White, Michael | Lab #2, Activity #1 ME 421L

$$V_a(t) = R_a * i_a(t) + L\frac{di_a(t)}{dt} + V_e(t)$$

$$V_e(t) = K_b \cdot \theta_m$$

$$T(t) = J_m \cdot \ddot{\theta}_m + B_m \cdot \dot{\theta}_m \; ; \; T(t) = K_t \cdot i_a(t)$$

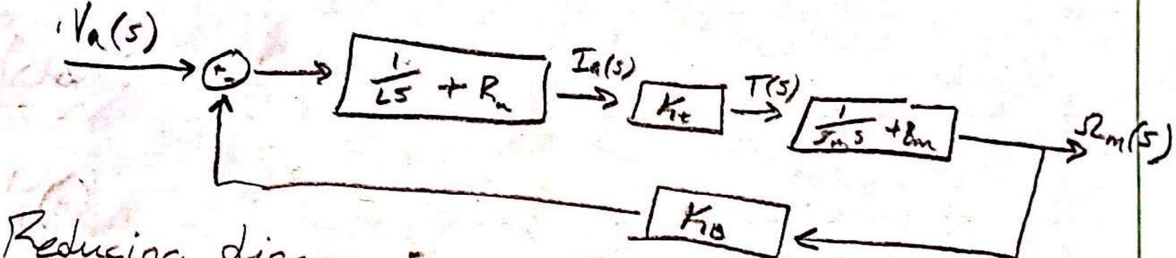
<u>Laplace:</u> $V_a(s) = R_a i_a(s) + L s i_a(s) + V_e(s)$

$$V_a(s) = (LS + R_a) i_a(s) + V_e(s) \; ; \; V_e(s) = K_b \cdot \Omega_m(s)$$

$$T(s) = (J_m S + B_m)\Omega_m(s) \; ; \; T(s) = K_b \cdot i_a(s)$$

$$\Omega_m(s) = \frac{T(s)}{J_m s + B_m}$$

<u>Model:</u>



Reducing diagram:

$$G(s) = \left[\frac{1}{LS + R_a}\right] \cdot K_t \cdot \left[\frac{1}{J_m s + B_m}\right] \quad H(s) = K_b$$

$$\frac{\Omega(s)}{V_a(s)} = \frac{\frac{K_t}{(LS + R_a)(J_m S + B_m)}}{1 + \frac{K_t K_B}{(LS + R_a)(J_m s + B_m)}} = \frac{K_t}{(Ls + R_a)(J_m S + B_m) + K_t K_b}$$

$$\frac{\Omega(s)}{V_a(s)} = \frac{K_t}{(L \cdot J_m)s^2 + (R_a \cdot J_m + B_m \cdot L)s + (K_t K_b + R_a B_m)}$$

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