

Modeling and simulation

## TITLE: Model a BLDC

Roll No: 2022MC58

Important parameters we must include are

- ❖ Impedance of the coil
- ❖ Radius of the motor
- ❖ Voltage
- ❖ Current
- ❖ Temperature
- ❖ Phase
- ❖ Duty cycle
- ❖ Frequency
- ❖ Motor-Velocity constant(kv)
- ❖ Back emf constant(1/kv)
- ❖ No of Poles

$$\text{Rpm} = \text{kv} * \text{current}$$

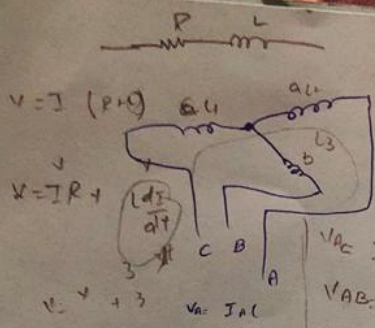
$$V = (I * Z) + \text{Back emf}$$

$$\omega = \frac{I * I * (r + l) \cos \phi}{\sqrt{3} t} (100 - \text{temp}) / 100$$

$$v = r \omega$$

$$\omega = \frac{I * V * \cos \phi}{\sqrt{3} t}$$

I get these formulas by ideally comparing electrical power with mechanical power and as losses I used temp to match the real world



$$V = I(R + L \frac{dI}{dt})$$

$$V = IR + L \frac{dI}{dt}$$

$$V = I(R + L \frac{dI}{dt})$$

$$K_t = K_e = \frac{1}{930} \text{ V/rad}$$

$$L = 5 \text{ mH}$$

$$R = 0.2 \Omega$$

$$V = 12 \text{ V}$$

$$I = 0.3 \text{ A}$$

$$R + \frac{L}{s}$$

$$T = K_t \cdot I \quad \text{current}$$

(Torque constant)

$$P = T\omega$$

$$K_t = \frac{T}{I} = r$$

$$\frac{12}{2} = 6 \text{ V}$$

$$\frac{3}{5} = 1 \text{ A}$$

$$V = IR + L \frac{dI}{dt}$$

$$V = IR + L \frac{dI}{dt}$$

$$V = 3 \text{ (R)} + L$$

$$4 \text{ V} \quad 4 - 3R \rightarrow 3.75 \text{ H}$$

$$\dot{\omega} = \frac{V - (I \cdot (R + K_e))}{K_e}$$

$$\dot{\omega} = \frac{V - I \cdot R - L \cdot \frac{dI}{dt}}{K_e}$$

$$P_E = V I \cos \phi$$

$$P_{E1} = V_1 I_1 \cos \phi_1$$

$$P_{E2} = V_2 I_2 \cos \phi_2$$

$$P_{E3} = V_3 I_3 \cos \phi_3$$

$$P_{E\gamma} = P_{E1} + P_{E2} + P_{E3}$$

$$\frac{P_{E\gamma}}{\sqrt{3}}$$

$$= \sqrt{3} \cdot I_1 \cdot \sqrt{3} \cdot I_2 \cdot \sqrt{3} \cdot I_3$$

$$= \sqrt{3} \cdot I$$

$$36 = T \dot{\omega}$$

$$\frac{36}{\dot{\omega}}$$

$$\frac{0.070}{0.010}$$

$$\frac{11.60}{11.20}$$

$$I_{sup} I$$

Mechanical power

$$P = T\dot{\omega}$$

$$P =$$

$$T = r \cdot S$$

$$T = r \cdot m \cdot a$$

$$T = r \cdot m \cdot \int_0^t (a) dt$$

$$T = r \cdot m \cdot \int_0^t \dot{\omega} dt$$

$$T = r \cdot m \cdot \alpha$$

$$V I = P$$

$$V I = T \dot{\omega}$$

$$\frac{11.3}{930}$$

$$3 \left( \frac{0.3}{R_1 + R_2 + R_3 + L_1 + L_2 + L_3} \right)$$

$$P = V I$$

$$3(0.090 + 0.090 + 0.090 + 0.090 + 0.01) = 0.003 \text{ Nm}$$

$$P_m = P_e - I^2 R_{ALY}$$

$$\sqrt{3} V I \cos \phi = T \dot{\omega}$$

$$\dot{\omega} = \frac{(\sqrt{3})(V I \cos \phi)}{T}$$

$$\text{Back emf} = k = \frac{1}{930} = k_e = k_t$$

$$\frac{0.9}{0.20} = 4.5$$

$$10 \text{ V} / 3 \cdot 8.9 \cdot 54 = 8000$$

$$76 \cdot 0.002$$

$$T \text{ or } V$$

$$3.2 \text{ mN}$$

$$2700$$

$$0.346$$

$$0.9$$

$$0.005528$$