9.9

$v_1 = 10\cos(377t + 60°)$, $v_2 = 20\cos(377t + 120°)$

توان متوسط که به دو سر مقاومت جذب می شود حساب کنید ؟

$V = 10\angle 60° + 20\angle 120° = 10\cos 60° - 20\cos 120° + j10\sin 60° - j20\sin 120°$

$= 5 + 10 + j0.866(10 - 20) = 15 - j8.66 = I$

$P_a = \frac{1}{2}Re(VI^*) = \frac{1}{2}Re\left(V\frac{V^*}{R}\right) = \frac{1}{2}|V|^2 = 150$ وات

9.22
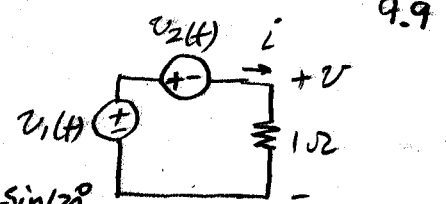
توان متوسط(اکتیو) که به دو سر مقاومت الهم جذب می شود را بیابید؟

$V = V_S \dfrac{2\,\|\,(1-j)}{j2 + 2\|(1-j)} \times \dfrac{1}{1-j}$

$2\|(1-j) = \dfrac{2(1-j)}{2+1-j} = \dfrac{2(1-j)}{3-j} = \dfrac{2(1-j)(3+j)}{9+1} = \dfrac{2(3+j-3j+1)}{10} = \dfrac{2(4-j2)}{10} = 0.8 - j0.4$

$V = V_S \times \dfrac{0.8 - j0.4}{0.8 + j1.6} \times \dfrac{1}{1-j} = V_S \dfrac{2-j}{2+j4} \times \dfrac{1}{1-j} = V_S\dfrac{2-j}{6+j2} = V_S\dfrac{(2-j)(6-j2)}{40} = V_S\dfrac{10 - j10}{40} = V_S\dfrac{1-j}{4}$

$P_a = \dfrac{1}{2}\dfrac{|V|^2}{1} = \dfrac{1}{2} \times 36 \times \dfrac{2}{16} = 4.5$ وات

9.68
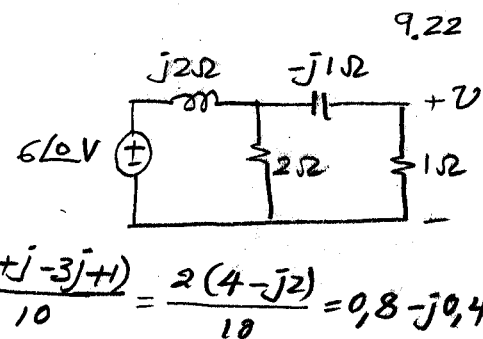
تلفات خط انتقال ؟

$P = 440 \times 220 \times 0.8 = 77.44 \text{ kW}$ بار

تلفات خط $= 80 - 77.44 = 2.56 \text{ kW}$

9.77

V_S ، S منبع ، PF منبع ؟
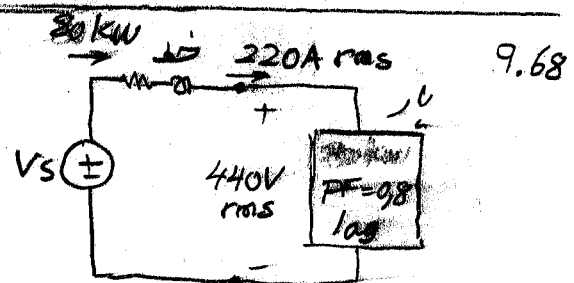
$70000 = 480 \times |I| \longrightarrow |I| = 145.8 \text{ A}$
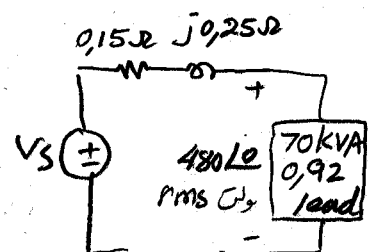
$I = 145.8 \angle +\cos^{-1}0.92$

