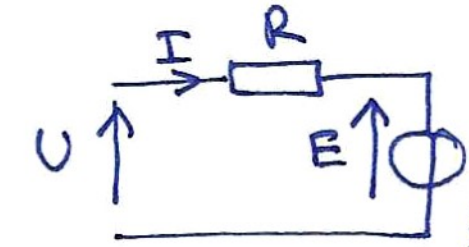
Correction BTS - Productique 2002

Partie A: étude du moteur

1.1 $\Omega = \frac{2\pi}{60} N$

$N_n = \frac{60}{2\pi} \times \Omega_n = \frac{60}{2\pi} \times 157 \simeq 15$ tr/min

1.2



$\boxed{E_n = U_n - R.I_n}$

$E_n = 220 - 0{,}95 \times I_n$?

$E_n = K \times \Omega_n = 1{,}25 \times 157 = \underline{196{,}25\ V}$

$I_n = \frac{U_n - E_n}{R} = \frac{220 - 196{,}25}{0{,}95} = 25\ A$

$\boxed{E_n = 196{,}25\ V}$ et $\boxed{I_n = 25\ A}$

1.3 $C_E = k.\Phi.I$ le moteur est à aimants permanents $\Rightarrow$ le flux magnétique produit par l'inducteur est constant $\Rightarrow$ le produit $\Phi = K$

donc $\boxed{C_E = K.I}$

AN: $C_E = 1{,}25 \times 25 = 31{,}25\ N.m$

$\boxed{C_E = 31{,}25\ N.m}$

1.4 $P_a = U_n I_n + \underbrace{U_e I_e}_{0}$ car moteur à aimants permanents.

$P_a = 220 \times 25 = 5{,}5\ kW$ $\boxed{P_a = 5{,}5\ kW}$

$P_M = P_a -$ pertes

Pertes = $P_{Ji} + \underbrace{P_{Je}}_{0} + P_c$

$P_{Ji} = RI^2 = 0{,}95 \times 25^2 = 593{,}75\ W$

$P_c = P_{fer} + p_{mec} \simeq 0$ (négligeables)

