Sohag University
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POWER ELECTRONICS

Sheet (2)

Ch4 Full Wave Rectifier

Uncontrolled Full-Wave Rectifier

1. A single-phase rectifier has a resistive load of 18 Ω. Determine (*a*) the average load current, (*b*) the rms load current, (*c*) the average and rms current in each diode (*d*) the average and rms source current. (e) power factor. For a bridge rectifier with an AC source of 120 V rms and 60 Hz.

2. A single-phase center-tapped transformer rectifier has an AC source of 240 V rms and 60 Hz. The overall transformer turns ratio is 3:1 (80 V between the extreme ends of the secondary and 40 V on each tap). The load is a resistance of 4 Ω . Determine (*a*) the average load current, (*b*) the rms load current, (*c*) the average source current, and (*d*) the rms source current. Sketch the current waveforms of the load and the source.

3. A single-phase bridge rectifier has an *RL* load with $R = 10\ \Omega$ and $L = 10$ mH. The ac source is 70.7 V rms, 60 Hz. (a) Determine the average current in the load. (b) Estimate the peak-to-peak variation in load current based on the first ac term in the Fourier series. (c) Determine the power absorbed by the load and the power factor of the circuit. (d) Determine the average and rms currents in the diodes.

4. The full-wave rectifier of Fig. 4-3*a* has ac source with 120 V rms at 60 Hz, $R = 2\ \Omega$, $L = 10$ mH, Vdc = 80 V. Determine (*a*) the power absorbed by the dc source, (*b*) the power absorbed by the resistor, and (*c*) the power factor. (*d*) Estimate the peak-to-peak variation in the load current by considering only the first ac term in the Fourier series for current.

5. The full-wave rectifier of Fig. 4-6*a* has a 120 rms V source at 60 Hz, $R = 500\ \Omega$, and $C = 100\ \mu$F. (*a*) an expression for output voltage (*b*) the peak and average diodes pair currents (*c*) Determine the peak-to-peak voltage variation of the output (*d*) Determine the value of capacitance that would reduce the output voltage ripple to 1percent of the dc value.

Controlled Full-Wave Rectifier

6. Show that the power factor for the controlled full-wave rectifier with a resistive load

is $PF = \sqrt{1 - \frac{\alpha}{\pi} + \frac{\sin(2\alpha)}{2\pi}}$

7. A controlled single-phase bridge rectifier of Fig. 4-10*a* has an AC input of 120 V rms at 60 Hz and a 20 Ω load resistor. The delay angle is 40. Determine the average current in the load, the power absorbed by the load, and the source voltamperes.

8. A controlled single-phase bridge rectifier of Fig. 4-11a has a source of 120 V rms at 60 Hz, R = 10 Ω, L = 20 mH, and The delay angle $\alpha = 60^{\circ}$. Determine (a) an expression for load current, (b) the average load current, and (c) the power absorbed by the load.

9. A controlled single-phase bridge rectifier of Fig. 4-11*a* has a source of 120 V rms at 60 Hz, an *RL* load where *R* = 10 Ω and *L* = 100 mH. The delay angle $\alpha = 60^{\circ}$ (same as problem 8 except *L* is larger). (*a*) Verify that the load current is continuous. (*b*) Determine the dc (average) component of the current. (*c*) Determine the power absorbed by the load.

10. The controlled rectifier of Fig. 4-14 has an AC source of 240 V rms at 60 Hz, *V*dc = 100 V, R = 5 Ω, and an inductor large enough to cause continuous current. (a) Determine the delay angle α such that the power absorbed by the dc source is 1000 W. (b) Determine the value of inductance that will limit the peak-to-peak load current variation to 2 A.