ATS 2003 - Corrigé

1. Régime permanent

111. $Em = k.w.ie = 0{,}11.157.25 = 431{,}75V$.
$wm = w/n = 157/0{,}5 = 314rd/s$ et $fm = 50Hz$.

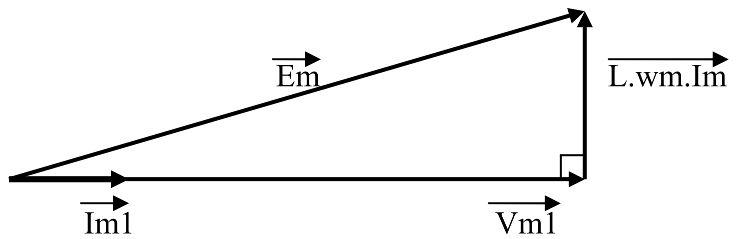
112. $No = 60.w/2\pi = 1500tr/mn$

113. $\underline{Z} = jL.wm$ $\quad |\underline{Z}| = L.wm = 3.10^{-3}.314 = 0{,}942\Omega$ et $\varphi z = \pi/2$ rd/s.

114. $\underline{Vm} = Vm$ $\quad \underline{Im} = Im\ e^{-j\varphi}$ $\quad \underline{Em} = Em\ e^{j\alpha}$

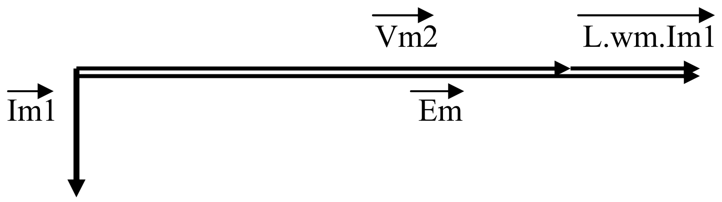
115. $\underline{Vm} = \underline{Em} - jL.wm.\underline{Im}$

121.



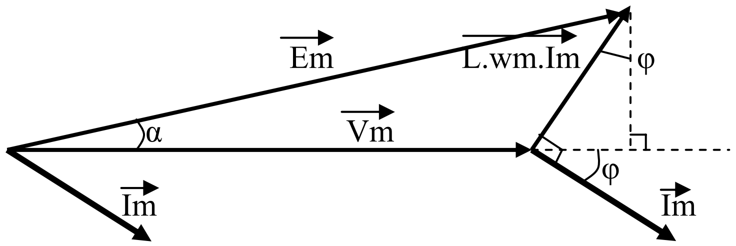
122. $Vm = [Em^2 - (L.wm.Im)^2]^{1/2} = [431{,}75^2 - (0{,}942.300)^2]^{1/2} = 326{,}4V$.

131.



132. $Vm2 = Em - L.wm.Im1 = 431{,}75 - (0{,}942.300) = 149{,}15V$

141.



142. $Em.\sin\alpha = |\underline{Z}|.\cos\varphi.Im$

143. $P = Vm.Im.\cos\varphi$

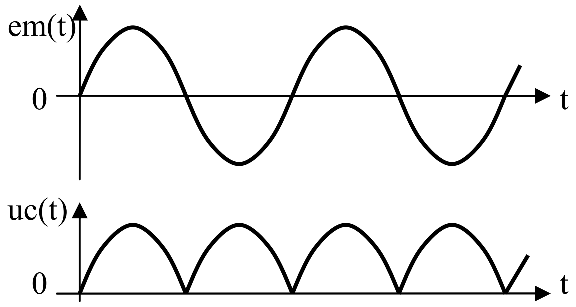
144. $P = (Vm.Em.\sin\alpha) / |\underline{Z}|$

145. P est maximale si $\alpha = \pi/2$ quand Em et Vm sont constants.

146. La charge est de type R-L.

2. Redressement.

211.



212. wc = 2.wm

213. Uco = 2.Em.√2 / π

214. Vc = Uco

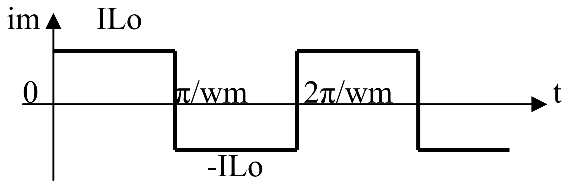
221. uc est une fonction paire donc tous les termes en sinus sont nuls.
Uc1 = (2/3) . (Uco/√2) = 4Em / 3π

222. uc = vl + vc où vc est constante. Alors VL1 = UC1.

