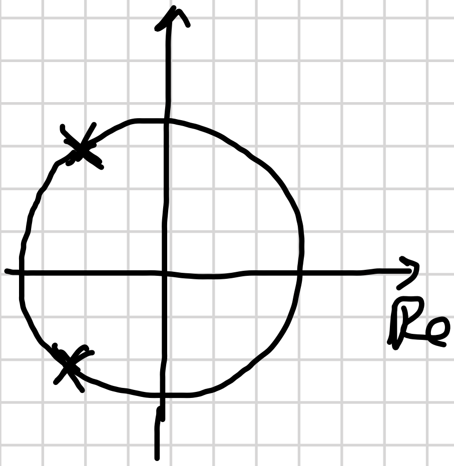
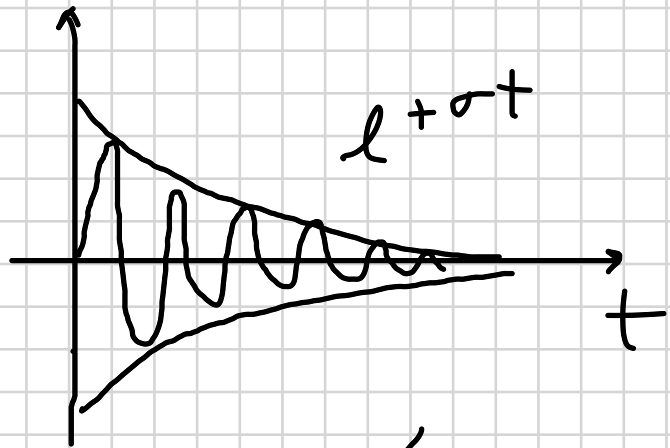
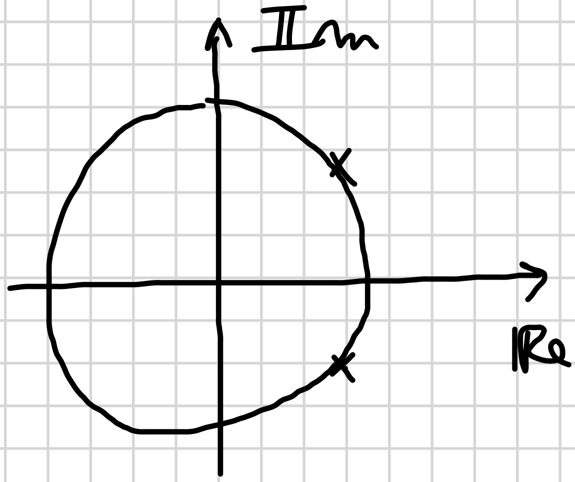
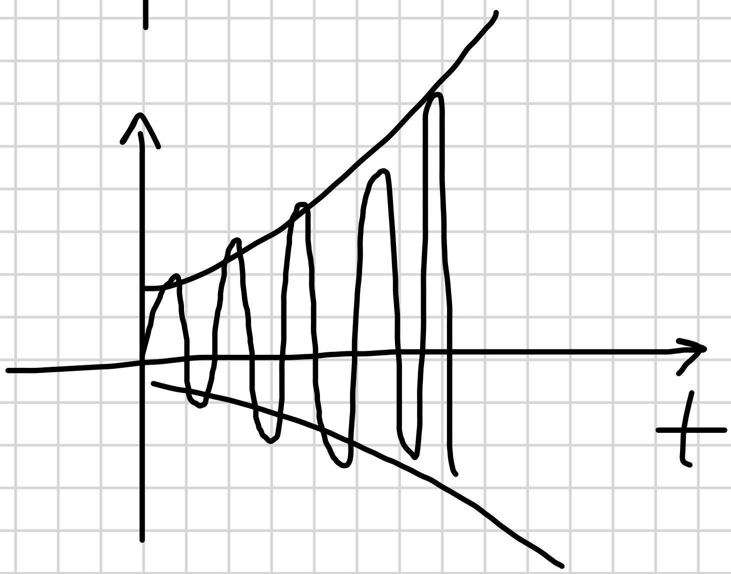
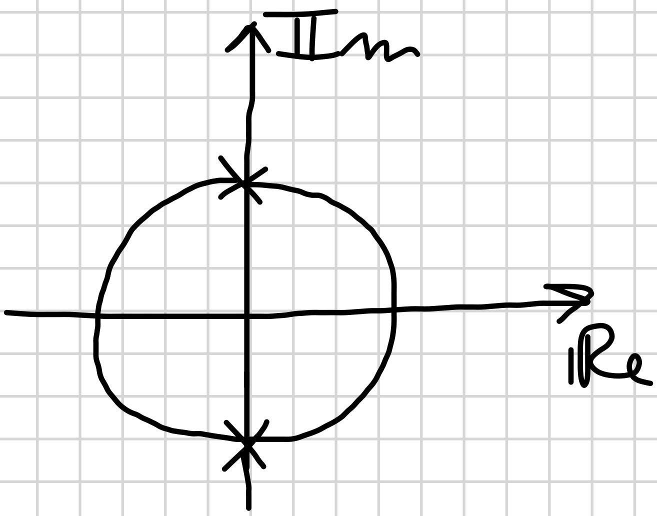
$$S = \sigma + j\omega_0$$

