1 - 10 - 2024

TD

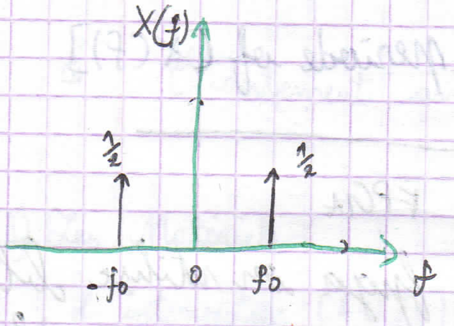
SAP // TAS

EXO 1 : $x(t) = \cos(2\pi f_0 t)$ $\quad f_0 = cte \leqslant 0,1$

1) Sample this signal with respecting the Shanon Condition in order ~~In order~~ to avoid loosing information

2) What is the minimum number of samples that can be used to represent $x(t)$ without loosing information ?

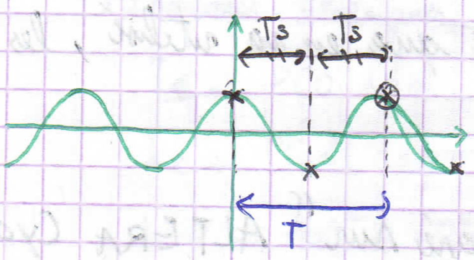
1) $x(t) \xrightarrow{F(x(t))} X(f) = \frac{1}{2}\left[\delta(f-f_0) + \delta(f+f_0)\right]$



$f_{max} = f_0$

$T_s \leqslant \frac{1}{2 f_{max}} \Rightarrow T_s \leqslant \frac{1}{2 f_0}$

2)



$T_s \leqslant \frac{1}{2 f_{max}} \Rightarrow T_s \leqslant \frac{T}{2}$

$T \geqslant 2T_s$

2 points

- Fourier transfer

Analog

$$\begin{cases} x(t) \xrightarrow{\mathcal{F}} X(f) = \int_{-\infty}^{+\infty} x(t)\, e^{-2j\pi f t}\, dt \quad \dots (1) \\ X(f) \xrightarrow{\mathcal{F}^{-1}} x(t) = \int_{-\infty}^{+\infty} X(f)\, e^{2\pi f j t}\, dt \quad \dots (2) \end{cases}$$

digital

We transform (1) with sampling $x(t)$ with $T_s = cte$

$t = n T_s \Rightarrow x(n) \Rightarrow \boxed{X(f) = \sum_{n=-\infty}^{+\infty} x(n \cdot T_s) \cdot e^{-2\pi j f n T_s}}$

if $T_s = 1$ $\boxed{X(f) = \sum_{n=-\infty}^{+\infty} x(n)\, e^{-2\pi f j n}}$

Exo 2 : Show that $\frac{1}{T_S} = f_S$ is a periode of $X(f)$

" " " $X(f)$ " periodic with $\frac{1}{T_S} = f_S$ is $X(f+f_s) = X(f)$?

f_s = sampling frequancy

$$X(f) = \sum x(nT_s)\, e^{-2\pi j f n T_s}$$

$$X(f+f_s) = \sum x(nT_s)\, e^{-2\pi j (f+f_s) n T_s}$$

$$= \sum x(nT_s)\, e^{-2\pi j f n T_s}\, \cancel{e^{-2\pi j f_s n T_s}} \to 1$$

$$= \sum x(nT_s)\, e^{-2\pi j f n T_s} = X(f)$$

- Yes, Fs is a periode of [X(f)]

FPGA

pour programmé un fpga on utilise blaster

" utilise " " comme un esclave

on utilise Device dans

Dans la carte dévlopement qui en va utilisé, les led son activé en 0,

La cart dévlopement est basé sur " ALTERA Cyclone II

EP2C8(F672C8N "

VHDL, VERILOG, QUARTUS WEB V13.0

↓ PC

7 _ 8 _ 2024

TD

SAMC

TD1 EXO1

. Etape 1: I) Les besoins fonctionels:

I2	I1	Commande
0	0	Tous les Led étaints
0	1	LED(1, 3, 5, 7) allumés
1	0	LED(2, 4, 6, 8) "
1	1	Clinotement avec LED Pair/Impair ((Temps 500ms))

. ~~Etape 2~~ II) Les Matériels

. 2 interrupteur (I_1, I_2)

. 8 LEDs

. Etape 2 :

I) Schémas Electriques

I_1 → PC0 (A_0)

I_2 → PC2(A_2)

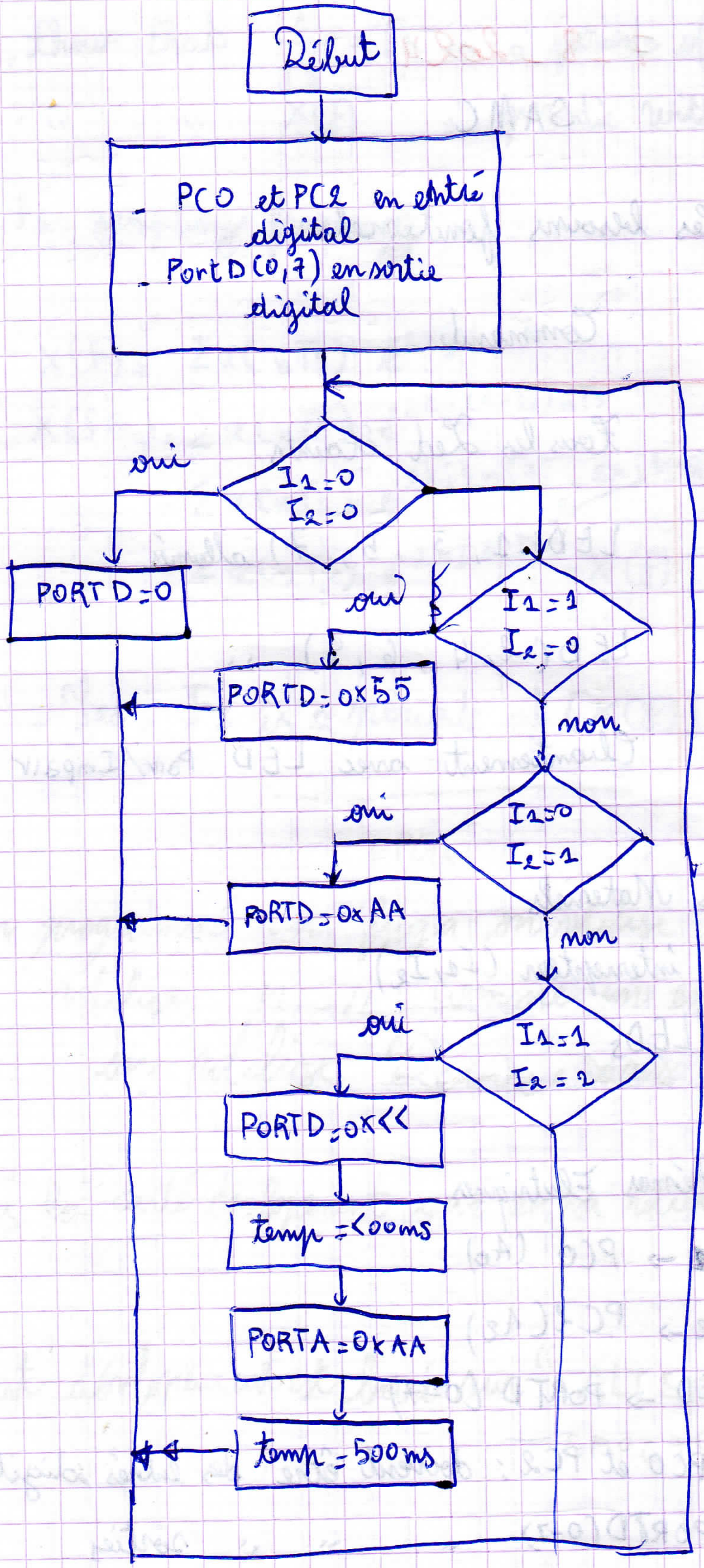
LED → PORTD (0-7)

