Problem 9 :

→ The equations used for designing BLDC Motor are referred from the Book Control System Engineering by Nagoor Kani.

The equations are as follows

$$J\frac{d^2\theta}{dt^2} = T - b\frac{d\theta}{dt} \Rightarrow \frac{d^2\theta}{dt^2} = \frac{1}{J}\left(K_t i - b\frac{d\theta}{dt}\right) \quad \rightarrow (1)$$

$$L\frac{di}{dt} = -Ri + V - e \Rightarrow \frac{di}{dt} = \frac{1}{L}\left(-Ri + V - K_e\frac{d\theta}{dt}\right) \rightarrow (2)$$

where

J = Moment of inertia

b = motor viscous friction constant

K_e = Electromotive force constant

K_t = motor torque constant

R = Resistance

L = Inductance