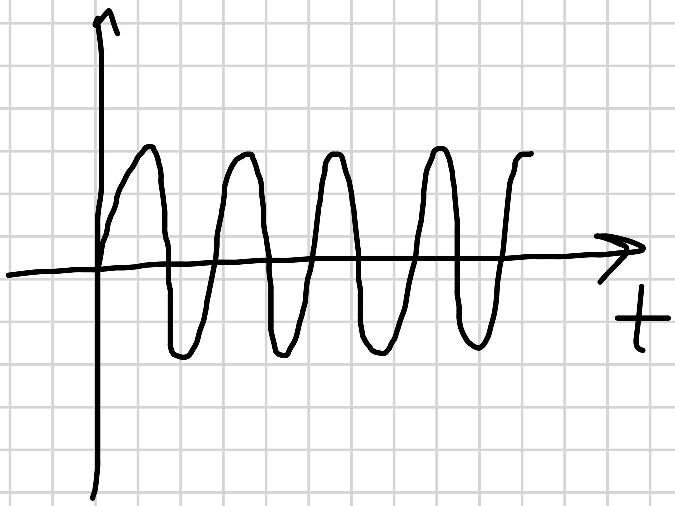


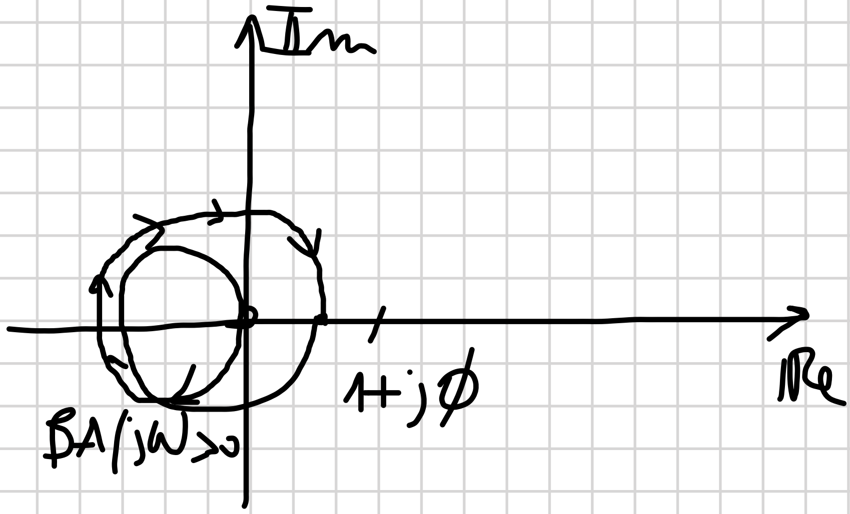


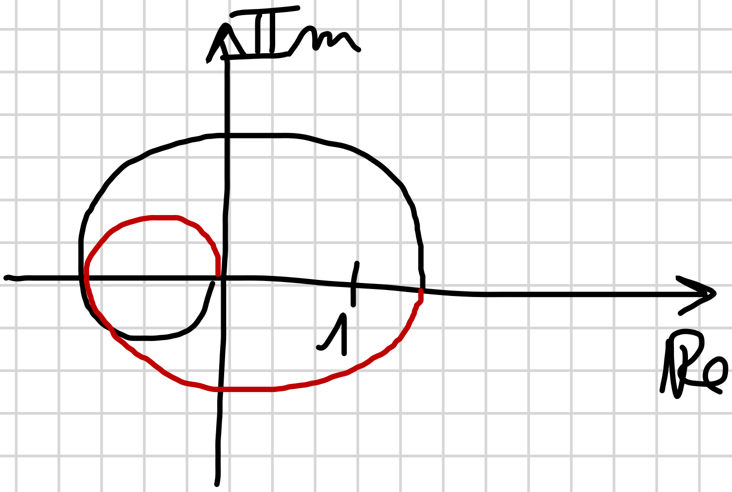


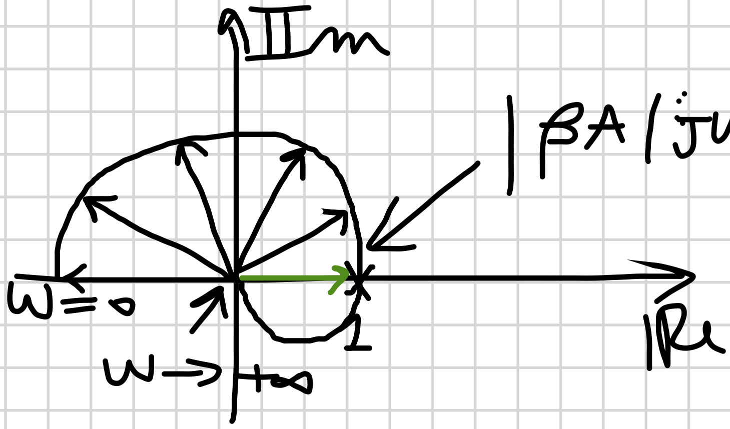






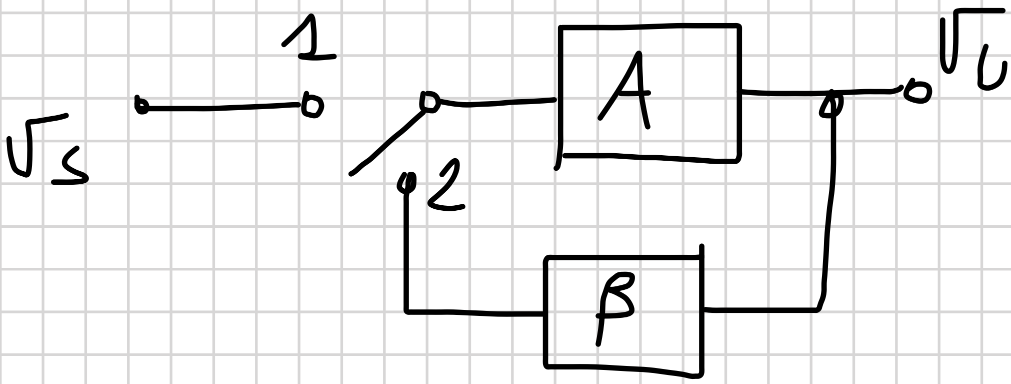






$$|\beta A(j\omega_0)| = 1$$

$$\angle \beta A(j\omega_0) = 0$$



$$V_S = V_m \sin(\omega_0 t) \Rightarrow$$