II) _ PC0 et PC2 : doivent être des entrés digital

_ PORTD(0-7) : " " " sorties

. Etape 3 : Organigrame

La page suivante →



Début
- PC0 et PC2 en entré digital
- Port D(0,7) en sortie digital
oui
I1=0
I2=0
PORTD=0
oui
I1=1
I2=0
PORTD=0x55
non
oui
I1=0
I2=1
PORTD=0xAA
non
oui
I1=1
I2=2
PORTD=0x<<
temp=<00ms
PORTA=0xAA
temp=500ms

9-10-2024

SAP // TAS

Sortie

$$\boxed{X_2(f) = Y(f) = H(f) \cdot X(f) \quad (1)}$$ ⇐ Filtring operation in Fourier space

From fréquency spale (FS) to timp space (TS) use IFT, (1) becoms

$$\boxed{\begin{aligned} &\underbrace{y(n)}_{\text{output}} = \underbrace{h(n)}_{IR} * \underbrace{x(n)}_{\text{input}} \end{aligned}} \quad h(n) = \mathcal{F}^{-1}[H(f)]$$

IR: impulse response

$$\boxed{= \sum_{i=-\infty}^{+\infty} h(i)\, x(n-i)}$$

- IR $h(i)$ is the principal characteristic of the filtre, it must have been known
- if $h(i)$ has infinit duration, then we must truncate it to produce one that has a finit duration P, so the equation becomes

$$\boxed{y(n) = \sum_{i=-\frac{P}{2}}^{\frac{P}{2}} h(i)\, x(n-i)}$$

EXO 1 : Show $h(i)$ of a low pass is even

10 - 10 - 2024

TD

SAN

TD1. EXO 1: $S(t) = 5\sin(3\pi t)$

1) $fe \geq 2 f max$

$s(t) = 5\sin(3\pi t)$ $-2 < t < 2$

$= 5\sin(2\pi f t)$

$\Rightarrow 2\pi f t = 3\pi t$

$2f = 3 \Rightarrow f = \frac{3}{2} = 1{,}5\,Hz$

$fe \geq 2.1{,}5 = \boxed{3\,Hz}$

2) L'allur de signal $fe = 4Hz$

L'allur de signal recontruit est la même que le signal $x(t)$

• donc, nous n'abons pas une perte d'information

3) L'allur de signal $fe = 1{,}6\,Hz$

L'allur de signal reconstruit n'est pas la même que le signal $x(t)$

• donc, nous avon une perte d'information

TD1. EXO 2:

$x(t) = 2\cos(100\pi t) + 5\sin(250\pi t + \frac{\pi}{6}) - 4\cos(380\pi t)$

$+ 16\sin(600\pi t + \frac{\pi}{4})$ $fe \geq 2 fmax$

$= 2\cos(2\pi f_1 t) + 5\sin(2\pi f_2 t + \frac{\pi}{6}) - 4\cos(2\pi f_3 t) + 16\sin(2\pi f_4 t + \frac{\pi}{4})$

$100\pi t = 2\pi f_1 t \Rightarrow \boxed{f_1 = 50\ Hz}$

$250\pi t + \frac{\pi}{6} = 2\pi f_2 t + \frac{\pi}{6} \Rightarrow \boxed{f_2 = 125\ Hz}$

