Preperation Lab 2

den 1 december 2024 09:03

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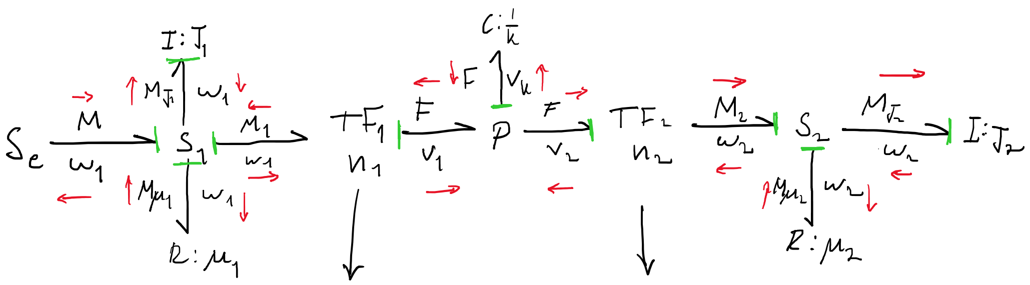
Preperation 2.1

Belt transmission



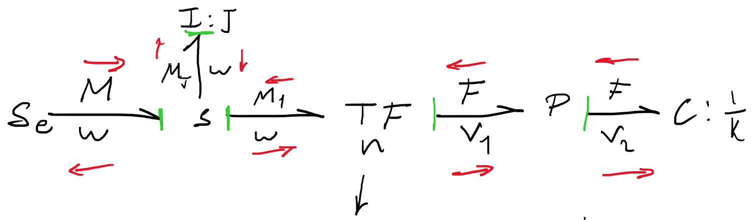
$v_1 = n_1 \omega_1$

$F = \frac{1}{n_1} M_1$

$\omega_2 = \frac{1}{n_2} v_2$

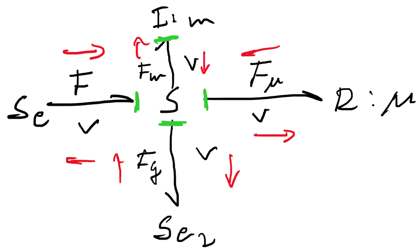
$M_2 = n_2 F$

Screw transmission



$v_1 = n \cdot w$, $F = \frac{1}{n} M_1$

Robot Arm



Preperation 2.2

Belt

$J_1 = \frac{\pi}{2} r^4 h \rho$, $r = 0.01m$, $h = 0.01m$, $\rho = 2.7 \cdot 10^3$

$\Rightarrow \frac{\pi}{2} \cdot (0.01)^4 \cdot 0.01 \cdot (2.7 \cdot 10^3) = \underline{4.24 \cdot 10^{-7}}$

$b_1 = 2 \cdot 10^{-5}$

$J_2 = \frac{\pi}{2} r^4 h \rho$, $r = 0.04m$, $h = 0.015m$, $\rho = 2.7 \cdot 10^3$

$\Rightarrow \frac{\pi}{2} (0.04)^4 \cdot 0.015 \cdot (2.7 \cdot 10^3) = \underline{1.63 \cdot 10^{-4}}$

$b_2 = 5 \cdot 10^{-5}$

Elastic force: $F = k \cdot \Delta x$

$F = 200\,N$, $\Delta x = 0{,}004 \cdot 750 = 0{,}003\ m$

$k = \frac{F}{\Delta x} = \frac{200}{0{,}003} = 66\ 667$

Screw

From B8000 , Screw inertia $= 5.2 \cdot 10^{-5}$

$16\ oz = 0{,}45359\ kp \Rightarrow oz = \frac{0{,}45359}{16}\ kp$

$kp = 9{,}81$

Giving

$J = 5{,}2 \cdot 10^{-5} \cdot \frac{0{,}45359}{16} \cdot 9{,}81 = 1{,}45 \cdot 10^{-5}$

Spring constant: $k = 75\ 000$

Arm

Mass: $m = 5.5$

μ : 25

$F_g = m \cdot g = 53{,}955$

Preperation 2.3

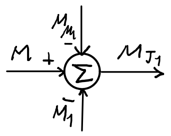
Choose simulink

Belt subsystem

$Se : u = M$

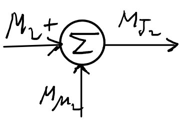
S_1 : $M - M_{J_1} - M_1 - M_{\mu_1} = 0$, Based on causality $\Rightarrow$

$M_{J_1} = M - M_1 - M_{\mu_1}$, Gives sum block



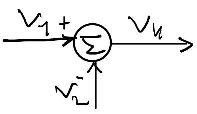
S_2: $M_2 - M_{J_2} - M_{\mu_2} = 0 \Rightarrow$

$M_{J_2} = M_2 - M_{\mu_2}$

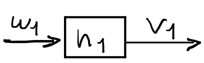


P: $V_1 - V_2 - V_k = 0 \Rightarrow$

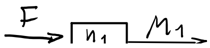
$V_k = V_1 - V_2$



TF_1: $V_1 = n_1 \omega_1 \longrightarrow$



$F = \frac{1}{n_1} M_1 \longrightarrow$



TF_1: $V_1 = n_1 \omega_1 \longrightarrow \xrightarrow{\omega_1}\boxed{n_1}\xrightarrow{V_1}$