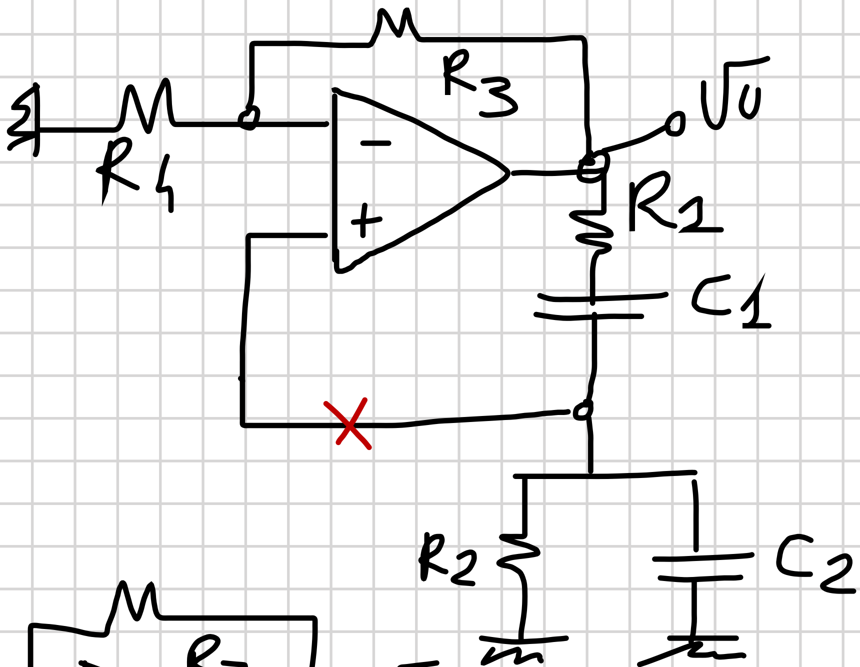
$$V_U = |A(j\omega_0)| V_m \sin\left(\omega_0 t + \angle A(j\omega_0)\right)$$

$$V_U = \beta A V_U \qquad \boxed{\beta A = 1}$$

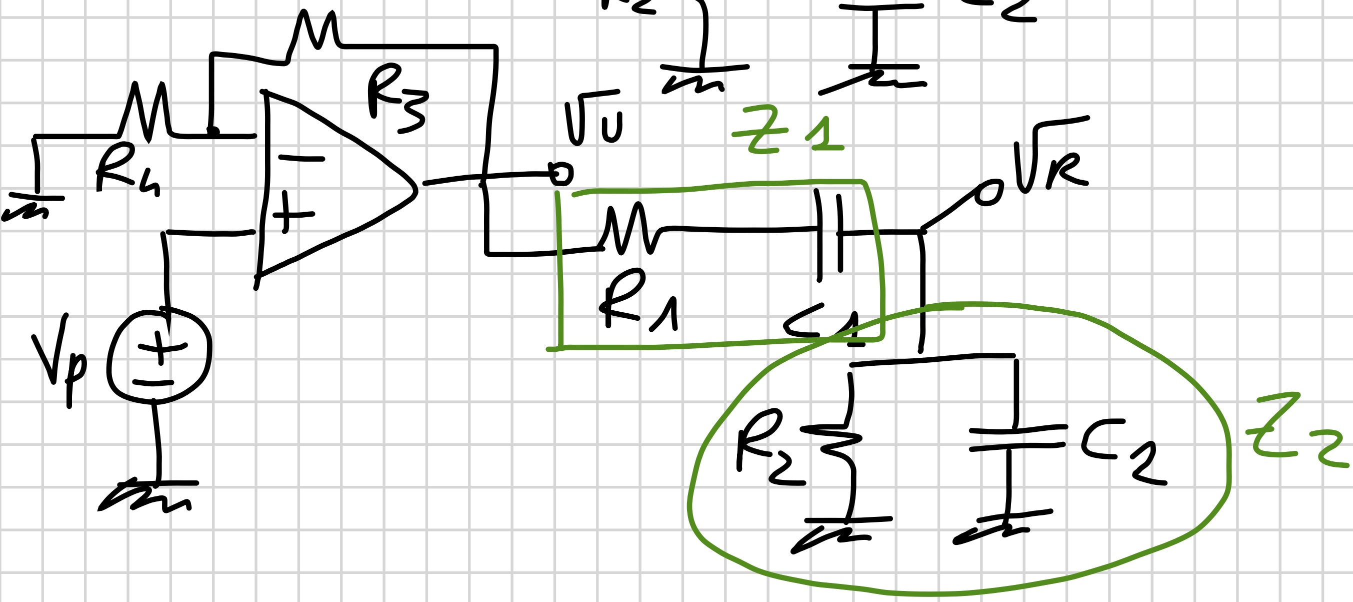
A regime
$$\beta A(j\omega_0) = 1$$
$$|\beta A(j\omega_0)| = 1$$
$$\angle \beta A(j\omega_0) = 0$$

