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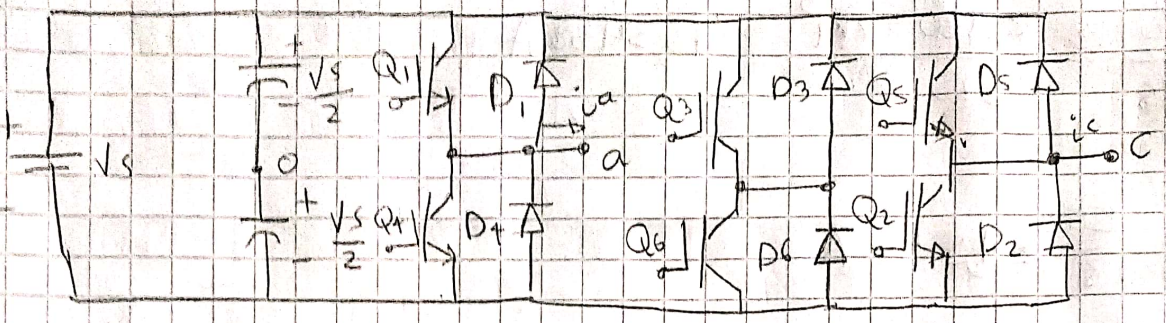
①



$R = 3\Omega \quad L = 7mH \quad C = 15\mu F \quad f_0 = 400\,Hz \quad V_S = 220V$

$Z_L = jwL \quad Z_C = -j \quad Z_C = \frac{-j}{wC} \quad \Phi_n = -\Phi_{Zn}$

$$Z_n = \sqrt{R^2 + \left(nwL - \frac{1}{nwC}\right)^2}$$

$$\Phi_n = -\tan^{-1}\left(\frac{nwL - \frac{1}{nwC}}{R}\right) \qquad I_a = \frac{V_{ab}}{|Z_n|}$$

$$V_{ab} = \sum_{n=1,3,5,7,9\ldots}^{\infty} \frac{4V_S}{n\pi} \sin\left(\frac{n\pi}{2}\right) \sin\left(\frac{n\pi}{3}\right) \sin\left(wt + \frac{\pi}{6}\right)$$

A) $V_{ab}(t) = 242,58 \sin(2513,3t + 30°) + -1,1435 \times 10^{-14} \sin(75398t + 90°)$
$+ -48,517 \sin(12566t + 150°) - 34,655 \sin(17593t + 210°)$
$+ 1,1435 \times 10^{-14} \sin(22619t + 270°) + 22,05 \sin(27646t + 330°)$ [V]

$$I_a = \frac{V_{ab}}{|Z_n|} \text{ [A]}$$

$I_a(t) = 25,74 \sin(2513,3t + 30°) + -2,59 \times 10^{-16} \sin(7539,8t + 90°)$
$+ -0,5865 \sin(12566t + 150°) - 0,29025 \sin(17593 + 210°)$
$+ 7,3573 \times 10^{-17} \sin(22619t + 270°) + 0,11538 \sin(27646t + 330°)$ [A]

$$I_L = \frac{\sqrt{(25,747)^2 + (2,59 \times 10^{-16})^2 + (+0,5865)^2 + (-0,29025)^2 + (7,35 \times 10^{-17})^2 + (0,1153)^2}}{\sqrt{2}}$$

$I_L = 18,1973\ A$

$P_0 = 3 I_L^2 R = 3(18,1973)^2 3 = 2,9803 \times 10^3\ W$

$$I_S = \frac{P_0}{V_S} = \frac{2,9803 \times 10^3}{220} = 13,5468\ A$$

$$I_{AVT} = \frac{I_S}{3} = 4,5156\ A$$

$$I_{RMS} = \frac{I_L}{\sqrt{3}} = 10,5062\ A$$

$$THD_{Ia} = \frac{1}{25,74}\sqrt{(-2,59 \times 10^{-16})^2 + (-0,58656)^2 + (-0,24025)^2 + (7,35 \times 10^{-17})^2 + (0,11)^2}$$