$V_S = 480\angle 0 + 145.8\angle 23.07° \times (0.15 + j0.25)$

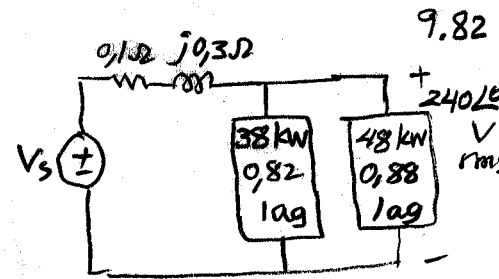$V_S = 480 + 145.8\angle 23.07° \times 0.291\angle 59.03° = 480 + 42.42\angle 82.1° = 485.8 + j42.01 = 487.6\angle 4.9°$

$PF = \cos(4.9° - 23.07°) = 0.95$

$S = V_S I^* = 487.6\angle 4.9° \times 145.8\angle -23.07° = 71.09\angle -18.1°$

9.82

$$I = I_1 + I_2 \quad , \quad I_1 = 38000$$

$$I = \frac{38000}{240} \angle -\cos^{-1}0.82 + \frac{48000}{240} \angle -\cos^{-1}0.88$$

$$= 158.3 \angle -34.9° + 200 \angle -28.3° = 305.8 - j185.3$$

$$V_S = V + Z_L \times I = 240 + (0.1 + j0.3)(305.8 - j185.3)$$

$$= 240 + 86.17 + j73.2 = 326.17 + j73.2 = 334.2 \angle 12.6°$$

9.89 — مقدار C ؟

$$|I| = \frac{40000}{270 \times 0.8} = 185.1 \text{ A}$$

$$I = 185.1 \angle -\cos^{-1}0.8 = 185.1 \angle -36.8° \quad , \quad V = 270 \angle 0$$
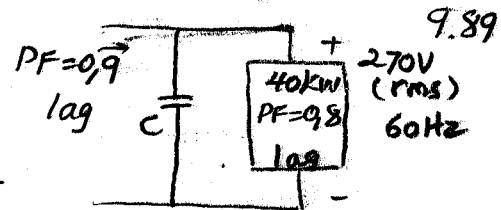
$$I_c = j\omega C V \Rightarrow I = I + I_c = 148.2 - j110.8 + j2\pi \times 60 \times 270 \times C$$

PF=0.9 باید

$$\tan^{-1}\frac{-110.8 + 101787C}{148.2} = -\cos^{-1}0.9 \quad\longleftarrow\quad C = 386\,\mu F$$

روش دیگر:

$$P = 40kW \quad , \quad \tan\theta = \frac{Q}{P} \rightarrow Q = P\tan\theta = 40\tan(-\cos^{-1}0.8) = -30\,kVAR$$

$$Q_c = Im(VI^*) = Im\left[V\left(\frac{V}{Z_c}\right)^*\right] = |V|^2 Im(j\omega c) = \omega c V^2 = 2\pi \times 60 \times C \times (270)^2$$

$$Q = -30 + 27483.6C \;kVAR \quad , \quad \frac{Q}{P} = \tan(-\cos^{-1}0.9) \rightarrow C = 386\,\mu F$$

9.100

اگر range به جای 240^V به 120^V وصل شود توان آن از 5100 وات به $\left(\frac{120}{240}\right)^2 \times 5100$ یعنی

1275 وات کاهش می‌یابد

9.103 — I_{aA} ، I_{nN} ، I_c ؟ قدرت در 24 ساعت ؟

$$I_c = \frac{1000}{240} \angle -\cos^{-1}0.9 = 4.16 \angle -25.8° \quad \text{آمپر}$$

$$I_{aA} = I_c + \frac{100}{120} \angle 0 = 4.58 - j1.81 = 4.92 \angle -21.5°$$

$$I_{nN} = 0 \qquad I_{aN} = \frac{100}{120} \angle 0 - \frac{100}{120} \angle 0 = 0$$

$$P = 100 + 100 + 1000 \times 0.9 = 1100\,W = 1.1\,kW$$

$$\text{مصرف در 24 ساعت} = 26.4\ kWh$$