$$\beta A(j\omega_0) > 1$$

PONTE DI WIEN



$$\beta A = \frac{V_R}{V_p}\bigg|_{V_S=0}$$



$$\beta A = \frac{Z_2}{Z_1+Z_2}\left(1+\frac{R_3}{R_4}\right)$$

$$Z_2 = R_2 \parallel \frac{1}{C_2 s} = \frac{R_2}{R_2 C_2 s + 1}$$

$$Z_1 = R_1 + \frac{1}{C_1 s} = \frac{R_1 C_1 s + 1}{C_1 s}$$

$$\beta A = \left(1+\frac{R_3}{R_4}\right)\frac{R_2C_1s}{R_2C_1s+(R_2C_2s+1)(R_1C_1s+1)} =$$

$$= \underbrace{\left(1+\frac{R_3}{R_4}\right)}_{G}\frac{R_2C_1s}{R_1C_1R_2C_2s^2+(R_1C_1+R_2C_2+R_2C_1)s+1}$$

$$R_1=R_2=R \quad ; \quad C_1=C_2=C$$

$$\beta A(s) = \frac{G\,RCs}{R^2C^2s^2+3RCs+1}$$

$$\beta A(j\omega) = \frac{G\,j\omega RC}{\underbrace{1-R^2C^2\omega^2}+3RC\,j\omega}$$