donc $P_u = P_a - P_{Ji} = 5500 - 593{,}75$

$$\boxed{P_u = 4906\ W}$$

Rendement : $\eta = \frac{P_u}{P_a} = \frac{4906}{5500} = 0{,}892$

$$\boxed{\eta = 89{,}2\ \%}$$

1-5

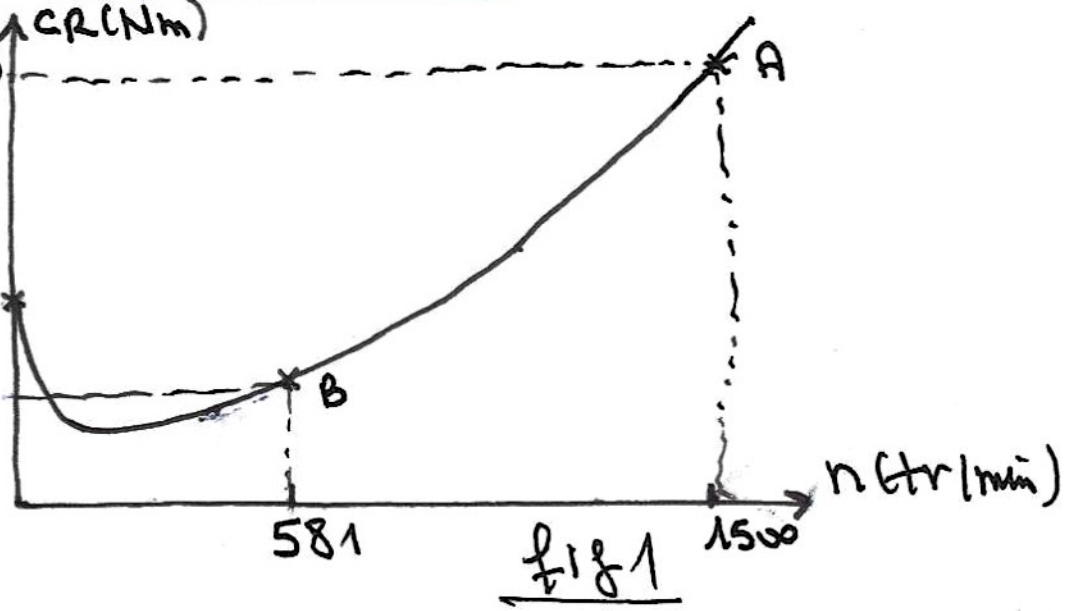


fig 1

Au point A_1 $n_A = 1500$ tr/min ; $C_M = 31{,}25$ N.m

$E_A = \Omega_A \times K$ $\quad \Omega_A = \frac{2\pi n_A}{60} = \frac{2\pi \times 1500}{60} = 157$ rad/s

donc $E_A = 1{,}25 \times 157 = \underline{196{,}25\ V}$

$I_A = \frac{C_M}{K} = \frac{C_E \cdot C_p}{K} = \frac{31{,}25}{1{,}25} = \underline{25\ A}$

$U_A = E_A + RI_A = 196{,}25 + 0{,}95 \times 25$

$$\boxed{U_A = 220\ V}$$

1-6

Au démarrage il faut que $C_{M_d} > C_{R_d}$

$U_D = R I_D + \underbrace{E_D}_{0}$ au démarrage $\Omega = 0 \Rightarrow E_{dc} = 0$

$\Rightarrow U_D = R_{\theta} I_D \Rightarrow I_D = \frac{U_D}{R} = \frac{22,8}{0,95}$

$$\boxed{I_D = 24\,A}$$

$C_{Ed} = K \times I_D = 1,25 \times 24 = 30\,Nm$

$C_{Rd} = 15\,Nm$ donc on a $C_{Ed} > C_{Rd}$ le moteur démarre

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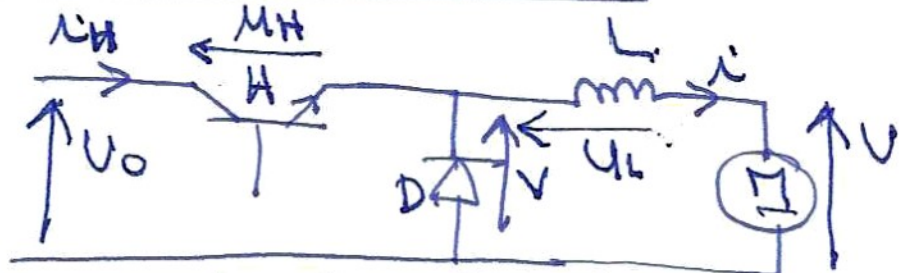
Partie II : Etude du hacheur

