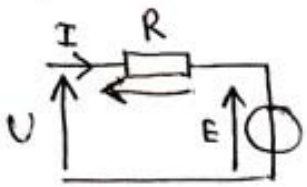
Exercice 1

1°/

1.1



$\boxed{U = E + RI}$

1.2 $E = U - RI = 160 - 1{,}6 \times 10 = 144\,V$

1.3 $T_e = KI$ avec $K = \frac{E}{\Omega}$ $\Omega = \frac{2\pi n}{60} = \frac{2\pi \times 1200}{60}$

$\Omega = 125{,}64\ rd/s$ $K = \frac{144}{125{,}64} = 1{,}146\ V\,rd^{-1}s$

K est une constante si le moteur est à excitation constante

$T_e = K \times I = 1{,}146 \times 10 = 11{,}46\ N.m$

1.4 $E = K \times \Omega = \underbrace{K \times \frac{2\pi}{60}}_{k} n = k \times n$ avec $k = K \times \frac{2\pi}{60}$

$k = \frac{1{,}146 \times 2\pi}{60} = 0{,}12\ V\,tr^{-1}mn$

2°/ $I' = 7{,}15\ A$

2.1 $T' = KI' = 1{,}146 \times 7{,}15 \approx 8{,}6\ N.m$

2.2 $n' = \frac{E'}{k}$ avec $E' = U - RI' = 160 - 1{,}6 \times 7{,}15$

$E' = 148\,V \Rightarrow n' = \frac{148}{0{,}12} = 1233{,}33\ tr/mn$

n est inférieur à n' on voit bien que si I ↗

$\Rightarrow E \nearrow$ (car la tension U est maintenue constante)

$\Rightarrow n \nearrow$

exercice 2

1.) a) $I_e = \frac{U_e}{r} = \frac{240}{160} = 1{,}5\,A$

b) $P_a = P_{a\,induit} + P_{a\,induc} = UI + \frac{U_e^2}{r}$

$P_a = 230 \times 52 + \frac{240^2}{160} = 12320\,W$

c) $E = U - RI = 230 - 0{,}16 \times 52 = 198{,}8\,V$

d) $pJ = pJ_i + pJ_e = RI^2 + \underbrace{rI_e^2}_{360W} = 0{,}16 \times 52^2 + 160 \times 45^2$

$pJ = 1982{,}4\,W$

e) $P_M = P_{em} - p_c \qquad P_{em} = E \times I = 198{,}8 \times 52$

$P_{em} = 10337{,}6\,W$

$P_M = 10337{,}6 - 500 = 9837{,}6\,W$

f) $T_M = \frac{P_M}{\Omega} \qquad \Omega = \frac{2\pi n}{60} = \frac{2\pi \times 750}{60} = 78{,}53\ rd/s$

$T_M = \frac{9837{,}6}{78{,}53} = 125{,}26\,N.m$

g) $\eta = \frac{P_M}{P_a} = \frac{9837{,}6}{12320} = 79{,}8\,\%$

2°/ $n' = 150\,tr/min$

$E' = k \times n' \qquad k = \frac{E}{n} = \frac{198{,}8}{750} = 0{,}265\ V\,tr^{-1}min$

$E' = 0{,}265 \times 150 = 39{,}76\,V$

$I_d = 95A$ au démarrage $n = 0 \Rightarrow E = 0$

$\Rightarrow U_d = RI_d = 0{,}16 \times 95 = 57\,V$

Exercice 3

1°) $n_1 = 1200\,tr/min \Longrightarrow Tem_1 = 60\,Nm$ et $I_1 = 26A$

$E_1 = \qquad P_{em} = E_1 \times I_1 = Tem_1 \times \Omega_1$

$\Rightarrow E_1 = \frac{Tem_1 \times \Omega_1}{I_1} \qquad \Omega_1 = \frac{2\pi n_1}{60} = \frac{2\pi \times 1200}{60}$

$\Omega_1 = 125{,}64\,rd/s$

donc $E_1 = \frac{60 \times 125{,}64}{26} \simeq 290\,V$

$U_1 = E_1 + RI_1 = 290 + 1 \times 26 = 316\,V$

2°/ $U_2 = 316V \Longrightarrow Tem_2 = 100 Nm$

$\Longrightarrow Tem_2 = K I_2$

$K = \frac{Tem_1}{I_1} = \frac{60}{26} = 2,307 \ Nm.A^{-1} = 2,307 SI$

$I_2 = \frac{Tem_2}{K} = \frac{100}{2,307} = 43,33 A$

$E_2 = U_2 - R I_2 = 316 - 1 \times 43,33 = 272,67 V$

$n_2 = \frac{E_2}{k}$ avec $k = \frac{E_1}{n_1} = \frac{290}{1200} =$

$k = 0,241 \ V.tr^{-1}.mi$

$n_2 = \frac{272,67}{0,241} = 1128,3 \ tr.min^{-1}$

Tant que le moteur fonctionne à flux constant, la constante k reste constante, même chose pour la constante K.

Exercice 4

A) 1°/ moteur 230/400V, $U_{réseau} = 400V$ } Tension nominale du moteur $U_n = 230V = U_{réseau}$ $\Longrightarrow$ le stator sera couplé en étoile

2°/ $g = \frac{n_s - n}{n_s}$ $n_s = \frac{f}{p} = \frac{400}{15} \times 60 = 1600 tr/mi$

$g = \frac{1600 - 1500}{1600} = 6,25\%$

3°/ $I = \frac{P}{U\sqrt{3}\cos\varphi} = \frac{7500}{400\sqrt{3} \times 0,8} = 13,532 A$

4°/ $pJS = 3 R I^2 = 3 \times 0,8 \times 13,532^2 = 450,5W$

5°/ $\eta = \frac{P_2}{P_1} =$ $P_2 = P_1 - pFS - pJS - pJr - pmec$

$P_2 = 6400W$ $P_2 = 7500 - 350 - 450 - 120 - 180$

$\eta = 6400/7500 = 85,33\%$

6°/ $T_M = \frac{P_M}{\Omega}$ $\Omega = \frac{2\pi n}{60} = \frac{2\pi \times 1500}{60} = 157 rd/s$

$T_M = \frac{6400}{157} = 40,76 Nm$