$$\beta A(j\omega_0) \geq 1$$

$$\angle \beta A(j\omega_0) = 0$$

$$1-R^2C^2\omega_0^2 = 0$$

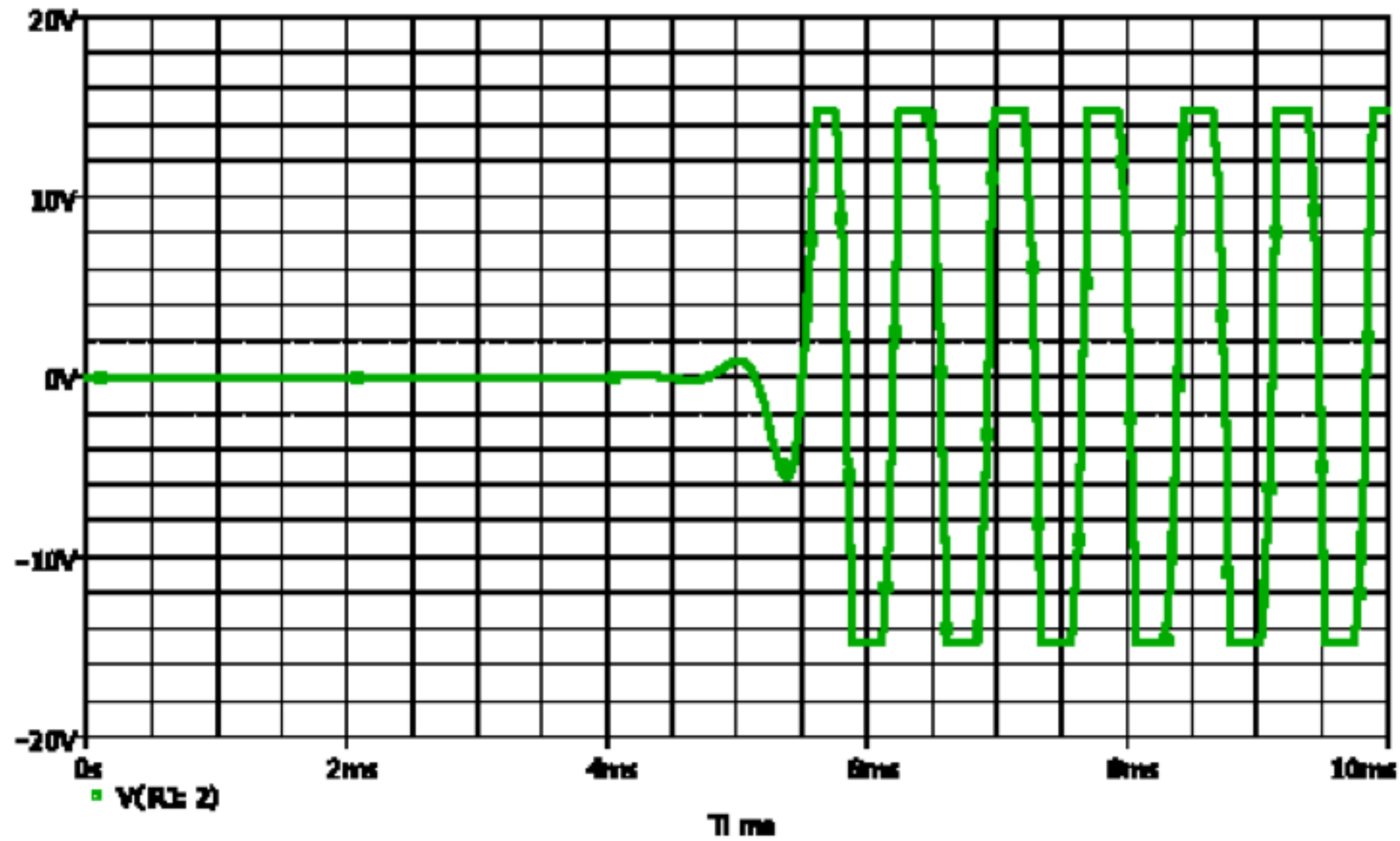
$$\boxed{\omega_0 = \frac{1}{RC}}$$

