Prof. A.M. Kulkarni


# Mech equations

$$\frac{2H}{\omega_B}\frac{d\omega}{dt} = T_m - (\psi_d i_q - \psi_q i_d)$$

$\rightarrow \psi_{de}, \psi_{qe}, \psi_{Fe}, \psi_{Ge}, \psi_{Ke}, \psi_{He}$

$$\frac{d\delta}{dt} = \omega - \omega_0 \leftarrow \text{freq infinite bus.}$$

$$\omega_e = \omega_0 \checkmark$$

$$\psi_{de},\ \psi_{qe},\ \psi_{fe} \cdots ?$$

$$\delta_e \cdots ?$$

$$\frac{d\delta}{dt} = 0 \quad \Rightarrow \quad \omega_e = \omega_0 .$$

$$\frac{d\omega}{dt} = 0 \quad T_m = T_{e_e}$$

$$E_{fd} , \; V_{t_{rms}} .$$

$$\delta_e$$

$$\omega = \omega_e .$$

$$V_d = -V_{Lmm} \sin\delta_e$$

$$V_q = V_{Lmm} \cos\delta_e$$

$$\theta = \omega_0 t + \delta$$

$$\frac{d}{dt}\psi = A_1\psi + \cdots$$

$$\psi = \underline{\underline{\psi_{de}}} + \underline{\underline{\Delta\psi}}$$

$$\frac{2H}{\omega_B} \cdot \frac{d\omega}{dt} = T_m - (\psi_d i_q - \psi_q i_d)$$

$$\omega = \omega_e + \Delta\omega$$

$$\frac{2H}{\omega_B} \frac{d\Delta\omega}{dt} = T_m - (\psi_d i_q - \psi_q i_d)$$

$$\frac{2H}{\omega_B} \cdot \frac{d\Delta\omega}{dt} = \psi_{de}\Delta i_d - \psi_{qe}\Delta i_q + \Delta\psi_d\, i_{de} - \Delta\psi_q\, i_{qe}.$$

$$\Delta\dot{x} = A\,\Delta x$$

$\Delta T_m = 0$

$\Delta E_{fd} = 0$.

$$\psi_d i_q - \psi_q i_d .$$

$$= (\psi_{de} + \Delta\psi_d)(i_{qe} + \Delta i_q)$$

$$- (\psi_{qe} + \Delta\psi_q)(i_{de} + \Delta i_d)$$

$$= (\psi_{de} i_{qe} - \psi_{qe} i_{de}) \text{ —— } T_m .$$

$$+ (\psi_{de}\Delta i_d - \psi_{qe}\Delta i_q)$$

$$+ (\Delta\psi_d i_{de} - \Delta\psi_q i_{qe})$$

$$+ 2^{nd} \text{ order.} \times$$

$$\psi_d i_q - \psi_q i_d$$

$$Te_e = \psi_{de} i_{qe} - \psi_{qe} i_{de}$$

$$= \frac{E_{fd} \cdot V_{t_{rms}} \sin\delta_e}{X_d} + \left(\frac{1}{X_q} - \frac{1}{X_d}\right) \frac{V_{t_{rms}}^2}{2} \sin 2\delta_e$$