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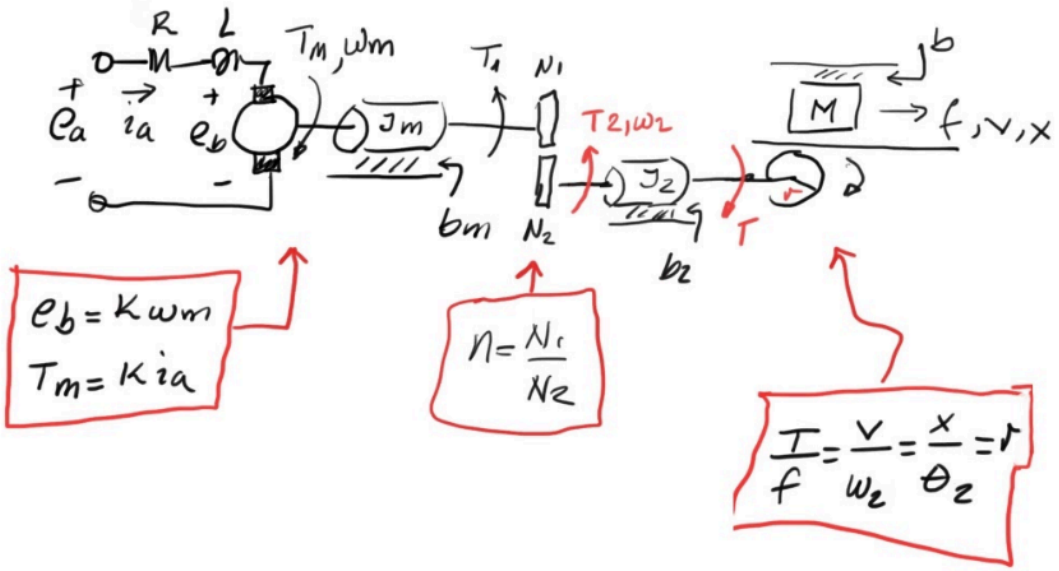
EJERCICIO DE SISTEMAS DE CONTROL

Para el sistema que se muestra en la figura, calcule la función de transferencia del sistema $T(s) = X(s)/E_a(s)$. Suponga que:

R= 2.0 Ohms, L= 0.5 Henrys, $K = K_m = K_b = 0.015$ constante motor, y emf, b_2=b =0.2 Nms, $J_m = J_2 = 0.02$ kg.m^2 ; r= 12 cm; M= 30 Kg n= N_1 /N_2=2



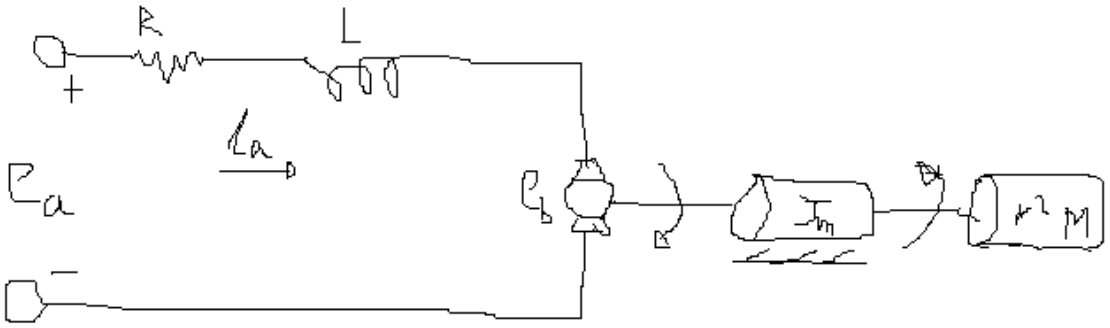
Modelado 1:

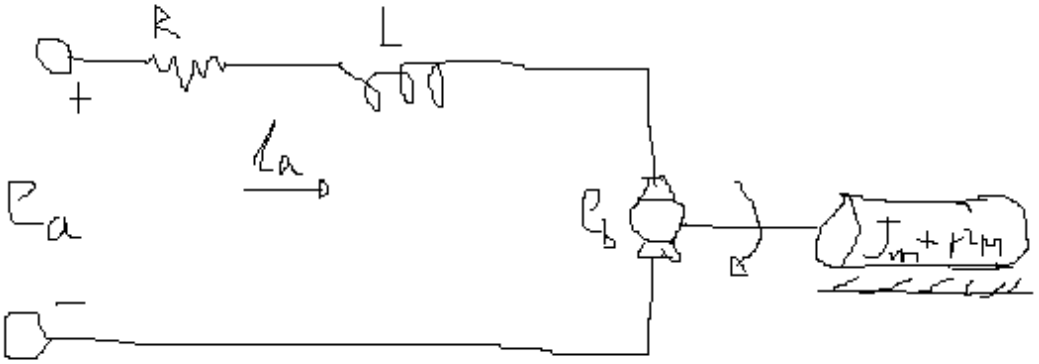
$$f - bW_m = M\frac{dV}{dt};\ si\ V = W_m r \Rightarrow f - bw_m = Mr\frac{dW_m}{dt}$$

sabemos que $TWm = fV = fW_m * r \Rightarrow T = f * r \Rightarrow f = \frac{T}{r}$;

luego $f - bW_m = Mr\frac{dW_m}{dt} \Rightarrow \frac{T}{r} - bW_m = Mr\frac{dW_m}{dt}$

$$T = r^2 M\frac{dW_m}{dt} + rbW_m \Rightarrow r^2 M\frac{dW_m}{dt} = T - rbW_m$$





