Sohag University
Faculty Of Engineering
Electrical Engineering Department

POWER ELECTRONICS

Sheet (3)

Ch5 AC Voltage Controllers

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1. The single-phase ac voltage controller of Fig. 5-1*a* has a 120-V rms 60-Hz source. The load resistance is 15 Ω . Determine (*a*) the delay angle required to deliver 500 W to the load, (*b*) the rms source current, (*c*) the rms and average currents in the SCRs, (*d*) the power factor, and (*e*) the total harmonic distortion (THD) of the source current.

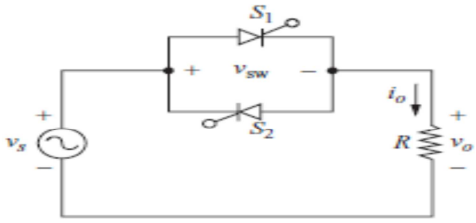
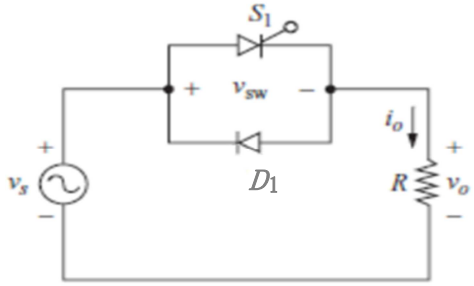


Fig. 5-1 (*a*)

2. Design a light-dimmer for a 120-V, 100-W incandescent light bulb. The source is 120 V rms, 60 Hz. Specify the delay angle α for the triac to produce an output power of (a) 75 W (b) 25 W. Assume that the bulb is a load of constant resistance.

3. A single-phase ac voltage controller is similar to Fig. 5-1a except that S2 is replaced with a diode. S1 operates at a delay angle α. Determine (a) an expression for rms load voltage as a function of α and Vm and (b) the range of rms voltage across a resistive load for this circuit.



4. The single-phase ac voltage controller of Fig. 5-1a is operated with unequal delays on the two SCRs ($\alpha 1 \neq \alpha 2$). Derive expressions for the rms load voltage and average load voltage in terms of Vm, α1, and α2.

5. For the single-phase voltage controller of Fig. 5-4*a*, the source is 120 V rms at 60 Hz, and the load is a series *RL* combination with $R = 20\ \Omega$ and $L = 50$ mH. The delay angle α is 90°. Determine (*a*) an expression for load current for the first half-period, (*b*) the rms load current, (*c*) the rms SCR current, (*d*) the average SCR current, (*e*) the power delivered to the load, and (*f*) the power factor.

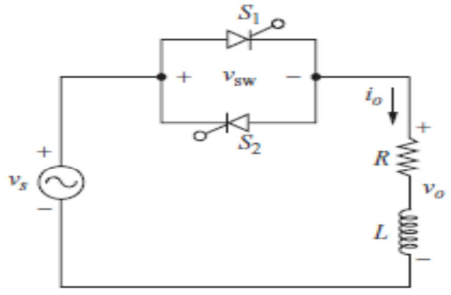


Fig. 5-4 (*a*)