

The starting torque in N.m is

$$T_s = \frac{4a |I_a| |E_m| \sin \alpha R_f}{\omega_s}$$

$$\alpha = 24.5 + 40.85 = 65.35^\circ$$

$$\omega_s = \frac{2\pi N_s}{60} = \frac{120 \times f}{P \times 60}, 2\pi = \frac{2\pi \times 120 \times 50}{4 \times 60} =$$

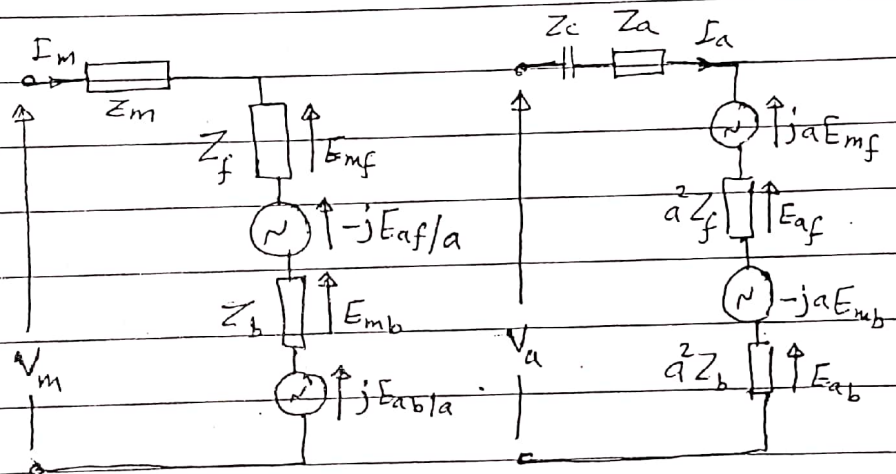
$$\omega_s = 157.07 \text{ rad/sec.}$$

$$T_s = \frac{4 \times 1.18 \times 6.53 \times 14.24 \sin(65.35) \times 1.91}{157.07} =$$

$$T_s = 4.85 \text{ N.m}$$



Q12)



Main winding circuit

Auxiliary winding circuit.

(21)

$$Z_f = R_f + jX_f = (jX_M) \parallel \left(\frac{r_2}{2s} + j\frac{X_2}{2} \right) = \frac{\left(\frac{r_2}{2s} + j\frac{X_2}{2} \right) (jX_M)}{\frac{r_2}{2s} + j\frac{X_2}{2} + jX_M} =$$

$$Z_f = \frac{\left(\frac{4.12}{2 \times 0.05} + j\frac{2.12}{2} \right) \times j\frac{66.8}{2}}{\frac{4.12}{2 \times 0.05} + j\frac{2.12}{2} + j\frac{66.8}{2}} = \frac{(41.2 + j1.06) \times j33.4}{41.2 + j1.06 + j33.4}$$

$$Z_f = \frac{41.2 \angle 1.47^\circ \times 33.4 \angle 90^\circ}{53.45 \angle 39.9^\circ} = 25.75 \angle 51.57^\circ =$$

$$Z_f = (16 + j20.17) \Omega$$

$$Z_b = R_b + jX_b = (jX_M) \parallel \left(\frac{r_2}{2(2-s)} + j\frac{X_2}{2} \right) =$$

$$Z_b = \frac{\left(\frac{4.12}{2(2-0.05)} + j\frac{2.12}{2} \right) \times j\frac{66.8}{2}}{\frac{4.12}{2(2-0.05)} + j\frac{2.12}{2} + j\frac{66.8}{2}} = \frac{(1.05 + j1.06) \times j33.4}{1.05 + j1.06 + j33.4} =$$

$$Z_b = \frac{1.49 \angle 45.27^\circ \times 33.4 \angle 90^\circ}{34.47 \angle 88.25^\circ} = 1.44 \angle 47.02^\circ$$

$$Z_b = R_b + jX_b = (0.98 + j1.05) \Omega$$

at $s=0.05$, only running capacitor is included in the equivalent circuit of the auxiliary winding.

