Astables RC à AOP

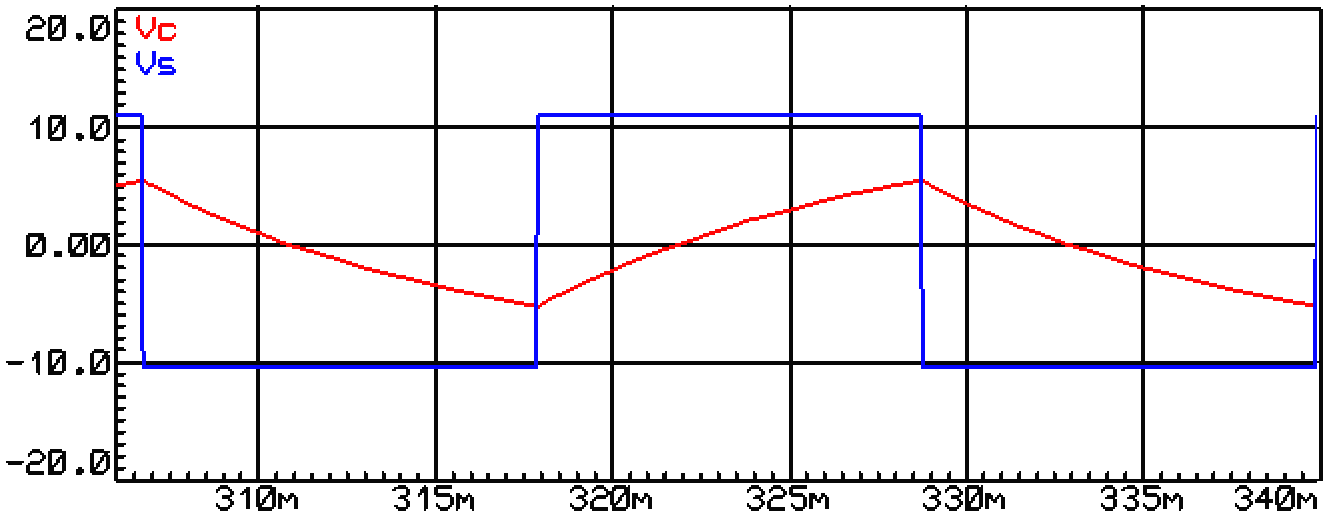
Exercice 1

1. On a deux seuils de basculement : $v^+ = \pm Vsat \frac{R_1}{R_1+R_2}$

$V_1 = 11V \times 10/(10+10)$ **$V_1 = 5,5V$**

$V_2 = -10,5V \times 10/(10+10)$ **$V_2 = -5,25V$**

2.



3.

$V_H = +Vsat = 11V$ $V_B = -Vsat = -10,5V$ $V_1 = 5,5V$ $V_2 = -5,25V$

$t_H = RCLn \frac{V_H - V_2}{V_H - V_1}$

$t_H = 10.10^3.10^{-6}$ Ln [(11- (-5,25))/(11 - 5,5)] **$t_H = 10,83ms$**

$t_B = RCLn \frac{V_B - V_1}{V_B - V_2}$

$t_B = 10.10^3.10^{-6}$ Ln [(-10,5 - 5,5)/(-10,5 – (-5,25))] **$t_B = 11,14ms$**

$T = t_H + t_B = 10,83ms + 11,14ms$ **$T = 21,97 \approx 22ms$**

Exercice 2

1. La diode D_1 permet la charge du condensateur à travers la résistance R_1 lorsque Vs = +Vsat.

La diode D_2 permet la décharge du condensateur dans la résistance R_2 lorsque Vs = -Vsat.

2. On a deux seuils de basculement : $v+ = \pm Vsat \frac{R_3}{R_3+R_4}$

V_1 = 11V x2,2/(2,2+2,2) **V_1 = 5,5V**

V_2 = -10,5V x2,2/(2,2+2,2) **V_2 = -5,25V**

3. V_H = +Vsat - V_D = 11V – 0,6V = 10,4V

V_B = -Vsat + V_D = -10,5V + 0,6V = -9,9V

V_1 = -5,25V V_2 = +5,5V

$$t_H = RCLn\frac{V_H - V_2}{V_H - V_1}$$

$t_H = 3{,}3.10^3.10^{-6}$ Ln [(10,4 – (-5,25))/(10,4 - 5,5)] **t_H = 3,83ms**

$$t_B = RCLn\frac{V_B - V_1}{V_B - V_2}$$

$t_B = 4{,}7.10^3.10^{-6}$ Ln [(-9,9 - 5,5)/(-9,9 – (-5,25))] **t_B = 5,63ms**

T = t_H + t_B = 3,83ms + 5,63ms **T = 9,46ms ≈ 9,5ms**

4. $\alpha = t_H / (t_H + t_B)$ = 3,83ms/9,46ms **α = 0,4**

5. Vs = ±Vsat, qui dépend de l'alimentation de l'AOP. Donc l'amplitude maximale de Vs dépend de l'alimentation de l'AOP.

Exercice 3

1. On a deux seuils de basculement :

$v+ = \pm Vsat \frac{R_1}{R_1+R_2}$ et $\pm Vsat = \pm(V_Z + V_D) = \pm(4,7V + 0,6V) = \pm 5,3V$