fig2

$U_0 = 275\,V$

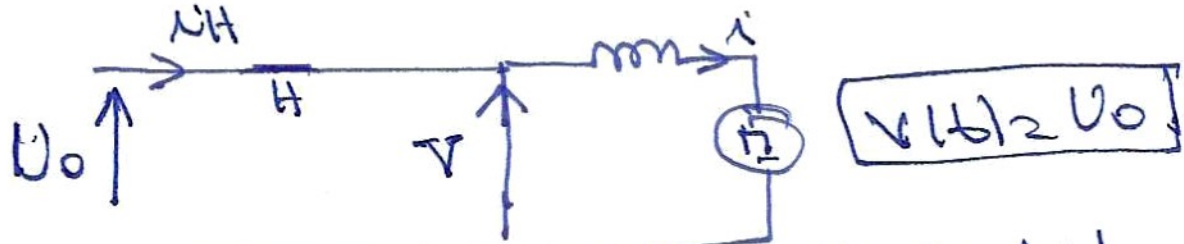
$T = 0,4\,ms$



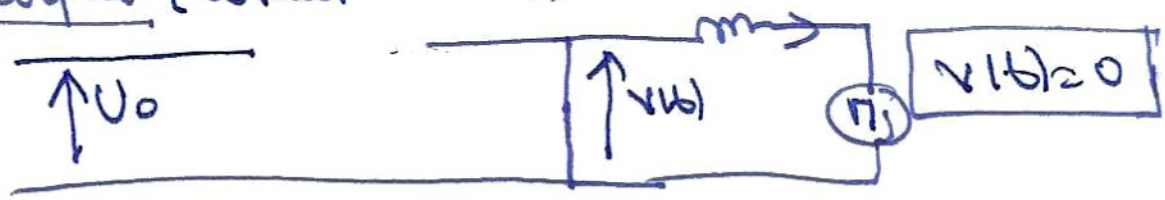
$0 < \alpha < 1$, $L = 11,55\,mH$

$$\boxed{C_E = K . I_{moy}}$$

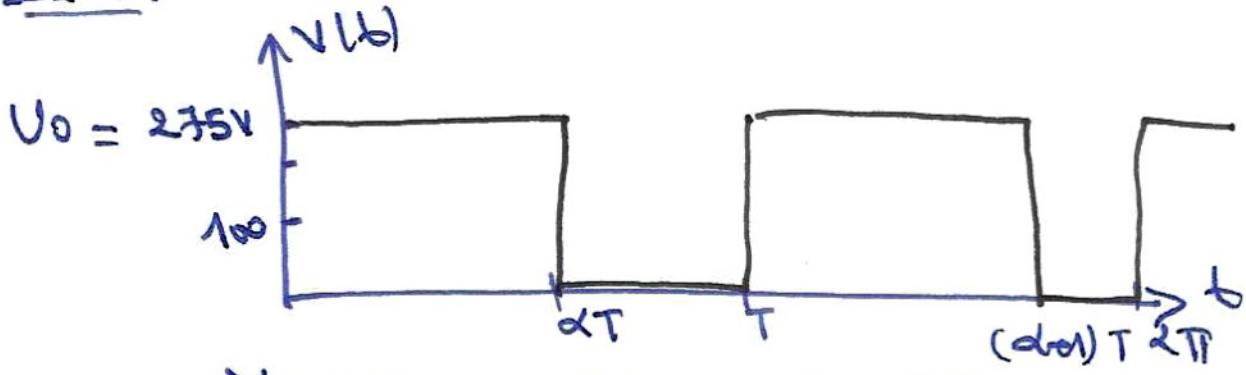
II.1°/ H : passant $\Rightarrow$ diode D : bloquée (circuit ouvert)



