



Problem 9:- Solution
eqn given in Pdf are

$$L \frac{di_a}{dt} = V_a - Ri_a - e_a \quad \text{--- (1)}$$

$$J \frac{d\omega}{dt} = T_e - T_L - B\omega \quad \text{--- (2)}$$

where, L = inductance self inductance

R = armature resistance

V_a = terminal phase voltage (also V_b, V_c)

i_a = motor input current (also i_b, i_c)

e_a = motor back emf (also, e_b, e_c)

T_e = torque output

T_L = load torque

B = friction coefficient

J = Inertia of rotor and coupled shaft

also, eqn we need to calculate T_e and e_a

$$T_e = \frac{e_a i_a + e_b i_b + e_c i_c}{\omega}$$

$$\theta_e = \frac{P}{2} \theta_m \quad \left[\begin{array}{l} \theta_m = \text{mechanical rotor angle} \\ \theta_e = \text{electrical rotor angle} \end{array} \right]$$

where, P = no. of poles

$$e_a = k_w f(\theta_e) \omega$$

where, k_w = back emf constant

$$e_b = k_w f(\theta_e - 120^\circ) \omega$$

$$e_c = k_w f(\theta_e + 120^\circ) \omega$$



We Assume Values:

$$V_d = 30V, R = 4.98 \Omega, L = 505mH, P = 4, T = 15.17 \times 10^{-6}$$
$$k_w = 56.28 \times 10^{-3}, \text{ load time} = 10s$$

for Speed Control,

we have to change ~~either~~ V_d ~~or~~ for constant load to T_e or variable load and ~~to load is for variable~~ (NOT IR-RED) ~~the~~

by using PWM, we generate pulses to rotate ~~speed~~ in motor in desired speed

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