$V_1 = 5,3V x 1,2/(1,2+2,2)$ **$V_1 = 1,87V$**

$V_2 = -5,3V x 1,2/(1,2+2,2)$ **$V_2 = -1,87V$**

2. $V_H = +Vsat = 5,3V$ $V_B = -Vsat = -5,3V$

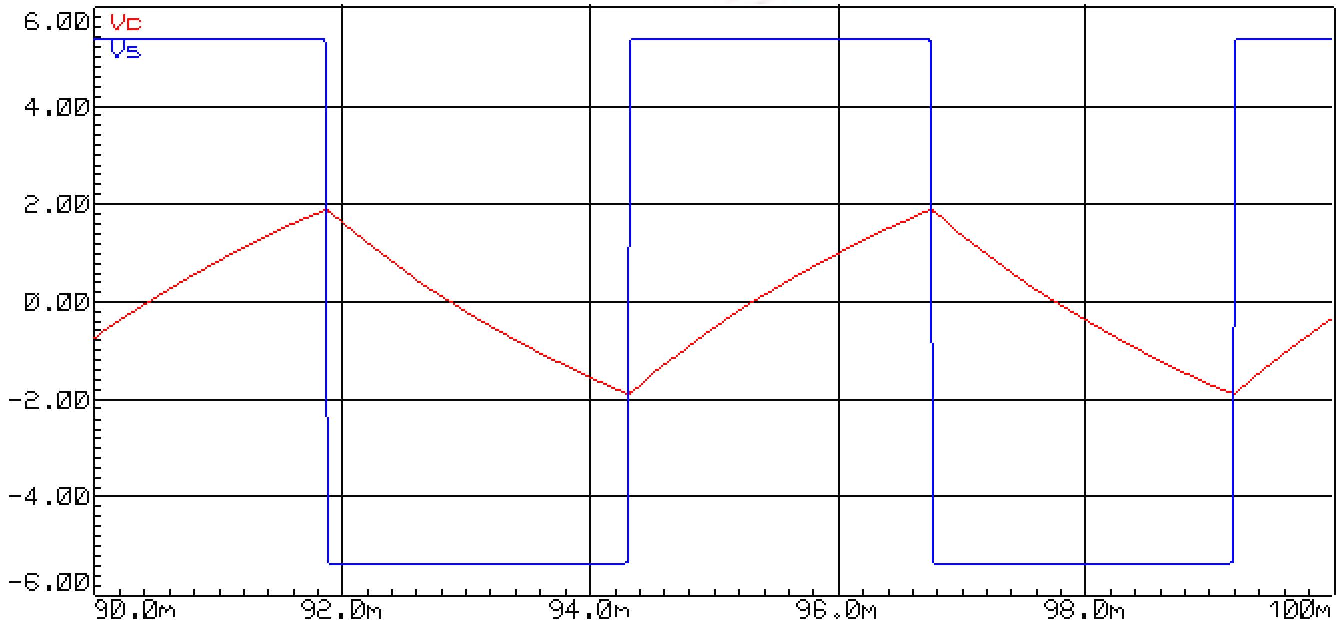
$t_H = 3,3.10^3.10^{-6}$ Ln $[(5,3 - (-1,87))/(5,3 - 1,87)]$ **$t_H = 2,43ms$**

$t_B = 3,3.10^3.10^{-6}$ Ln $[(-5,3 - 1,87)/(-5,3 - (-1,87))]$ **$t_B = 2,43ms$**

$T = t_H + t_B = 2x2,43ms$ **$T = 4,86ms \approx 5ms$**

3. $\alpha = t_H / (t_H + t_B) = t_H / 2t_H$ **$\alpha = 0,5$**

4.



Exercice 4

1. $v+ = \dfrac{\dfrac{Vcc}{R_3} + \dfrac{Vs}{R_2}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}}$ et $Vs = \pm Vsat$ $+Vsat = Vcc = 5V$ $-Vsat = 0V$

On a deux seuils de basculement :

$$V_1 = \dfrac{\dfrac{Vcc}{R_3} + \dfrac{Vcc}{R_2}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}} = \dfrac{\dfrac{5V}{15} + \dfrac{5V}{1,2}}{\dfrac{1}{3,3} + \dfrac{1}{1,2} + \dfrac{1}{15}}$$

$V_1 = 3,74V$

$$V_2 = \dfrac{\dfrac{Vcc}{R_3} + \dfrac{0}{R_2}}{\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}} = \dfrac{\dfrac{5V}{15}}{\dfrac{1}{3,3} + \dfrac{1}{1,2} + \dfrac{1}{15}}$$

$V_2 = 0,28V$

2. $V_H = +Vsat = 5V$ $V_B = -Vsat = 0V$

$t_H = 3,3.10^3.10^{-6}$ Ln [(5 - 0,28)/(5 - 3,74)] **$t_H = 4,36ms$**

$t_B = 3,3.10^3.10^{-6}$ Ln [(0 - 3,74)/(0 - 0,28)] **$t_B = 8,55ms$**

$T = t_H + t_B = 4,36ms + 8,55ms$ **$T = 12,91ms \approx 13ms$**

3. $\alpha = t_H / (t_H + t_B) = t_H / T$ **$\alpha \approx 0,34$**

4.