$$THD_{Ia} = 0,0258 \Rightarrow 2,58\%$$

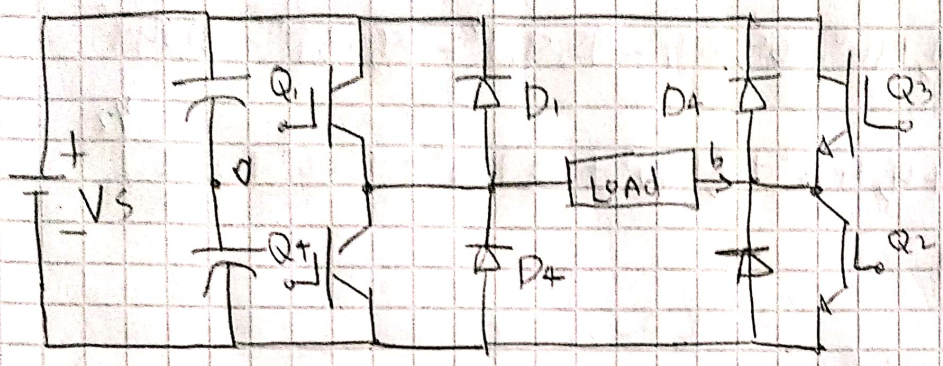
$$THD_{Vab} = \frac{1}{242,58}\sqrt{(-1,14 \times 10^{-14})^2 + (-48,517)^2 + (-31,65)^2 + (1,14 \times 10^{-14})^2 + (22,05)^2}$$

$$THD_{Vab} = 0,2621 \Rightarrow 26,21\%$$

(2)

$R = X\Omega \quad L = 31,5\,mH \quad C = 112\,\mu F \quad F_0 = 60\,Hz$

$W = 2\pi f_0 = 376,991\,rad/s$



$X_L = j\pi WL = (376,991)(31,5\,m)\,j\pi$

$X_L = 11,875\,j\pi\ \Omega$

$X_C = \dfrac{-j}{\pi wc} = \dfrac{-j}{[(376,991)(112\,\mu\pi)]} = -j\,23,683/\pi\ [\Omega]$

a) Para este tipo de inversor $V_o = V_s$

$V_o = V_s = 360\,[V]$

b) $|\bar{Z}_1| = \left[R^2 + (X_L + X_{C1})^2\right]^{1/2}$

despejando $R \rightarrow R = \left[|Z_1|^2 - (X_L + X_{C1})^2\right]^{1/2}$

$R = \left[23,23^2 - (11,875 - 23,683)^2\right]^{1/2}$

$\boxed{R = 20,005\ \Omega}$

c) $V_o = \sum_{n=1,3,5}^{N} \dfrac{4V_s}{n\pi} \sin(n\omega t)$

$V_o = 458,36\sin(376,9t) + 152,789\sin(1130,973t) + 91,673\sin(1884,96)$
$65,481\sin(2638,937t) + 50,93[3392,919\,t) + 41,67\sin(4146,9t)$

$i_o = \dfrac{V_o}{|Z|}$

Scribd

con $19,732\sin(376,991t) + 4,468\sin(1130,973t) + 1,576\sin(1884,95t)$
$+0,796\sin(2639,736t) + 0,485\sin(3392,919t) + 0,32\sin(4146,902t)$

$\theta_n = 30,553° - 54,144° - 69,89° - 75,917° - 79,137° - 81,149°$

$I_m = (19,732^2 + 4,468^2 + 1,516^2 + 0,796^2 + 0,48^2 + 0,32^2)^{1/2}$

$I_m = 20,316\ A.$

$I_o = \frac{I_m}{\sqrt{2}} = 14,365\ A.$

$P_o = \frac{V_o^2}{R} = \frac{360^2}{20} = \boxed{6480\ W}$

d) $I_p = I_m = \boxed{20,316\ A.}$

③ Diseñe Control UPWM RMS out 70% máximo

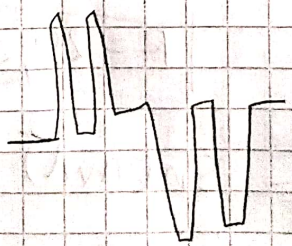
→ Para el UPWM se define el número de Pulsos necesarios

$$P = \frac{M_f}{2}$$

$$M_f = \frac{F_c}{f_o}$$

2 pulsos por Ciclo.

$M_f = 2$ y $P = 1$



Frecuencia del inversor a 400 Hz

$f_c = 2 \cdot 400 = 800\ Hz$

(3)

(A) $\frac{4Vs}{\sqrt{2}\pi}\sin\left(\frac{\delta}{2}\right) = Vo\,rms = 0{,}7Vs$

$\delta = 102{,}06°$

$360\,Vrms = 0{,}9\,Vs$

$Vs = 400\,V$

(B) $M\left(\frac{Ar}{Acr}\right) = \frac{\delta \cdot 2P}{\omega T} = \frac{102{,}06°\left(\frac{\pi}{180°}\right)(2)(1)}{(60)\,2\pi\,\frac{1}{60}}$

$M\left(\frac{Ar}{Acr}\right) = 0{,}56$

(C) $fp = p \cdot 2 \cdot f = (1)(2)(60) = 120\,Hz$

(D) $Acr = 5V$

$M = \frac{Ar}{Acr}$

$Ar = Acr \cdot M = 0{,}56 \cdot 5V$

$Ar = 2{,}81\,V$