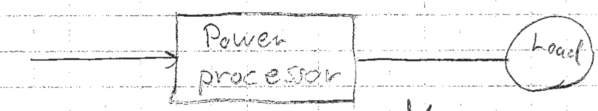
1-1

$\eta = 0{,}95$



$V_o = 200\ V$ (line-to-line) 3-phase

$V_i = 230\ V$ 1-phase

$f = 52\ Hz$

$I_o = 10 A$

$f = 60\ Hz$

power factor 1

power factor 0,8 (lagging)

- Calculate input current and input power.

Output power $P_o = 3 \cdot V I \cos\phi = 3 \cdot \frac{V_o}{\sqrt{3}} I_o \cos\phi_o = \sqrt{3}\, 200 \cdot 10 \cdot 0{,}8 \Rightarrow$

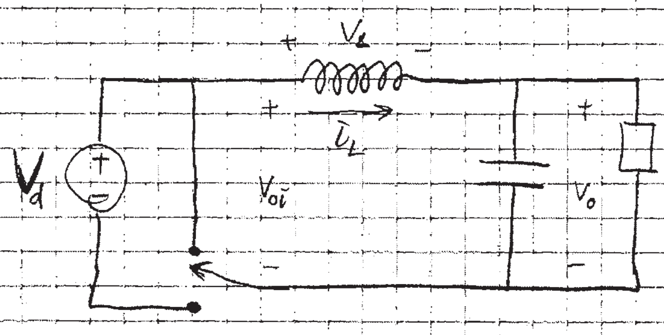
$$P_o = 2{,}77\ kW$$

Input power $\eta = \frac{P_o}{P_i} \Rightarrow \quad \underline{P_i} = \frac{P_o}{\eta} = \frac{2{,}77 \cdot 10^3}{0{,}95} = \underline{\underline{2{,}92\ kW}}$

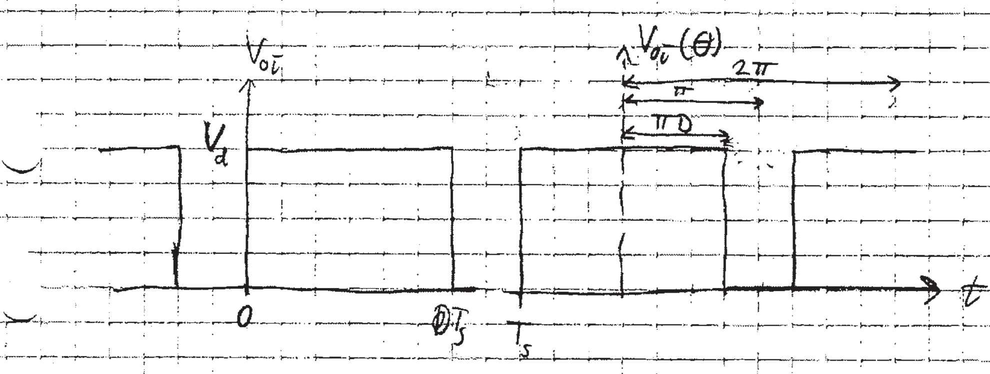
Input current $P_i = V_i I_i \cos\phi_i \Rightarrow$

$$\underline{\underline{I_i}} = \frac{P_i}{V_i \cos\phi_i} = \frac{2{,}92 \cdot 10^3}{230 \cdot 1} = \underline{\underline{12{,}68\ A}}$$

1–3



$V_d = 20\,V \qquad D = 0{,}75$



We select a "new" starting point for the fourier analysis of V_{oi}. From this we see that

$V_{oi}(\theta)$ is even $\quad V_{oi}(\theta) = V_{oi}(-\theta) \Rightarrow$

$b_n = 0$ for all n

$$\underline{\underline{a_n}} = \frac{2}{\pi}\int_0^{\pi} V_{oi}(\theta)\cos(n\theta)\,d\theta = \frac{2}{\pi}\int_0^{\pi D} V_d \cos(n\theta)\,d\theta =$$