223. I1 = VL1 / Lc.wc = 4.EM /3.π.Lc.2.wm = 2.EM /3.π.Lc.wm

224. Lc > 2.EM /3.π.I1.wm = 2.400 / 3.π.5.314 = 54mH.

231. P = Uco.<iL> donc <iL> = Ilo = 300.10^3.π / 2.400.√2 = 833A.



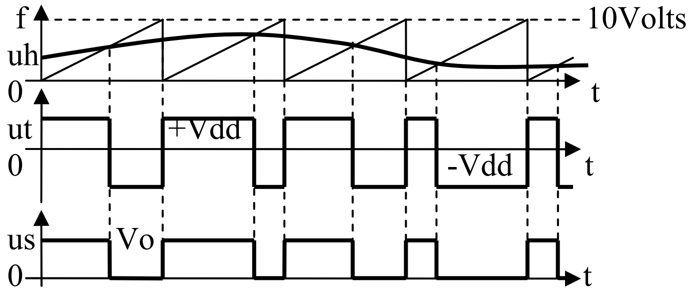
232. Imo = Ilo = 833A.

24. En ralentissement ; Em décroit et L.wm aussi comme Uco.

3. Asservissement du courant d'excitation.

311. AOP en comparateur.

312.313



321. $uso = \beta o.Vo$

322. $Ieo = \beta o.Vo / Re$

323. $us = Re.ie + Le.die/dt$

324. De à $\beta.Th$, $Vo = Re.ie + Le.die/dt$ donc $ie = e^{-t/\tau e} + Vo/Re$ où $\tau e = Le/Re$
$ie = Vo/Re + (Jo – Vo/Re).e^{-t/\tau e}$.

325. à $\beta o.Th$, $ie = J1 = (Jo – Vo/Re).e^{-\beta oTh/\tau e} + Vo/Re$

326. De $\beta o.Th$ à Th, $0 = Re.ie + Le.die/dt$ donc $ie = J1.e^{-(t – \beta oTh)/\tau e}$

327. En fin de période $ie = J2 = J1.\ e^{-(Th – \beta oTh)/\tau e}$

328. En régime stable $J2 = Jo = [(Jo – Vo/Re).e^{-\beta oTh/\tau e} + Vo/Re].e^{-Th(1 – \beta o)/\tau e}$

329. Si $Th > \tau e$ avec les approximations $e^x = 1 + x$ et $e^{-x} = 1 – x$:
$Jo = [(Jo – Vo/Re).(1 - \beta oTh/\tau e) + Vo/Re].[1 – (Th/\tau e)(1 - \beta o)]$

$Jo = (Jo – Jo\ \beta oTh / \tau e + Vo\beta oTh / \tau eRe).[1 – (Th/\tau e)(1 – \beta o)]$

$Jo = Jo – Jo\beta oTh/\tau e + Vo\beta oTh/\tau eRe – JoTh/\tau e + Jo\beta oTh/\tau e – Jo\beta o(Th/\tau e)^2 – Jo(\beta oTh/\tau e)^2 + (Vo/Re)(\beta oTh/\tau e)^2$

$Jo = Vo\ \beta o/Re$

3210. $J1 = (Jo – Vo/Re).(1 - \beta oTh/\tau e) + Vo/Re$

$J1 = Jo – Jo\ \beta oTh / \tau e + Vo\beta oTh / \tau eRe = Jo + (Vo\beta oTh/Le)(1 – \beta o)$

331. Donc $\Delta ie = (Vo\beta oTh/Le)(1 – \beta o)$

332. Δie est maximum si $\beta o = 0,5$.

333. $\Delta iemaxi = ThVo/4Lemin$ et $Lemin = ThVo/4\ \Delta iemaxi$ ou $Thmaxi = 4Le\Delta ie/Vo$