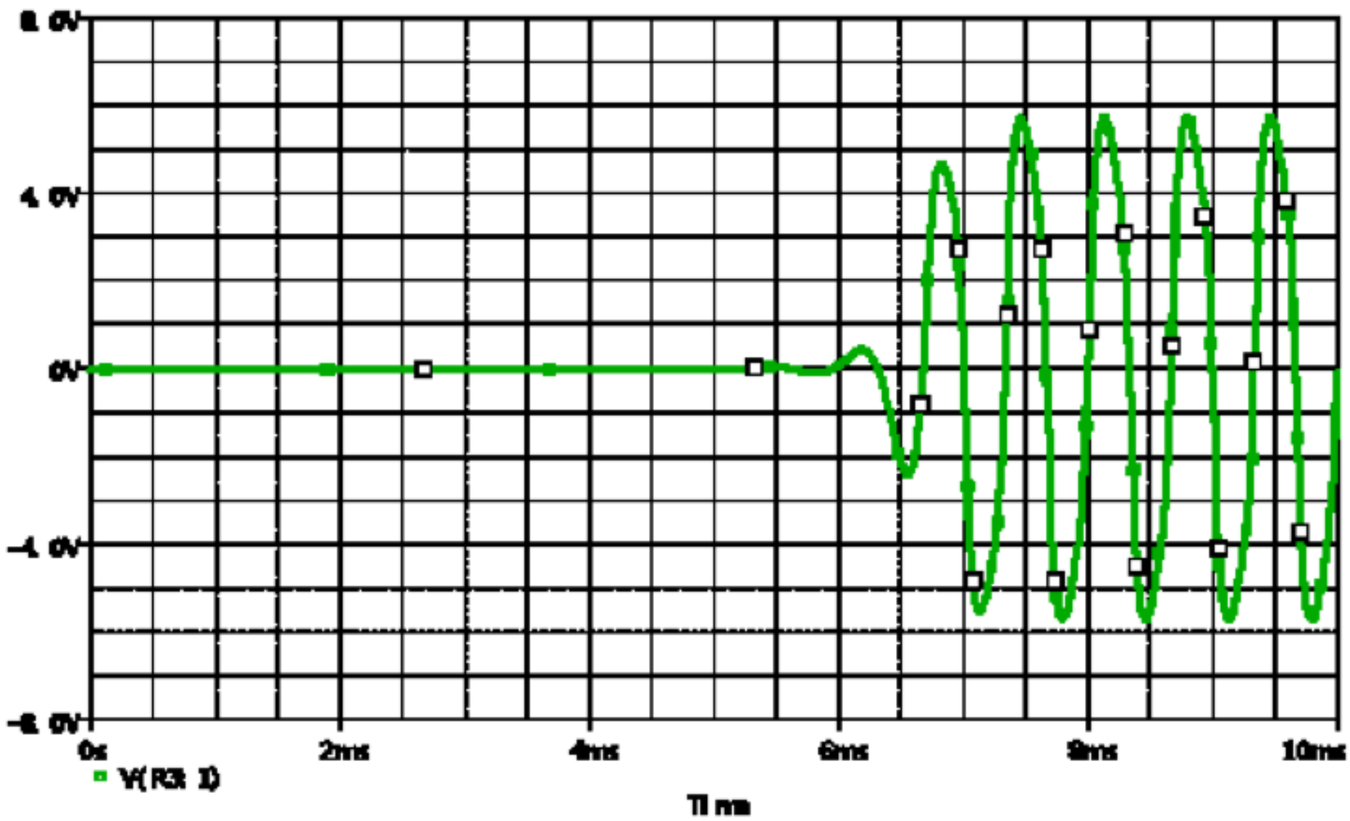
$$\beta A(j\omega_0) = \frac{G\,\cancel{j\omega_0}\,\cancel{RC}}{3\,\cancel{RC}\,\cancel{j\omega_0}} = \boxed{\frac{G}{3}}$$

