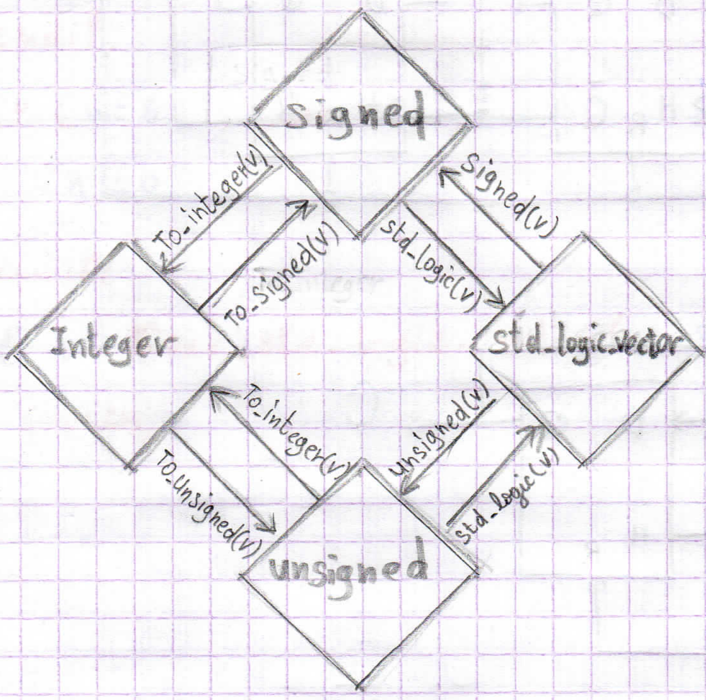
26 - 11 - 2024

FPGA Cours



V= To_integer ('15,67', True) ;-- V = 15
V=To_integer('15,67', false) ;-- v=16

V = To_integer (q, 5) ;-- V est une valeur 5bit

compteur peut être un générateur des signaux d'adresse

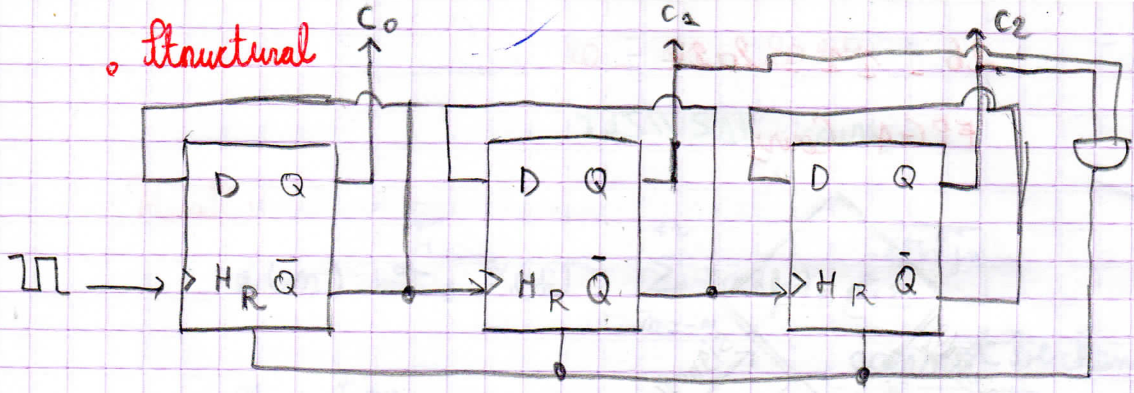
un compteur qui retourn forcément à 0 s'il à une valeur n on l'appile "Modulo n counter"

↳ " 3 "
" 6 " ...etc

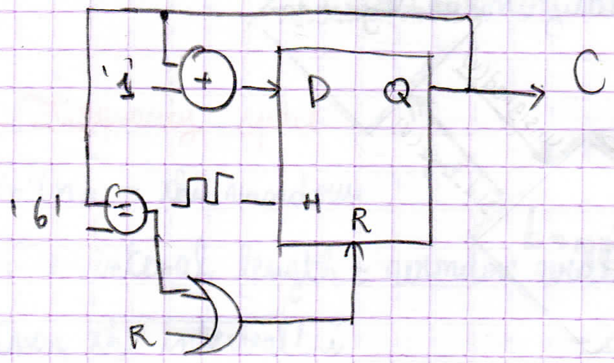
◦ Modulo 6 counter

La Page Suivante →

. Structural



. Comportemantale



Programme !

```
Library IEEE;
USE ieee.std_logic_1164.all;
USE ieee.std_logic_unsigned.all;
USE ieee.std_logic_arith.all;

Entity CountM6 is port (
    clk : In std_logic;
    R   : In std_logic;
    Q   : Out std_logic_Vector (2 downto 0));
End ;
Architecture behave of CountM6 is Begin
    process (Clk) is
        Variable n: integer range 0 to 7 := 0;
    Begin
        if R = '1' then n:='0';
```

```
        elsif (RISING_EDGE(clk)) then
            n:= n+1;
        endif;
        if (n=6 ) then
            n:=0;
        end if;
        Q <= conv_std-logic-vector(n, 3); -- integer to logic vector
    end process;
end;
```