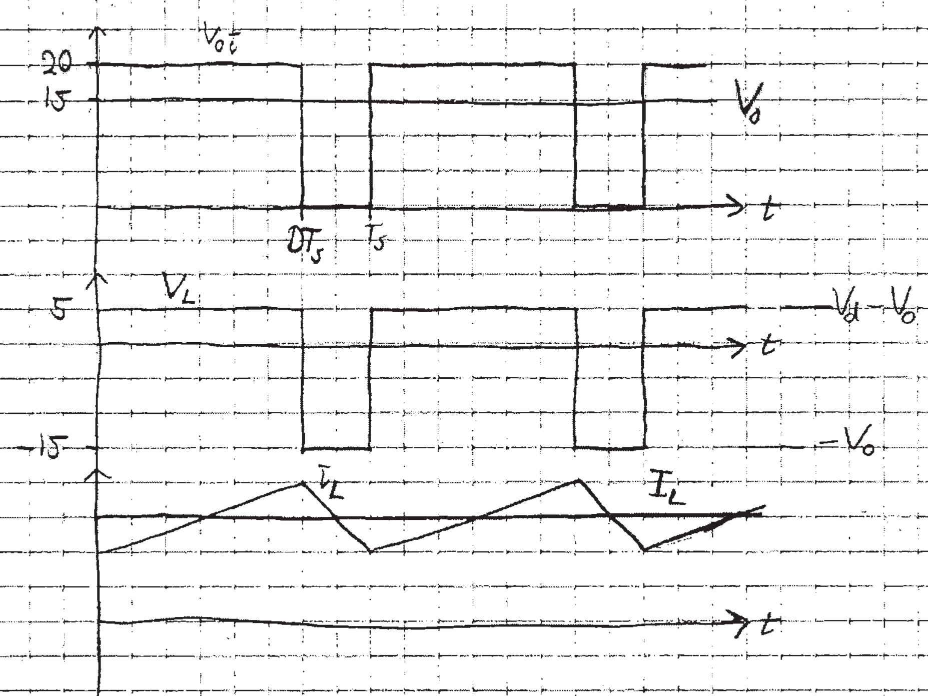
$$= \frac{2}{\pi} V_d \left[\frac{1}{n}\sin(n\theta)\right]_0^{\pi D} = \frac{2}{\pi n} V_d \left(\sin(n\pi D) - \sin(0)\right) =$$

$$= \underline{\underline{\frac{2}{\pi}\frac{V_d}{n}\sin(n\pi D)}} \qquad n = 1 .. \infty$$

$$\underline{V_{oi,av}} = \frac{1}{2}a_0 = \frac{1}{\pi}\int_0^{\pi D} V_d\,d\theta = V_d D = 20 \cdot 0{,}75 = \underline{\underline{15V}}$$

n	a_n ← peak values
1	9,0 V
2	−6,37 V
3	3,0 V
4	0
5	−1,80 V
6	2,12 V

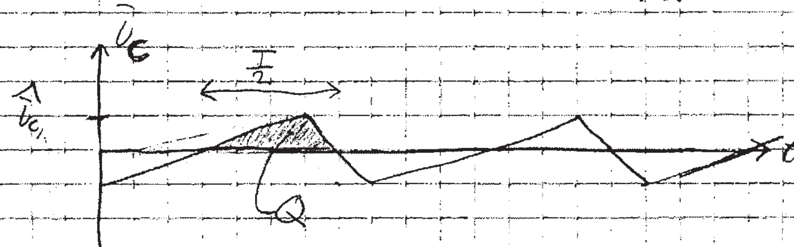
1-5



From $v_L = L\frac{di_L}{dt}$ we know that when $v_L > 0$ the inductor current must increase and when $v_L < 0$ it must decrease. Since $v_L = 5V$ during the time the switch is on i_L increases linearly (constant derivative of i_L).

We have also made the assumption that $v_o(t) = V_o$ = constant ⇒ constant current through the resistor ⇒ the ripple in i_L go through the capacitor. ⇒ $I_L = I_{R_{load}}$

$$\Delta V_C = \frac{1}{C} Q = \frac{1}{C}\frac{\hat{i}_C T_s}{2\cdot 2} = \frac{4,8}{4\cdot 50\cdot 10^{-6}\cdot 300\cdot 10^{3}} = 80\,mV$$



The carge Q increases the voltage over the capacitance.

$$\hat{i}_C = \frac{(V_d-V_o)DT_s}{2L} = \frac{5\cdot 0,75}{2\cdot 300\cdot 10^{3}\cdot 1,3\cdot 10^{-6}} = 4,8A$$