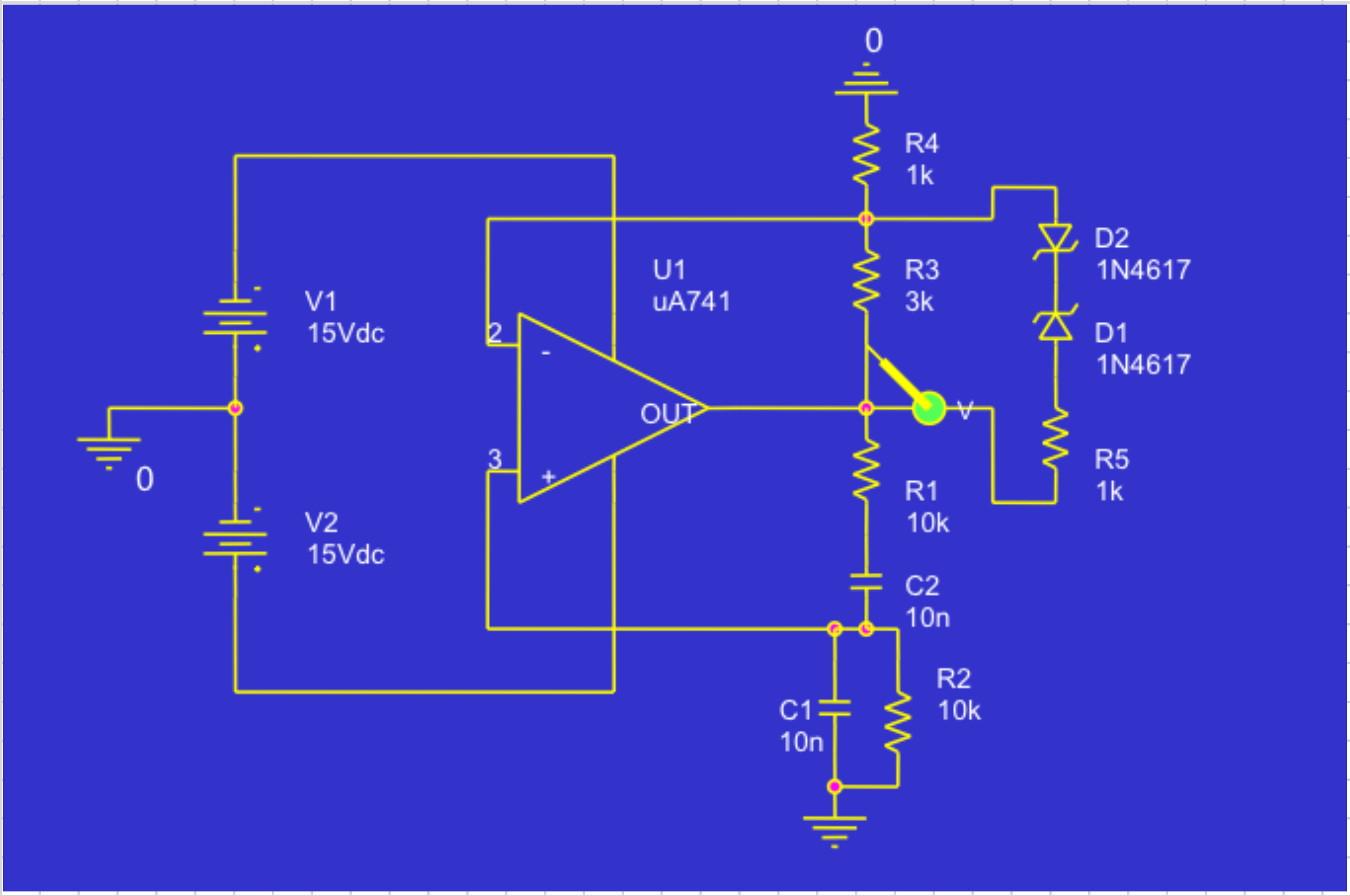
$$G>3 \Rightarrow \left(1+\frac{R_3}{R_4}\right) > 3$$