334. $fmini = Vo/4Le\Delta ie = 400/4.50.10^{-3}.1 = 2000Hz$

341. $V2 = -(R'/R)Vdc$

342. $R'/R = 25$ $R' = 25R$

343. $V3 = -(Vrc + V2) = (R'/R)Vdc – Vrc = 25Vdc - Vrc$

344. $V4(p) = - (V3(p) / R3)(R2 + 1/pC2) = - V3(p) (1 + pR2C2) / pR3C2$

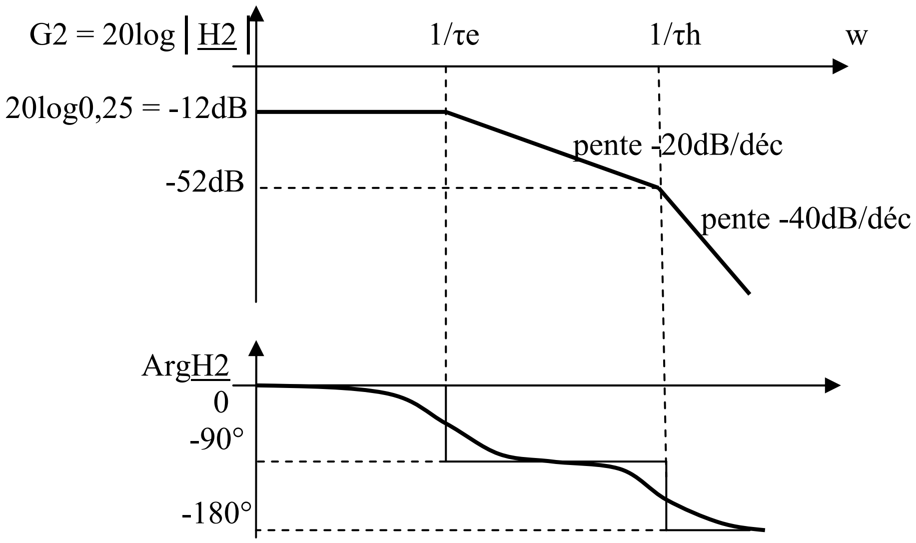
345. $V4(p) = [Vrc(p) – 25Vdc(p)](1 + pR2C2) / pR3C2$ donc $H(p) = (1 + pR2C2) / pR3C2$

$H(p) = k23.(1 + p\tau 2) / p\tau 2$

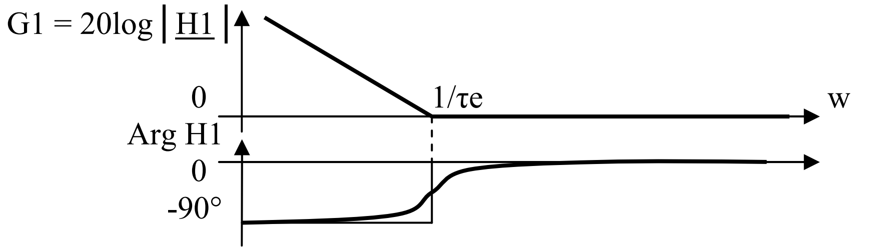
351. $H2(p) = Ie(p) / Uh(p) = kh / (1 + p\tau e).(1 + p\tau h)$

$H1(p) = k23.(1 + p\tau 2) / p\tau 2$

352.

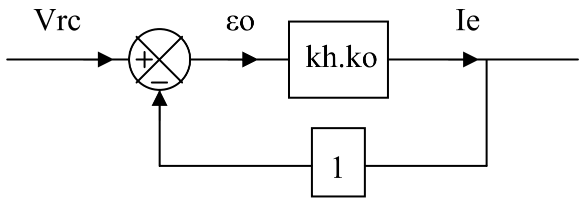


353.



354. Arg(H1.H2)= -135°(pour une marge de phase de 45°) quand $w = 1/\tau h$. Alors $|H1.H2| = 1 = k23.kh / (\tau e\sqrt{2}/\tau h)$ et $k23 = \tau e.\sqrt{2} / (\tau h.kh) = 566$

355. En statique



$\varepsilon o = Ie / kh.ko = Ie / 566.0,25 = 0,7\%Ie$

356. $Gbf(p) = H1(p).H2(p) / [1 + H1(p).H2(p)]$

$Gbf(p) = [kh / (1 + p\tau e) (1 + p\tau h)][k23.(1 + p\tau e) / p\tau e] / [1 + (kh.k23 / p\tau e.\{ 1 + p\tau h \}]$

$Gbf(p) = kh.k23 /(kh.k23 + p\tau e + p^2\tau e\tau h)$ $Gbf(p) = 1/(1+100\tau hp /kh.k23 +100\tau h^2p^2/kh.k23)$

357. $wo = (kh.k23)^{1/2} / 10\ \tau h = 59,5.10^{-3}rd/s$ et $m = 5 / (kh.k23)^{1/2} = 0,42$

358. $wr = wo(1 -2m^2)^{1/2} = 47.10^3 rd/s$.