Homework 7

Page 138-139, Chinese textbook

Question 2

Considering a buck chopper circuit shown in the Fig. 5-1a, with $E = 200V$, $R = 10\Omega$, L is large enough and $E_m = 50V$. Use the pulse width modulation method, calculate the average output voltage U_o and the average output current I_o when $T = 40\mu s$ and $t_{on} = 20\mu s$.

Question 5

Considering a boost chopper circuit shown in the Fig. 5-2a, with $E = 50V$, L and C are large enough and $R = 25\Omega$. Use the pulse width modulation method, calculate the average output voltage U_o and the average output current I_o when $T = 50\mu s$ and $t_{on} = 20\mu s$.

Question 11

Try to analyze the maximum voltage, maximum current and average current of the switch and the rectifier diode in forward circuit and flyback circuit during operation.

Question 12

Try to analyze the maximum voltage, maximum current and average current of the switch and the rectifier diode in full-bridge, half-bridge and push-pull circuit during operation.

Answer 5.2

Because L is large enough, the load current is continuous.

The average value of output voltage is

$$U_0 = \frac{t_{on}}{T} E = \frac{20}{40} \times 200V = 100V$$

The average value of output current is

$$I_0 = \frac{U_0 - E_M}{R} = \frac{100 - 50}{10} A = 5A$$

Answer 5.5

The average value of output voltage is

$$U_o = \frac{T}{t_{off}} E = \frac{50}{50 - 20} \times 50V = 83.3333V$$

The average value of output current is

$$I_o = \frac{U_o}{R} = \frac{83.3333}{25} A = 3.33333A$$

Answer 5.11

The maximum voltage

	switch	rectifier diode
Forward circuit	$\left(1 + \frac{N_1}{N_3}\right) U_i$	$U_i \frac{N_2}{N_3}$
Flyback circuit	$U_i + U_o \frac{N_1}{N_3}$	$U_i \frac{N_2}{N_1} + U_o$

The maximum current

	switch	rectifier diode
Forward circuit	$I_d \frac{N_2}{N_1}$	$I_d \frac{N_3}{N_1}$
Flyback circuit	$I_d \frac{N_2}{N_1}$	I_d

The average current

	switch	rectifier diode
Forward circuit	$I_d \frac{N_2}{2N_1}$	$I_d \frac{N_3}{2N_1}$
Flyback circuit	$I_d \frac{N_2}{2N_1}$	$\frac{I_d}{2}$

Answer 5.12

The full-bridge circuit

	maximum voltage	maximum current	average current
switch	U_i	$I_d \frac{N_2}{N_1}$	$I_d \frac{N_2}{2N_1}$
rectifier diode	$U_i \frac{N_2}{N_1}$	I_d	$\frac{I_d}{2}$

The half-bridge circuit

	maximum voltage	maximum current	average current
switch	U_i	$I_d \frac{N_2}{N_1}$	$I_d \frac{N_2}{2N_1}$
rectifier diode	$U_i \frac{N_2}{2N_1}$	I_d	$\frac{I_d}{2}$

The push-pull circuit

	maximum voltage	maximum current	average current
switch	$2U_i$	$I_d \frac{N_2}{N_1}$	$I_d \frac{N_2}{2N_1}$
rectifier diode	$U_i \frac{N_2}{N_1}$	I_d	$\frac{I_d}{2}$