$$Z_c = (9 - j172) \Omega$$

$$Z_M = Z_m + Z_f + Z_b = 21.02 + j2.79 + 16 + j20.17 + 0.98 + j1.05 =$$

$$Z_M = (19 + j24.11) \Omega$$

(22)

$$Z_A = Z_a + Z_c + a^2(Z_f + Z_b) = 7.4 + j3.22 + 9 - j172 + (1.18)^2(16 + j20.17 - 0.98 + j1.05)$$

$$Z_A = (40 - j139.23) \Omega$$

$$I_M = \frac{V_M Z_A + j a V_a (Z_f - Z_b)}{Z_M Z_A - a^2 (Z_f - Z_b)^2}, \quad V_M = V_a = V = 110 \angle 0^\circ \text{ V}$$

$$I_M = \frac{110(40 - j139.23) + j1.18 \times 110(16 + j20.17 - 0.98 - j1.05)}{(19 + j24.01)(40 - j139.23) - (1.18)^2(16 + j20.17 - 0.98 - j1.05)^2} =$$

$$I_M = \frac{4400 - j15315.3 - 2481.77 + j1949.59}{4101.52 - j1685.37 + 194.89 - j799.73} =$$

$$I_M = \frac{1918.23 - j13365.71}{4296.41 - j2485.1} = \frac{13502.65 \angle -81.8^\circ}{4963.35 \angle -30^\circ} =$$

$$I_M = 2.72 \angle -51.8^\circ \text{ A} = (1.68 - j2.13) \text{ A}$$

$$I_a = \frac{V_a Z_M - j a V_M (Z_f - Z_b)}{Z_M Z_A - a^2 (Z_f - Z_b)^2}$$

$$I_a = \frac{110(19 + j24.01) - j1.18 \times 110(16 + j20.17 - 0.98 - j1.05)}{(19 + j24.01)(40 - j139.23) - (1.18)^2(16 + j20.17 - 0.98 - j1.05)^2} =$$

$$I_a = \frac{2090 + j2641.1 + 2481.77 - j1949.59}{4296.41 - j2485.1} =$$

$$I_a = \frac{4571.77 + j691.41}{4963.35 \angle -30^\circ} = \frac{4623.75 \angle 8.59^\circ}{4963.35 \angle -30^\circ} = 0.93 \angle 38.59^\circ \text{ A} =$$

$$I_a = (0.72 + j0.187) \text{ A}$$

$$I_{in} = I_M + I_a = 1.68 - j2.13 + 0.72 + j0.187 = (2.4 - j1.943) \text{ A} =$$

$$I_{in} = 3.08 \angle -38.9^\circ \text{ A}$$

$$P_f = \cos(-38.9^\circ) = 0.778 \text{ (lagging)}$$

کتاب
اصل کوڑا + 2.5

۱۵ اصل مع تقاریر ۱۲,۵

نظریہ 6 عملی 5 رک ۱۲,۵

۴.۵ { اسمی نسبت
رابطہ

اسلامی انجیر 2

(23)

$$V_c = I_a Z_c = (0.72 + j0.187)(9 - j1.72) =$$

$$V_c = (38.64 - j122.15) V = 128 \angle -72.4^\circ V$$

$$T = (I_m^2 + a^2 I_a^2)(R_f - R_b) + 2a |I_a| |I_m| \sin \alpha (R_f + R_b)$$

$$T = [(2.72)^2 + (1.18)^2 (0.93)^2] [16 - 0.98] + 2 \times 1.18 \times 2.72 \times 0.93 \times$$

$$\sin(51.8 + 38.59)(16 + 0.98) =$$

T = 230.57 Synchronous Watt.

Torque in N.m is

$$T = \frac{230.57}{\omega_s} = \frac{230.57}{2\pi \times \frac{120 \times 50}{60 \times 4}} = 1.46 \text{ N.m}$$

۱۲,۵ اصل (1)

۱۵% = $\frac{\text{اجمعی سے 30}}{3} = \text{اصلی کوڑا سے 10} + \text{اصلی 2 تقاریر سے 10}$

2.5 = curve

۱۲,۵ نظریہ (2)

6 - نظریہ (P)

۴.۵ = $\frac{1}{2}$, 6.5 = $\frac{1}{2}$ اسمی نسبت +

2 (اسلامی انجیر)