gm}{s}$$

$$Y(S) = \frac{F(s)+\frac{gm}{s}}{(s^2+ds)}$$

$$\frac{Y(s)}{F(s)} = \frac{1}{(s^2+s)} + \frac{\frac{gm}{s}}{F(s)\times(s^2+s)}$$

$$s\frac{Y(s)}{F(s)} = \frac{1}{(s+d)}$$

C) deriving G(s) closed loop

$$G(s) = \left(k \times c - \frac{9{,}81}{s}\right) \times G(s)$$

$$G(s) = \left(k \times c - \frac{9{,}81}{s}\right) \times \frac{1}{(s+d)}$$

$$G_{close\ loop} = \frac{(k\times c)\times\frac{1}{(s+d)}}{1+(k\times c)\times\frac{1}{(s+d)}\times\frac{1}{s}\times k}$$

b)

$$sY(s) = X(s)\mathrm{G}_{\text{closed loop}}(\mathrm{s}) + G_v g(s)$$

$$sY(s) = X(s) \times \frac{(k\times c)\times\frac{1}{(s+d)}}{1+(k\times c)\times\frac{1}{(s+d)}\times\frac{1}{s}\times k} + \frac{\frac{1}{(s+d)}\times\frac{1}{s}}{1+c\times\frac{1}{(s+d)}\times\frac{1}{s}\times k} \times \frac{9{,}81}{s}$$

i)

$$errer\ constant = \lim_{s\to 0} \frac{1}{1+\frac{1}{(\mathrm{s+b})}}$$

$$errer\ constant = \frac{b}{b+1}$$

II)type 1

iii) should be zero.

C) Simulink