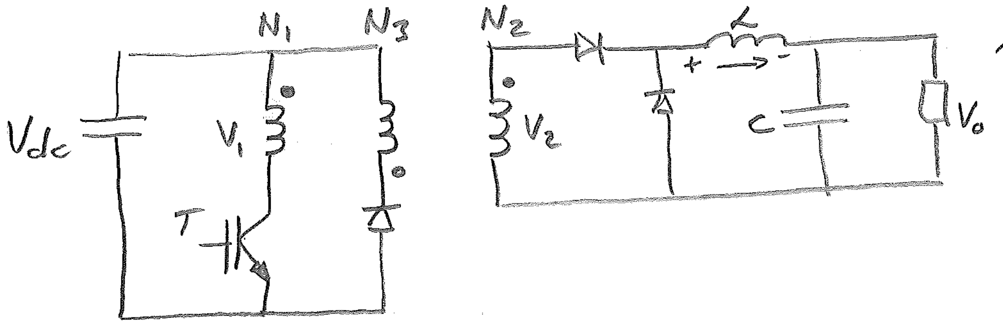
BWW Uppg. 17.14

$N_1 = N_2 = N_3$



$L = 250\,\mu H$
$C = 220\,\mu F$

T=TILL: $V_1 = V_{dc} \Rightarrow V_2 = \frac{N_2}{N_1} \cdot V_1 = \frac{N_2}{N_1} V_{dc}$

$$L \cdot \frac{di_2}{dt} = V_2 - V_0 \Rightarrow \Delta i_2 = \frac{N_2/N_1\, V_{dc} - V_0}{L}\, t_T$$

T=FRÅN: $-L\,\frac{di_2}{dt} = V_0 \Rightarrow |\Delta i_2| = \frac{V_0}{L} \cdot t_D$

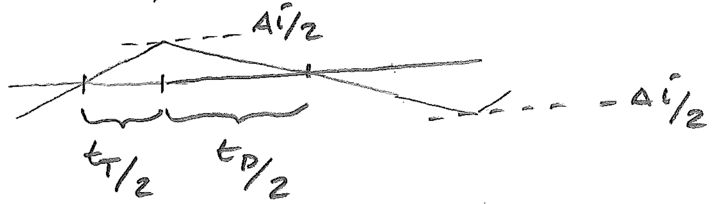
↑ negativ derivata

LIKHET: Antag ansluten drift på utgången, alltså kontinuerlig ström i L:

$$(N_2/N_1\, V_{dc} - V_0) \cdot \delta_T \cancel{T} = V_0 (1 - \delta_T) \cancel{T}$$

i) $$V_0 = \frac{N_2}{N_1} \cdot V_{dc} \cdot \delta = \frac{1}{1} \cdot 96 \cdot 0{,}4 = 38{,}4\,V$$

Spänningsrippel i kondensatorn



Räkna bara på intervallet när $i_c > 0$

$$i_c = C\,\frac{dv_c}{dt} \Rightarrow \Delta v_c = \frac{1}{C} \int i_c\, dt =$$

$$= \frac{1}{C}\left(\int_0^{t_T/2} \frac{\Delta i/2}{t_T/2} \cdot t\, dt + \int_0^{t_D/2} \frac{\Delta i}{2} - \frac{\Delta i/2}{t_D/2} \cdot t\, dt \right) =$$

$$= \frac{1}{C}\left(\left[\frac{\Delta i}{t_T} \cdot \frac{t^2}{2} \right]_0^{t_T/2} + \left[\frac{\Delta i}{2} \cdot t - \frac{\Delta i}{t_D} \cdot \frac{t^2}{2} \right]_0^{t_D/2} \right) =$$

$$= \frac{1}{C}\left(\frac{\Delta i}{8} t_T + \frac{\Delta i}{4} \cdot t_D - \frac{\Delta i}{8} t_D\right) =$$

$$= \frac{1}{C}\left(\frac{\Delta i \, t_T}{8} + \frac{\Delta i \, t_D}{8}\right) = \{t_D + t_T = T\} = \frac{1}{8} \frac{\Delta i \, T}{C}$$

$$\Delta i = \Delta i_2 = \{\text{enl. "T=FRÅN"}\} = \frac{V_o}{L} \cdot t_D = \frac{V_o}{L}(1-\delta)T$$

$$\Delta v_c = \frac{1}{8} \frac{V_o}{LC}(1-\delta)T^2 = \frac{1}{8} \frac{38{,}4}{250\mu H \cdot 220\mu F}(1-0{,}4)\cdot\left(\frac{1}{40kHz}\right)^2 =$$

$$= 32{,}7 \, mV$$

ii) $\bar{I}_o = \frac{\bar{V}_o}{R_{LOAD}} = \frac{38{,}4}{24} = 1{,}6 A$

$$\Delta i_2 = \frac{N_2/N_1 \cdot V_{dc} - \bar{V}_o}{L} \cdot \delta T = \frac{1/1 \cdot 96 - 38{,}4}{250 \cdot 10^{-6}} \cdot 0{,}4 \frac{1}{40kHz} = 2{,}3 A$$

Om anslufen drift: $\bar{I}_o \geq \frac{\Delta i_2}{2} = \frac{2{,}3}{2} = 1{,}15$ ok

iii) I en forward-omvandlare avmagnetiseras trafon mellan switchningarna.
Räkna på primärsidan:

$$L_m' \frac{\Delta i_m'}{\Delta t} = V_{dc}$$

$$\Delta i_m' = \frac{V_{dc}}{L_m'} \Delta t = \frac{V_{dc}}{L_m'} \delta \cdot T = \frac{96}{4mH} \cdot 0{,}4 \frac{1}{40kHz} = 0{,}24 A$$

iv) I en forward-omvandlare sammanfaller lastströmmen och magnetiseringsströmmens toppvärde

$$\hat{i}_T = \hat{i}_L' + \hat{i}_m' = \frac{N_2}{N_1} \hat{i}_L'' + \hat{i}_m' = \frac{N_2}{N_1}\left(\bar{I}_o + \frac{\Delta i_2}{2}\right) + \hat{i}_m' =$$

$$= \frac{1}{1}\left(1{,}6 + \frac{2{,}3}{2}\right) + 0{,}24 = 2{,}99 A$$