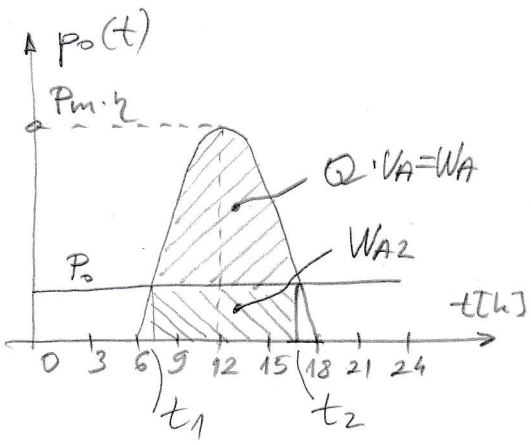
TE-20160616-1

(1) $W_p = \int_{6h}^{18h} P_p(t)\,dt = \int_{0}^{12h} P_m \sin\frac{2\pi}{24}t = P_m \frac{24}{2\pi}\left(-\cos\frac{2\pi}{24}t\right)\Big|_0^{12h}$

$W_p = P_m \cdot \frac{24}{2\pi}\left(1-(-1)\right) = \frac{24}{\pi} P_m = \underline{1910\ Wh}$

$W_o = \eta W_p = 0{,}85 \cdot 1910 = \underline{1623\ Wh}$.

$P_o = \frac{W_o}{24h} = \frac{1623}{24} = \underline{67{,}6\ W}$



$W_A = Q \cdot V_A = \int_{t_1}^{t_2} p_o(t)\,dt - (t_2 - t_1)\cdot P_o$

$W_A = \underbrace{\int_{t_1}^{t_2} P_m \cdot \eta \sin\frac{2\pi}{24}t\,dt}_{W_{A1}} - \underbrace{(t_2 - t)P_o}_{W_{A2}}$

$p_o(t) = P_m \cdot \eta \sin\frac{2\pi}{24}(t_1 - 6)$

$t_1 - 6 = \frac{24}{2\pi} \cdot \arcsin\frac{P_o}{P_m \cdot \eta} = \frac{24}{2\pi}\arcsin\frac{67{,}6}{250 \cdot 0{,}85} = 0{,}62h$

$t_1 = 6 + 0{,}62 = 6{,}62h$

$t_2 = 18 - 0{,}62 = 17{,}32h$

$W_{A1} = \int_{6{,}62}^{17{,}38} P_m \cdot \eta \sin\frac{2\pi}{24}(t-6)\,dt = P_m \cdot \eta \int_{0{,}62}^{11{,}38} \sin\frac{2\pi}{24}t = P_m \cdot 2\left(-\cos\frac{2\pi}{24}t\right)\Big|_{0{,}62}^{11{,}38}$

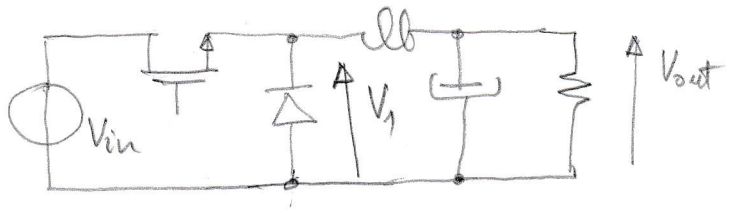
$W_{A1} = \frac{24}{2\pi} 250 \cdot 0{,}85\,(0{,}987 + 0{,}987) = \underline{1602\ Wh}$

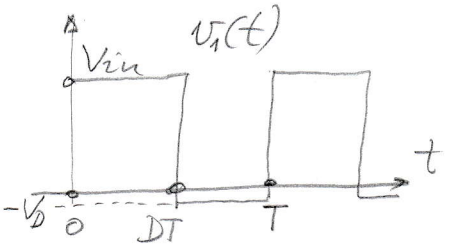
$W_{A2} = (t_2 - t_1)P_o = (11{,}38 - 0{,}62)\cdot 67{,}6 = 727\ Wh$

$W_A = W_{A1} - W_{A2} = 1602 - 727 = \underline{875\ Wh}$

$Q = \frac{W_A}{V_A} = \frac{875}{12} = \underline{73\ Ah}$

(2)





a) $V_1 = V_{in}$ $\quad 0 < t < DT$

$V_1 = -V_D$ $\quad DT < t < T$

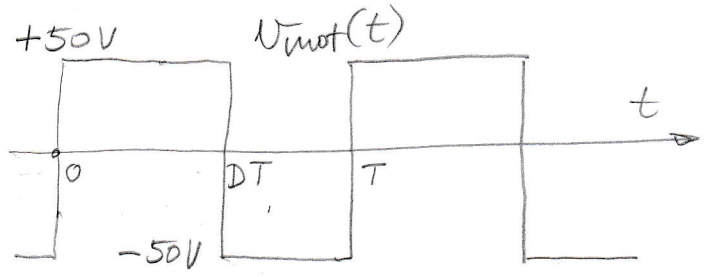
$V_{outa} = V_{in} D - V_D(1-D) = 28 \cdot 0{,}5 - 1 \cdot 0{,}5 = 27 \cdot 0{,}5 = \underline{13{,}5\ V}$

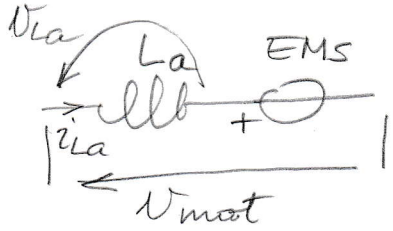
b) $V_{outb} = (V_{in} - r_{DSon} \cdot I_{out})D - V_D(1-D) = 0{,}98\ V_{outa} = 0{,}98 \cdot 13{,}5$

$$(28 - r_{DSon} \cdot 50) \cdot 0{,}5 - 1 \cdot 0{,}5 = 0{,}98 \cdot 13{,}5$$

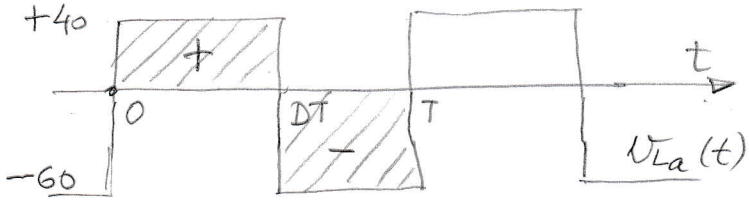
$$r_{DSon} = \frac{28 - 1 - 0{,}98 \cdot 13{,}5 \cdot 2}{50} = \underline{10{,}8\ m\Omega}$$

(3)





$$EMS = \overline{v_{mot}(t)} = 50 \cdot 0{,}6 - 50 \cdot 0{,}4 = \underline{10\ V.}$$



$$v_{La}(t) = v_{mot}(t) - EMS$$

$$\Delta I_{La} = \frac{DT \cdot 40}{La} \Rightarrow La = \frac{DT \cdot 40}{\Delta I_{La}}$$

$$La = \frac{D \cdot 40}{\Delta I_{La} \cdot f} = \frac{0{,}6 \cdot 40}{10 \cdot 5 \cdot 10^3}$$

$$\underline{La = 480\mu H}$$