27 - 11 - 2024

TAS // SAP Cours

- Heisenberg principle (incertitude)

incertitude Δx in position x and the incertitude ΔP in momentum

$P = v.m$ (speed, mass) always exist : $\Delta x \Delta P \geq \bar{h}$ $\quad \bar{h} = \frac{h}{2\pi}$ $\quad$ h : plank's constant

$$\left.\begin{array}{l} P = m\,v \\ \Delta E = F\,\Delta x \end{array}\right\} \Rightarrow F = \frac{\Delta P}{\Delta t} = m\frac{\Delta v}{\Delta t} = m\,a$$

$\Delta E = h\,\Delta f$ ← in quantum mechanics

we have

$$\left.\begin{array}{l} \Delta E = F\Delta x \\ \Delta E = h\,\Delta f \\ F = \frac{\Delta P}{\Delta t} \end{array}\right\} \Rightarrow \left\{\begin{array}{l} \Delta E = \frac{\Delta P}{\Delta t}\Delta x \\ \Delta E = h\,\Delta f \end{array}\right\} \Rightarrow \frac{\Delta P}{\Delta t}\Delta x = h\Delta f$$

$$\Rightarrow \frac{\Delta f\,\Delta t}{h} = \Delta x \Delta P > \frac{h}{2\pi}$$

$$\Rightarrow \boxed{\Delta f\,\Delta t \geq \frac{1}{2\pi}}$$

best case scenario $\Rightarrow \boxed{\Delta f\,\Delta t = \frac{1}{2\pi}}$

$$\Rightarrow \boxed{\Delta f = \frac{1}{2\pi}\,\frac{1}{\Delta t}}$$

that means that the resolution in time and the resolution in frequancy are inversely proportional, so - increasing the resolution in time will decrease the resolution in frequancy, and vise-verza

28 - 11 - 2024

SAN Cours

$$H(p) = \frac{k}{(1+\alpha p)(1+\beta p)} = \frac{k}{\frac{p^2}{\omega_n^2} + \frac{2\xi}{\omega_n} p + 1}$$

PI $\Rightarrow$ 2 paramètre à calculer (r_0, r_1) ou (k, z_0)

gain zéro

PID $\Rightarrow$ 3 " " " (r_0, r_1, r_2)

k, z_0, z_1

gain zéros normalement pôles

$$\lambda = e^{-\frac{T}{\tau}}$$

$$\omega_c = \frac{1}{\tau} \Rightarrow f_c = \frac{1}{Te} = \frac{1}{2\pi\tau}$$

$$\frac{5}{2\pi\tau} \leq \frac{1}{Te} \leq \frac{25}{2\pi\tau} \Rightarrow \frac{2\pi\tau}{5} \geqslant Te \geqslant \frac{2\pi\tau}{25}$$

$\Rightarrow \approx 0{,}25\tau \geqslant Te \geqslant 1{,}26\tau$

$0{,}01 \geqslant Te \geqslant 0{,}05$

4-12-2024

TAS//SAP Cours

- Conside $x(n)$ a digital signal and its FT $X(f)$

→ Determine the FT of $x(n)\,e^{2\pi f_0 j n}$ with $f_0 = cte$

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

$$FT\{x(n)e^{2\pi j f_0 n}\} = \sum_{n=-\infty}^{+\infty} x(n)\, e^{2\pi f_0 j n}\, e^{-2\pi f j n}$$

$$= \sum_{n=-\infty}^{+\infty} x(n)\, (e^{2\pi j n})^{f_0}\, (e^{2\pi j n})^{-f}$$

$$= \sum_{n=-\infty}^{+\infty} x(n)\, e^{2\pi (f_0 - f) j n}$$

$\sigma = f - f_0$

$$= \sum_{n=-\infty}^{+\infty} x(n)\, e^{-2\pi (f - f_0) j n} = \sum_{n=-\infty}^{+\infty} x(n)\, e^{-2\pi \sigma j n} = X(\sigma)$$

$$\boxed{= X(f - f_0)}$$

- Consider $h(n) = \dfrac{\sin(B\pi n)}{\pi n}$ IR low pass

- Determin the expression of H_R IR of the corresponding band pass

$$H_{R_1} = H(f - f_{ce}) \Rightarrow h_{r_1}(n) = h(n)\, e^{2\pi f_{ce} j n}$$

$$H_{R_2} = H(f + f_{ce}) \qquad = \frac{\sin(B\pi n)}{\pi n}\, e^{2\pi f_{ce} j n}$$

$$\Rightarrow h_{r_2} = h(n)\, e^{-2\pi f_{ce} j n}$$

$$H_R = H_{R1} + H_{R2} \Rightarrow h_r(n) = h_{r_1}(n) + h_{r_2}(n)$$

$$= h(n)\left[e^{2\pi f_{ce} j n} + e^{-2\pi f_{ce} j n}\right]$$

$= \cancel{h(n)}$ →

$$= h(n)\left[\cos(2\pi f_{ce}\, n) + j\cancel{\sin(2\pi f_{ce}\, n)} + \cos(2\pi f_{ce}\, n) - \cancel{j\sin(2\pi f_{ce}\, n)}\right]$$

$$= h(n) \cdot 2\cos(2\pi f_{ce}\, n)$$