$380\pi t = 2\pi f_3 t \Rightarrow \boxed{f_3 = 190\ Hz}$

$600\pi t + \frac{\pi}{4} = 2\pi f_4 t + \frac{\pi}{4} \Rightarrow \boxed{f_4 = 300\,Hz}$

on a $f_4 > f_3 > f_2 > f_1$ donc $\boxed{fmax = f_4 = 300\,Hz}$

ead.univ-mosta.dz/fac/fst/

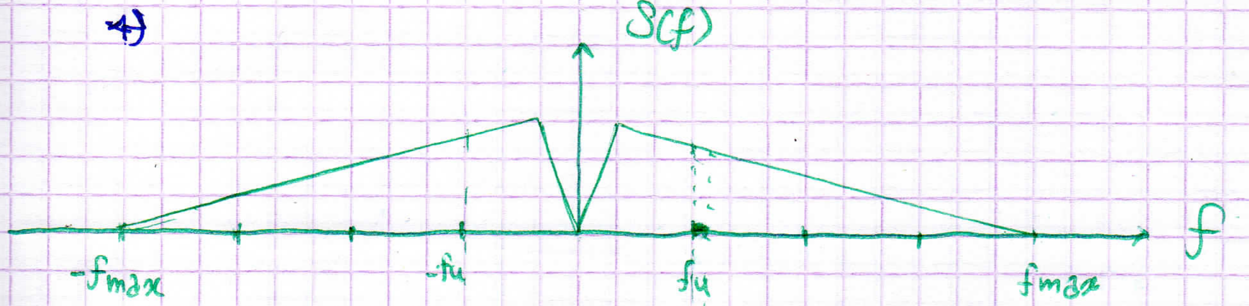
filtre anti-remplissement = élimine le bruit

bruit = haut fréquence

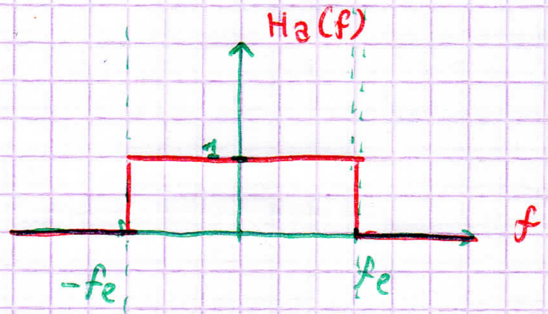
donc $\boxed{\begin{array}{l} f_e \geq 2 f_{max} \\ f_e \geq 600\,Hz \end{array}}$ $\Rightarrow$ $\boxed{f_{e\,min} = 600\,Hz}$

TD2. EXO3

1)

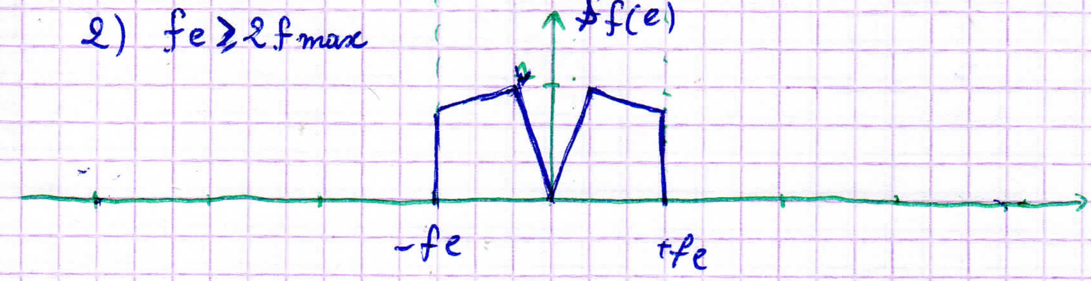


1)



$$H_a(f) = \begin{cases} 1 & -f_e < f < f_e \\ 0 & \text{ailleurs} \end{cases}$$

2) $f_e \geq 2 f_{max}$



on a la fréquence maximale est f_e donc $f_e \geq 2 f_u$

alors $f_{e\,min} = 2 f_u = \dfrac{2 f_{max}}{4} = \dfrac{f_{max}}{2}$