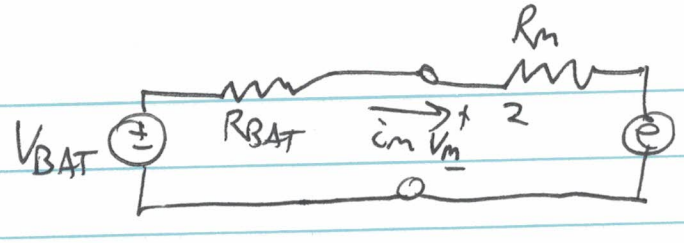
Worksheet 1 Solution

2/6/2015



$V_e = k_e \dot{\theta}_m$

$\tau = k_\tau i_m$

$k_e = 0.01 \frac{V\text{-}S}{rad}$, $k_\tau = 0.1 \frac{N}{m}$

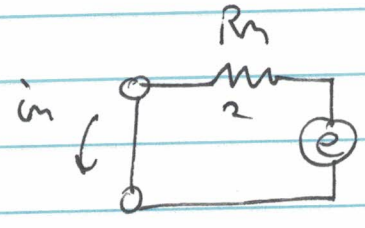
1. unloaded, $\tau = 0$, $i_m = 0 \Rightarrow e = V_{bat}$

$k_e \dot{\theta}_m = 6V$, $\dot{\theta}_m = 600$ rad/sec

2. $\dot{\theta}_m = 0$, $V_e = 0$ $\quad \frac{V_{BAT}}{2\Omega} = 3$ amps $= i_m$, $\tau = 0.3$ Nm

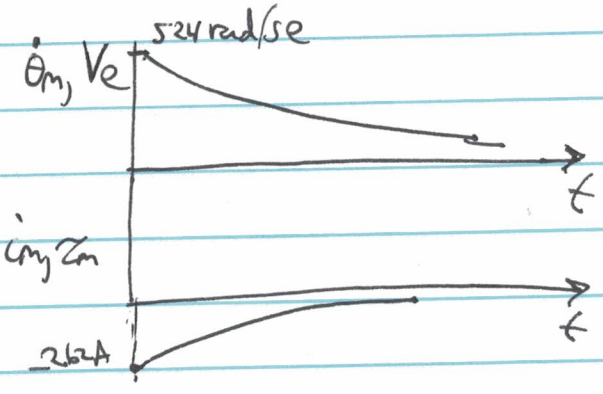
3. 5000 rpm = 524 rad/sec, open circuit $V_m = k_e \dot{\theta}_m$

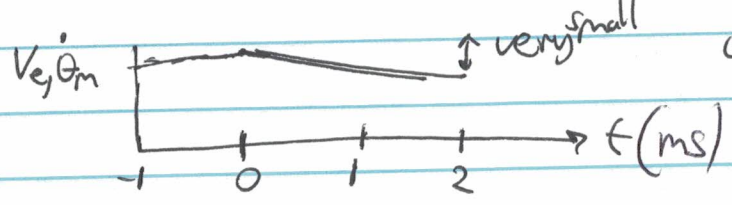
$= 5.24V$

4. 

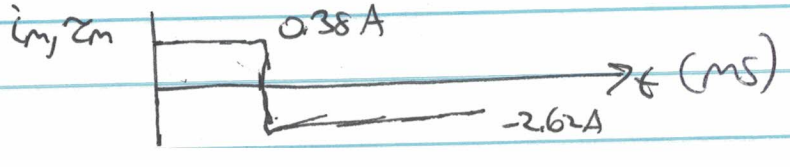
$i_m = \frac{-5.24V}{2} = -2.62$ amps

$\tau = -0.26$ N-m hole braking.

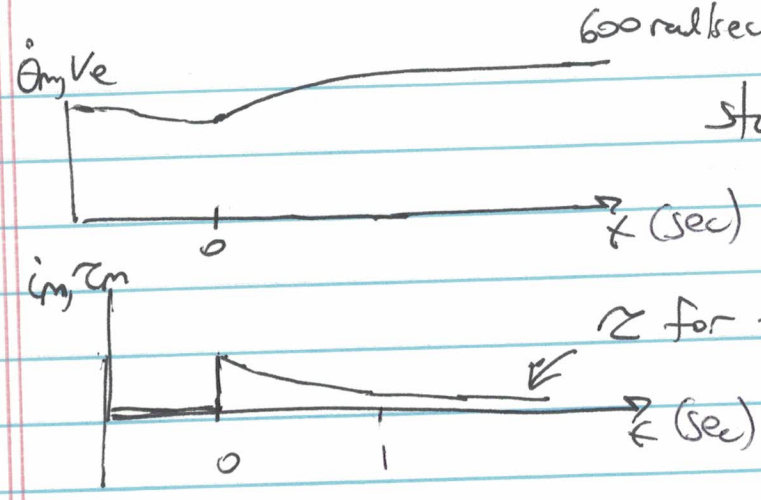
5. 

6. 

assume connected to battery $-1 < t < 0$ ms



7.

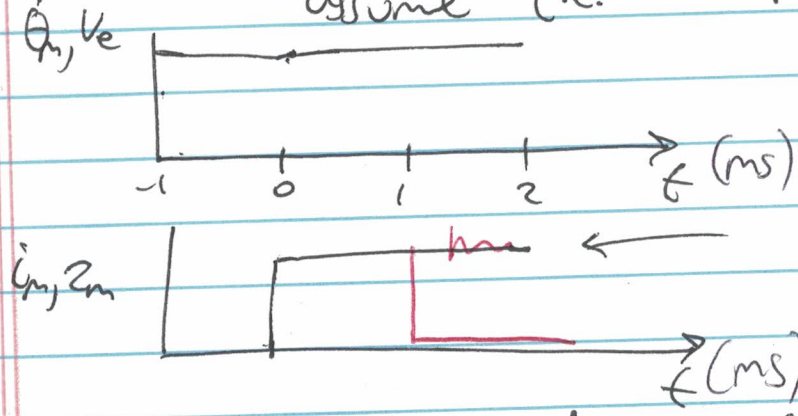


starting at 5000 rpm, open circuit

max velocity 600 rad/sec

τ for friction. based on 6V battery and $K_e = 0.01$ Vs/rad

8.



$$i_m = \frac{6V - K_e \dot{\theta}_m}{R_m} = \frac{6V - 5.24V}{2} = 0.38 \text{ amps}$$

$\tau = .038$ N-m.