$F = \frac{1}{n_1} M_1 \longrightarrow \xrightarrow{F}\boxed{n_1}\xrightarrow{M_1}$

TF_2: $M_2 = n_2 F \longrightarrow \xrightarrow{F}\boxed{n_2}\xrightarrow{M_2}$

$\omega_2 = \frac{1}{n_2} V_2 \longrightarrow \xrightarrow{\omega_2}\boxed{n_2}\xrightarrow{V_2}$

$I: J_1$: $\omega_1 = \frac{1}{J_1}\int M_{J_1}(\tau)\,d\tau \longrightarrow \xrightarrow{M_{J_1}}\boxed{\frac{1}{J_1}\int}\xrightarrow{\omega_1}$

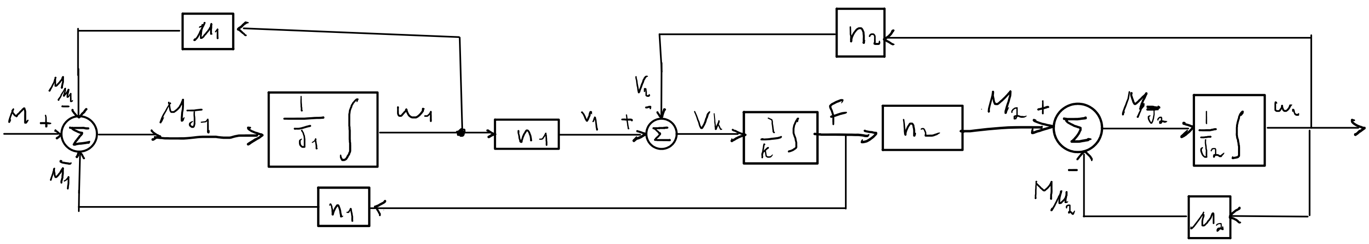
$I: J_2$: $\omega_2 = \frac{1}{J_2}\int M_{J_2}(\tau)\,d\tau \longrightarrow \xrightarrow{M_{J_2}}\boxed{\frac{1}{J_2}\int}\xrightarrow{\omega_2}$

$R: \mu_1$: $M_{\mu_1} = \mu_1 \omega_1 \longrightarrow \xrightarrow{\omega_1}\boxed{\mu_1}\xrightarrow{M_{\mu_1}}$

$R: \mu_2$: $M_{\mu_2} = \mu_2 \omega_2 \longrightarrow \xrightarrow{\omega_2}\boxed{\mu_2}\xrightarrow{M_{\mu_2}}$

$C: \frac{1}{k}$: $F = \frac{1}{k}\int V_k(\tau)\,d\tau \longrightarrow \xrightarrow{V_k}\boxed{\frac{1}{k}\int}\xrightarrow{F}$

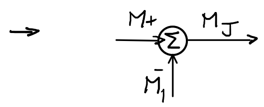
Put together gives following block diagram:



Screw

S_e: $u = M$

S_1: $M - M_J - M_1 = 0 \Rightarrow M_J = M - M_1$



Not sure

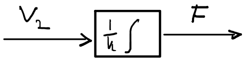
P: $V_1 - V_2 = 0 \Rightarrow V_1 = V_2 \longrightarrow \xrightarrow{V_1}\bigcirc\xrightarrow{V_2}$ Maybe wrong

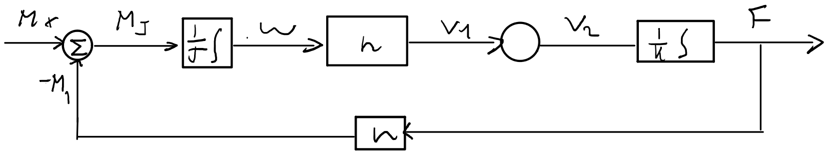
TF: $V_1 = n \cdot \omega \longrightarrow \xrightarrow{\omega}\boxed{n}\xrightarrow{V_1}$

$M_1 = \frac{1}{n} F \longrightarrow \xrightarrow{F}\boxed{n}\xrightarrow{M_1}$ Might be wrong

$I: J$ $\omega = \frac{1}{J}\int M_J(\tau)\,d\tau \longrightarrow \xrightarrow{M_J}\boxed{\frac{1}{J}\int}\xrightarrow{\omega}$

$C: \frac{1}{K}$ $\quad F = \frac{1}{k}\int v_2(\tau)\,d\tau \longrightarrow$





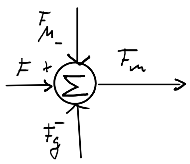
Might be wrong

Arm

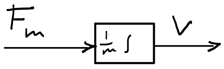
$Se_1: \ u_1 = F$

$Se_2: \ u_2 = F_g \quad (mg)$

$S: \ F - F_m - F_\mu - F_g = 0 \Rightarrow F_m = F - F_\mu - F_g \longrightarrow$



$I: m \quad v = \frac{1}{m}\int F_m(\tau)\,d\tau \longrightarrow$



$R: \mu \quad F_\mu = \mu v \longrightarrow$