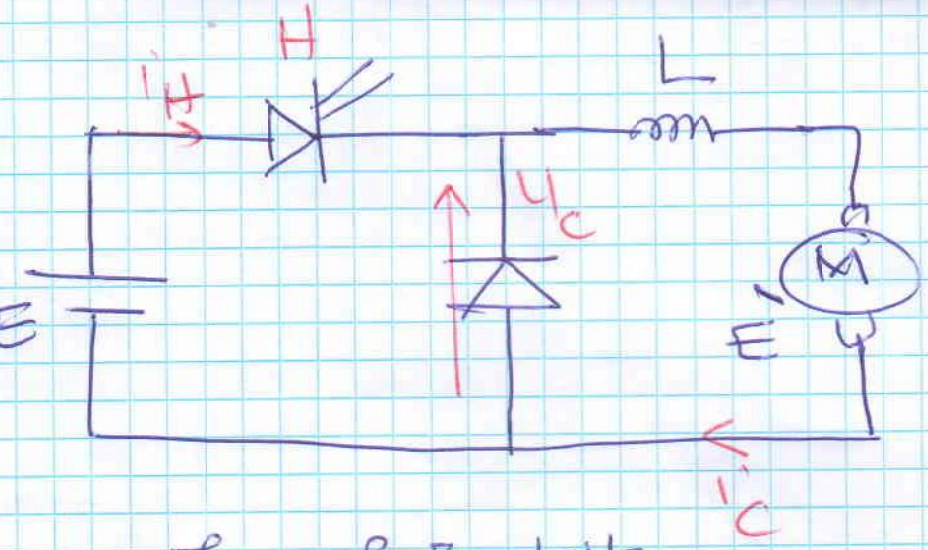
[redacted] EXERCICE 1



$L = 20\ mH$

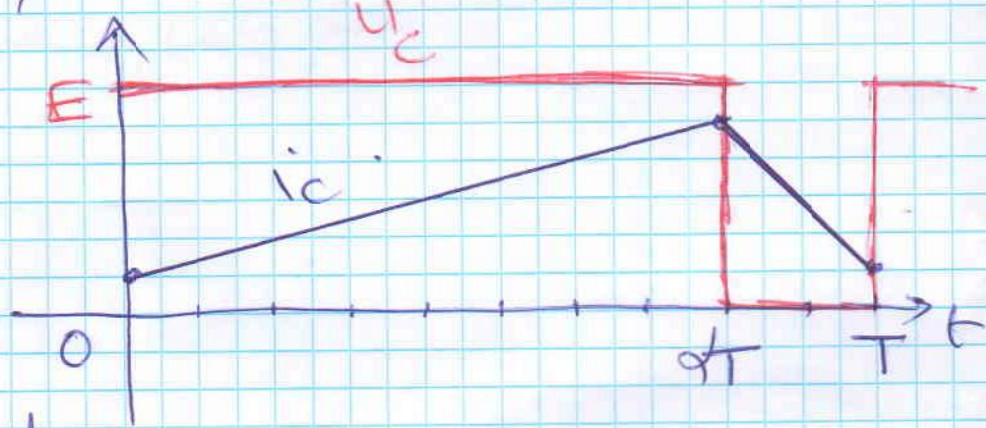
$$\begin{pmatrix} E' = 99\ V \\ \alpha = 0{,}792 \end{pmatrix}$$

$R \simeq 0$

E constante, $f = 2{,}5\ kHz$

$I_{moy} = 6\ A.$

1)



$0 < t < \alpha T$:
H fermé, D ouverte
$u_c = E$

$\alpha T < t < T$: H ouvert, D fermée
$u_c = 0$

2) E ?

$$u_{cmoy} = \frac{1}{T}(E \cdot \alpha T) = \alpha E \longrightarrow (1)$$

$$u_c = R i + L \frac{di}{dt} + E'$$

$$u_{cmoy} = \underbrace{\cancel{R}}_{0} I_{moy} + E' = E' \longrightarrow (2)$$

(1) et (2) : $\boxed{E = \frac{E'}{\alpha} = \frac{99}{0{,}792} = 125\ V}$

3) i_c ?

$0 < t < \alpha T$: $E' + L \frac{di_c}{dt} = E$

$$\frac{di_c}{dt} = \frac{E-E'}{L} \Rightarrow \int_{i_c(0)}^{i_c} di_c = \int_0^t \frac{E-E'}{L}\, dt$$

$$i_c - i_c(0) = \frac{E-E'}{L}\, t$$

$$i_c = \frac{E-E'}{L}\, t + i_c(0)$$

soit $i_c(0) = I_{min}$

$$\Rightarrow i_c(t) = \frac{E-E'}{L}\, t + I_{min} \rightarrow (3)$$

$\alpha T < t < T$: $\quad E' + L\dfrac{di_c}{dt} = 0$

$$\frac{di_c}{dt} = -\frac{E'}{L} \Rightarrow \int_{i_c(\alpha T)}^{i_c} di_c = -\int_{\alpha T}^{t} \frac{E'}{L}\, dt$$

$$i_c(t) - i_c(\alpha T) = -\frac{E'}{L}(t - \alpha T)$$

soit $i_c(\alpha T) = I_{max}$

$$i_c(t) = I_{max} - \frac{E'}{L}(t - \alpha T) \rightarrow (4)$$

l'allure de i_c (voir figure précédente).

4) Δi_c ?

(3) : $i_c(\alpha T) = I_{max} = \dfrac{E-E'}{L}\alpha T + I_{min}$

$$I_{max} - I_{min} = \boxed{\frac{E-E'}{L}\alpha T = \Delta i_c}$$

$$\Delta i_c = \frac{E - E'}{Lf} \cdot \alpha = \frac{E - \alpha E}{Lf} \cdot \alpha = \frac{E}{Lf}(1-\alpha)\alpha$$

$$\frac{d \Delta i_c}{d\alpha} = 0 \Rightarrow \frac{d}{d\alpha}\left(\alpha - \alpha^2\right) = 0$$

$$1 - 2\alpha = 0 \Rightarrow \alpha = \frac{1}{2}.$$

$$\Delta i_{max} = \Delta i_c\left(\alpha = \frac{1}{2}\right) = \frac{E}{4Lf} = \frac{125}{4 \cdot 20 \cdot \cancel{10^{-3}} \cdot 2{,}5 \cdot \cancel{10}}$$

$$\Delta i_{max} = 0{,}625\ A$$