

國立台灣科技大學九十七學年度碩博士在職專班招生試題

系所組別：電機工程系博士在職專班乙組

科目：電力電子學

「總分 100 分」

1. Explain the reverse-recovery time of a diode. (10%)
2. The simple circuit model of Fig. P2 (a) can use to consider power dissipation in a semiconductor switch. Assume that V_d is a constant voltage source, I_o is a constant current source and D is an ideal diode, but T is a practically controllable switch, such as a MOSFET or IGBT. Figure P2 (b) shows the switch control signal for turning on and off the controllable switch, while Fig. P2 (c) shows the corresponding voltage across and current through the switch with the polarities shown in Fig. P2 (a). According to the information given in this problem, please analyze the turn-on switching, turn-off switching and on-state losses in this switch. (20%)

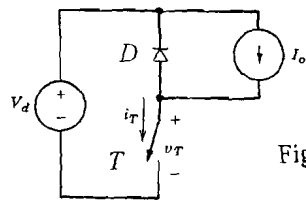


Fig. P2(a)

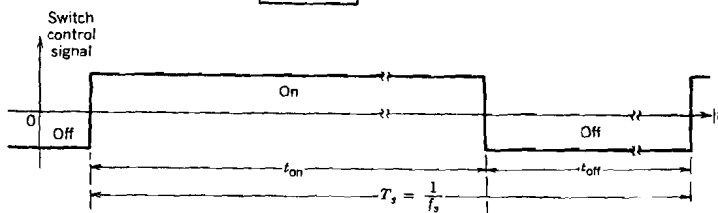


Fig. P2(b)

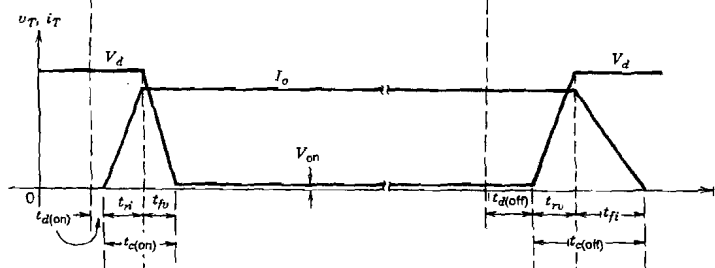


Fig. P2(c)

3. Consider the single-phase full converter in Fig. P3, where $v_s(t) = 110\sqrt{2} \sin \omega t$ V, $I_d = 10$ A is a constant current source and L_s is the ac-side inductance. Let the delay angle $\alpha = 120^\circ$, which means SCR1 and SCR2 are triggered at $\omega t = 120^\circ$ simultaneously, and SCR3 and SCR4 are triggered at $\omega t = 300^\circ$ simultaneously. Due to the effect of L_s , the line current commutation takes a finite commutation interval u . If it is known that $u = 10^\circ$, please
 - (a) sketch v_s , v_d and i_s (i_s can be seen as a trapezoidal waveform) waveforms, and (10%)
 - (b) explain the power delivery between v_s and I_d . (10%)

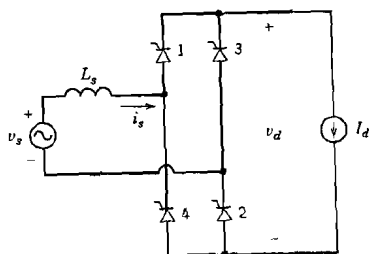
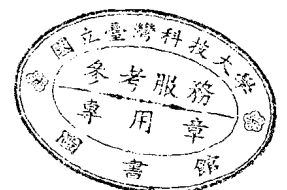


Fig. P3



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6. For the single-phase inverter shown in Fig. P6, the switching frequency is chosen as 20 kHz and the fundamental output frequency of V_o is 60 Hz.

- Briefly explain what are bipolar voltage switching and unipolar voltage switching. (7 %)
- Design the passive component values (L and C) for the output filter. (8 %)

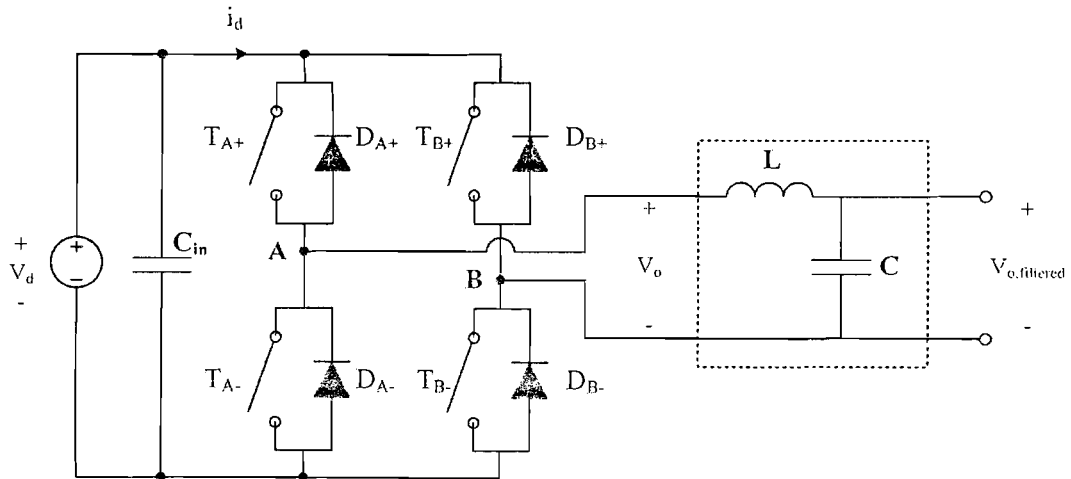


Fig. P6