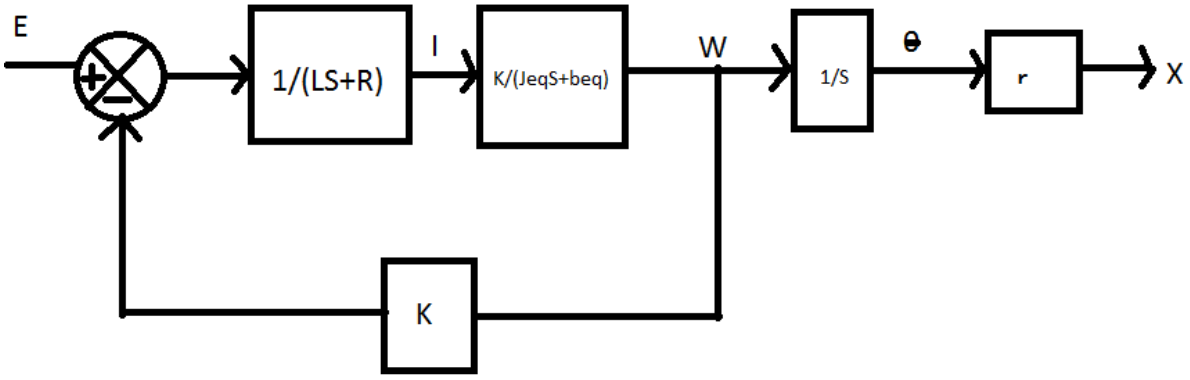
$J_m + r^2M = J_{eq} \quad ; \quad b_m + r^2b = b_{eq}$

$\left\{L\frac{di}{dt} = e_a - Ri - e_b = e_a - Ri - KW_m\right\} \Rightarrow LSI_S = E - RI_S - KW_m \Rightarrow I_S = \frac{E-KW_m}{LS+R} = \frac{1}{LS+R}(E - KW_m)$

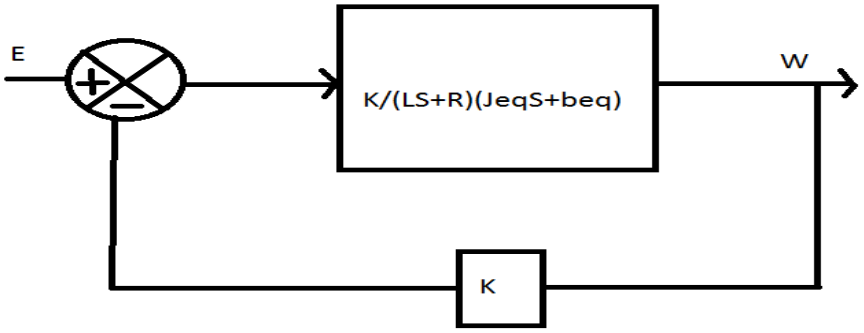
$\left\{j_{eq}\frac{dW_m}{dt} = T_m - (b_m + r^2)bW_m\right\} \Rightarrow j_{eq}SW_{ms} = T_m - beqW_{ms}$

si$\left\{T_m\right\} = KI_S \Rightarrow W_{ms} = \frac{T_m}{j_{eq}S+b_{eq}} = \frac{KI_S}{j_{eq}S+b_{eq}}$

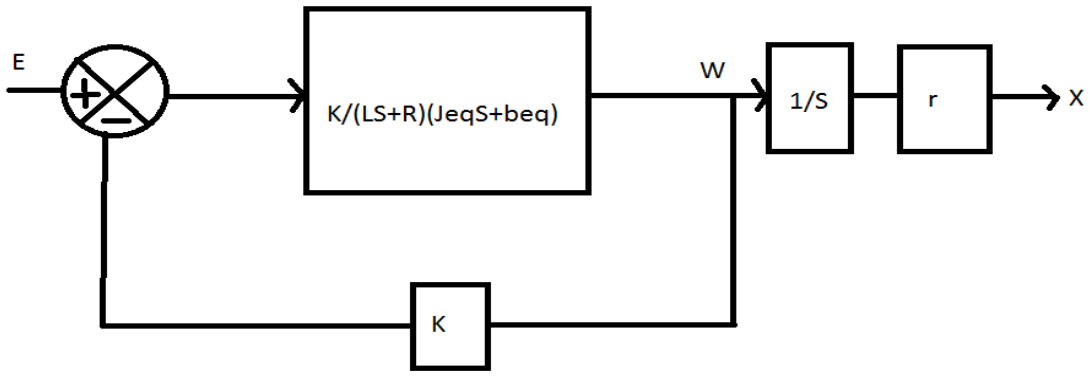
$J_{eq} = 0.02 + (0.12)^2 * 30 = 0.452kgm^2$



reducimos el diagrama de E-W



$$\frac{W}{E} = \frac{G}{1+HG} = \frac{\frac{K}{(LS+R)(j_{EQ}S+b_{EQ})}}{1+\frac{k^2}{(LS+R)(j_{EQ}S+b_{eq})}}$$



$$\frac{X_{(S)}}{E_{(s)}} = \frac{Kr}{\left[(LS+R)(JeqS+beq)+K^2\right]S} = \frac{0.0018}{(0.226s^2+0.112s+0.904s+0.448+0.000225)s}$$

la función de transferencia es;

$$T_{(S)} = \frac{X_{(S)}}{E_{(s)}} = \frac{0.0018}{0.226s^3+1.016s^2+0.448225s}$$