یا لطیف

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۹۸۱۴۳۰۳

تمرین سری 5 الکترونیک صنعتی

5-1

$$\begin{cases} V_m = 480^v \ (rms) \\ f = 60 \text{ Hz} \\ R_L = 50 \ \Omega \\ \alpha = 60^\circ \end{cases}$$

a) rms Load voltage? $V_{o,rms} = \frac{V_m}{\sqrt{2}}\left[1 - \frac{\alpha}{\pi} + \frac{\sin(2\alpha)}{2\pi}\right]^{\frac{1}{2}} = V_{rms}\sqrt{1 - \frac{\alpha}{\pi} + \frac{\sin(2\alpha)}{2\pi}}$

$V_m = 480\sqrt{2}$, $\alpha = 60^\circ$, $V_{o,rms} = 431^v \Rightarrow I_{o,rms} = \frac{V_{o,rms}}{R} = \frac{431}{50} = 8.61^A$

b) $P_L = \frac{V_{o,rms}^2}{R} = \frac{(431)^2}{50} = 3708^W$

c) $PF = \frac{P}{S} = \frac{P}{V_{rms} I_{rms}} = \frac{3708}{480(8.61)} = 0.897$

d) $I_{avg,SCR} = \frac{V_m}{2\pi R}(1 + \cos\alpha) = \frac{480\sqrt{2}}{2\pi(50)}(1 + \cos 60) = 3.24^A$

$I_{rms,SCR} = \frac{I_{o,rms}}{\sqrt{2}} = \frac{8.61}{\sqrt{2}} = 6.1 \ A$

e) $I_{1,rms} \approx 0.84\left(\frac{480}{50}\right) = 8^A \Rightarrow THD_1 = \frac{\sqrt{I_{rms}^2 - I_{1,rms}^2}}{I_{1,rms}} = \frac{\sqrt{(8.61)^2 - 8^2}}{8} = 38\%$

5-6

for $P = 750 \ W \Rightarrow V_{o,rms} = \sqrt{PR} = \sqrt{750(32)} = 154.9^V$

$\Rightarrow 154.9 - 240\sqrt{1 - \frac{\alpha}{\pi} + \frac{\sin(2\alpha)}{2\pi}} = 0 \Rightarrow \alpha = 1.703^{Rad} = 97.6^\circ$

for $P = 1500^W \Rightarrow V_{o,rms} = \sqrt{PR} = \sqrt{1500(32)} = 219^V$

$\Rightarrow 219 - 240\sqrt{1 - \frac{\alpha}{\pi} + \frac{\sin(2\alpha)}{2\pi}} = 0 \Rightarrow \alpha = 0.986^{Rad} = 56.5^\circ$

$I_{SCR,rms} = \frac{I_o}{\sqrt{2}} = \frac{\frac{219}{32}}{\sqrt{2}} = 4.84^A$, $I_{SCR,avg} = \frac{V_m}{2\pi R}(1 + \cos\alpha) = \frac{240\sqrt{2}}{2\pi(32)}(1 + \cos(56.5^\circ))$

$= 2.62^{A} \quad \Rightarrow V_{max} = 240\sqrt{2} = 340\,V$

5-9

for $\begin{cases} S_1 : ON & ; \ (\alpha, \pi) \\ D_2 : ON & ; \ (\alpha, 2\pi) \end{cases}$

$V_o(\omega t) = V_m \sin \omega t \quad ; \quad \alpha < \omega t < 2\pi \quad \Rightarrow \quad V_{o,rms} = \left[\frac{1}{2\pi} \int_{\alpha}^{2\pi} (V_m \sin \omega t)^2 \, d\omega t \right]^{1/2}$

$= V_m \left[\frac{1}{2} - \frac{\alpha}{4\pi} + \frac{\sin(2\alpha)}{8\pi} \right]^{1/2} = \frac{V_m}{\sqrt{2}} \left[1 - \frac{\alpha}{2\pi} + \frac{\sin(2\alpha)}{4\pi} \right]^{1/2} \xrightarrow{0 \le \alpha \le \pi} \frac{V_m}{2} \le V_{o,rms} \le \frac{V_m}{\sqrt{2}}$

5-13

$\begin{cases} Z = 15^{\Omega} \\ \theta = 0.646^{Rad} \\ \omega\tau = 0.754 \end{cases}$

$i(\omega t) = 11.3 \sin(\omega t - 0.646) - 11.3 e^{\frac{-\omega t}{0.754}} \; A$

$\alpha = 115^{\circ} = 2.01^{Rad} \quad , \quad \beta = 3.681^{Rad} = 211^{\circ}$

$I_{rms} = 2.95^{A}$

مسائل 18، 23 در ویرایش انگلیسی، مسائل شبیه با spice بودند. لذا به این دلیل است که این دو مسئله حل نشده است.