

ET4119 Electronic Power Conversion 2009/2010
Homework assignment 3

1. Given is a full-bridge dc-dc converter (H-bridge) with dc motor load as shown (Fig. 1). The motor is modelled by the series connection of R_a , L_a and e_a . For control of the switches so called bipolar voltage switching is applied, where the control signals are obtained by comparing a control signal $v_{control}$ with a triangular waveform v_{tri} .

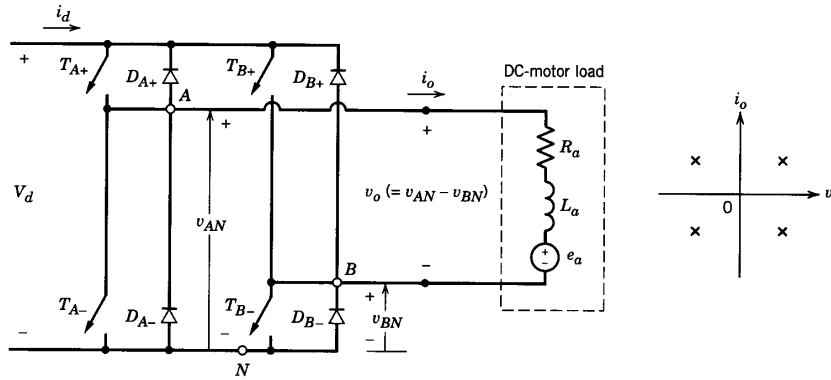


Fig. 1

The following is given:

- $T_s = 1 \text{ ms}$ (T_s is the period of triangular waveform)
- $R_a = 0.1 \text{ Ohm}$
- $L_a = 2 \text{ mH}$
- $V_d = 300 \text{ V}$
- $e_a = 120 \text{ V}$

For the calculation of the current waveform, the resistance R_a can be neglected.

- 1.1 Express the average value of v_o in V_d and $v_{control} / \hat{v}_{tri}$.
- 1.2 Calculate the required ratio of $v_{control} / \hat{v}_{tri}$ to maintain an average output current of $I_0 = +10 \text{ A}$ at $e_a = +120 \text{ V}$.
- 1.3 Calculate the required ratio of $v_{control} / \hat{v}_{tri}$ to maintain an average output current of $I_0 = -10 \text{ A}$ at $e_a = +120 \text{ V}$.
- 1.4 Sketch the $v_o(t)$, $i_o(t)$ and the supply current $i_d(t)$ for $I_0 = +10 \text{ A}$ at $e_a = +120 \text{ V}$.

2. Given is a single-phase full-bridge inverter operating in a square-wave mode. The dc voltage is 244V and the frequency of the output voltage that supplies a motor load is 47Hz. The inductance is $L=100\text{mH}$. Calculate the peak value of the ripple in the output current.