H : bloqué (circuit ouvert) $\Rightarrow$ D : conduit

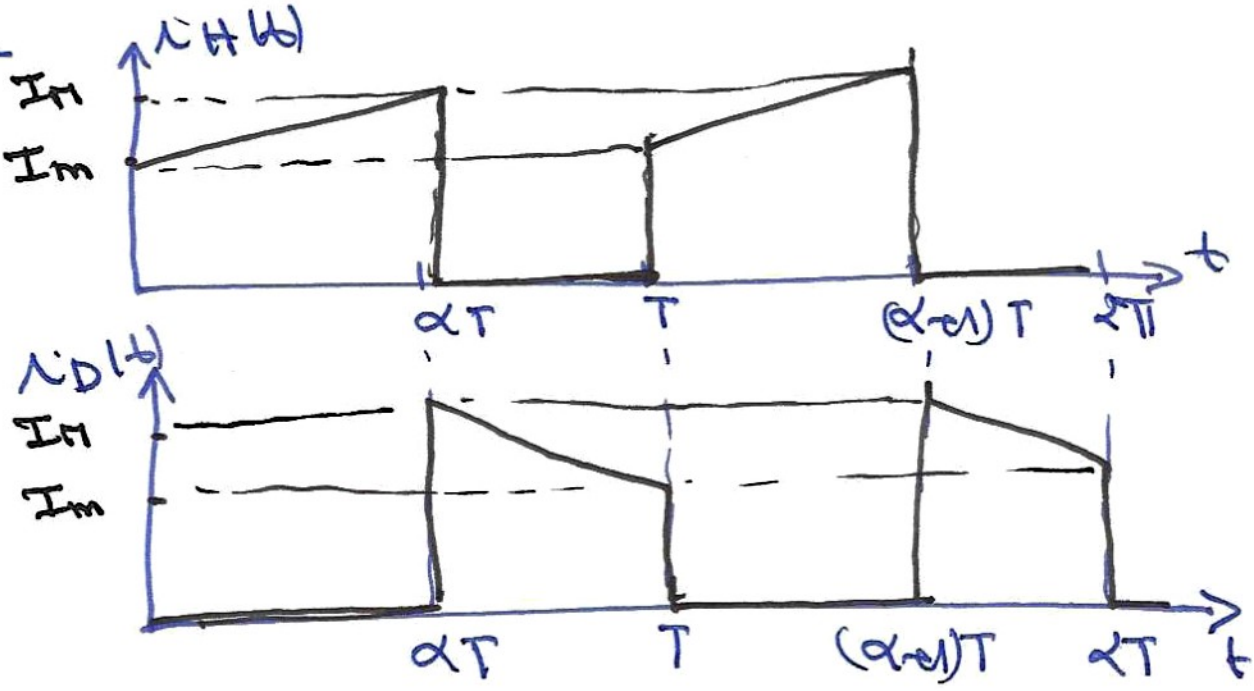


II.2/



$V_{moy} = \alpha . U_0 = 0,4 \times 275 = \underline{110V}$

II.3



$i = i_D + i_H$

Pour $0 < \alpha t < \alpha T$ H est passant D bloquée

$\Rightarrow i_D = 0 \Rightarrow \boxed{i_H = i}$

Pour $\alpha T < \alpha t < T \Rightarrow$ H est bloqué et D : passante

$\Rightarrow i_H = 0 \Rightarrow \boxed{i_D = i}$

II.4

Loi de mailles : $v(t) = u_L + U$

en passant en valeurs moyennes :

$V_{moy} = \underbrace{U_{L\,moy}}_{0} + U \Rightarrow \boxed{V_{moy} = U}$

Comme $V_{moy} = \alpha V_0 \Rightarrow \boxed{V = \alpha V_0}$

Pour $V_A = 220\,V \Rightarrow \alpha_A = \frac{V_A}{V_0} = \frac{220}{275}$

$\boxed{\alpha_A = 0{,}8}$

Pour $V_B = 82{,}5\,V \Rightarrow \alpha_B = \frac{V_B}{V_0} = \frac{82{,}5}{275}$

$\boxed{\alpha_B = 0{,}3}$

V.5 $\Delta i = I_M - I_m = \frac{V_0 T_d (1-\alpha)}{L}$

Pour $\alpha_B = 0{,}3 \Rightarrow I_{moy} = 6{,}8\,A$

$\Delta i = \frac{275 \times 0{,}4 \cdot 10^{-3}}{11{,}55 \cdot 10^{-3}} \times 0{,}3\,(1-0{,}3) = 2\,A$

$\boxed{\Delta i = 2\,A}$

$\Delta i = I_{max} - I_{min}$; $I_{moy} = \frac{I_{max} + I_{min}}{2}$

donc $\begin{cases} I_M - I_m = \Delta i = 2 & (1) \\ \frac{I_M + I_m}{2} = I_{moy} = 6{,}8 & (2) \end{cases}$

$\Rightarrow \begin{cases} I_M - I_m = 2 \\ + \\ I_M + I_m = 2 \times 6{,}8 = 13{,}6 \end{cases}$

$2 I_M = 15{,}8 \Rightarrow I_M = \frac{15{,}6}{2} = 7{,}8\,A$

$(1) \Rightarrow I_m = I_M - \Delta i = 7{,}8 - 2 = 5{,}8\,A$

$\boxed{I_M = 7{,}8\,A}$ et $\boxed{I_m = 5{,}8\,A}$

DRL

$\alpha = 0{,}13$