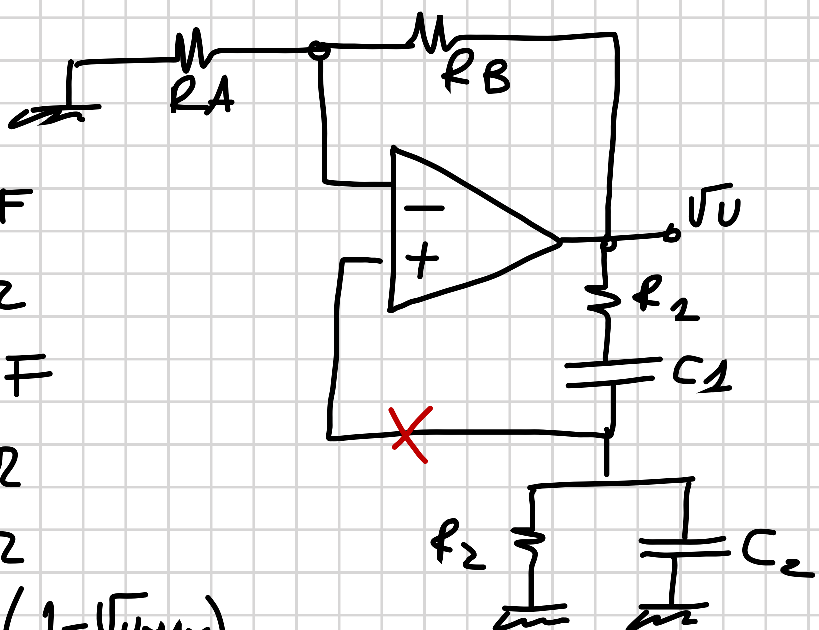
$R_3 > 2R_4$ INNESCO

$R_3 = 2R_4$ A REGIME


20V
10V
0V
-10V
-20V
0s
2ms
4ms
6ms
8ms
10ms
V(R1: 2)
Time


8.0V
4.0V
0V
-4.0V
-8.0V
0s
2ms
4ms
6ms
8ms
10ms
V(R3: 1)
Time





$C_1 = 1\mu F$

$R_1 = 1 k\Omega$

$C_2 = 2\mu F$

$R_2 = 2 k\Omega$

$R_A = 1 k\Omega$

$R_B = R_0 \left(1 - \frac{V_{Umax}}{V_0}\right)$

$R_0 = 6 k\Omega$

$V_0 = 5V$

$$\beta A(s) = \left(1 + \frac{R_B}{R_A}\right) \frac{R_2 C_1 s}{R_1 R_2 C_1 C_2 s^2 + (R_1 C_1 + R_2 C_2 + R_2 C_1) s + 1}$$

$$\beta A(j\omega) = \left(1 + \frac{R_B}{R_A}\right) \frac{j\omega R_2 C_1}{1 - R_1 R_2 C_1 C_2 \omega^2 + j\omega (R_1 C_1 + R_2 C_2 + R_2 C_1)}$$

$$\angle \beta A(jW_0) = 0 \Longrightarrow 1 - R_1 R_2 C_1 C_2 W_0^2 = 0$$

$$W_0 = \frac{1}{\sqrt{R_1 R_2 C_1 C_2}} = 500 \text{ rad/sec}$$

$$|\beta A(jW_0)| > 1$$

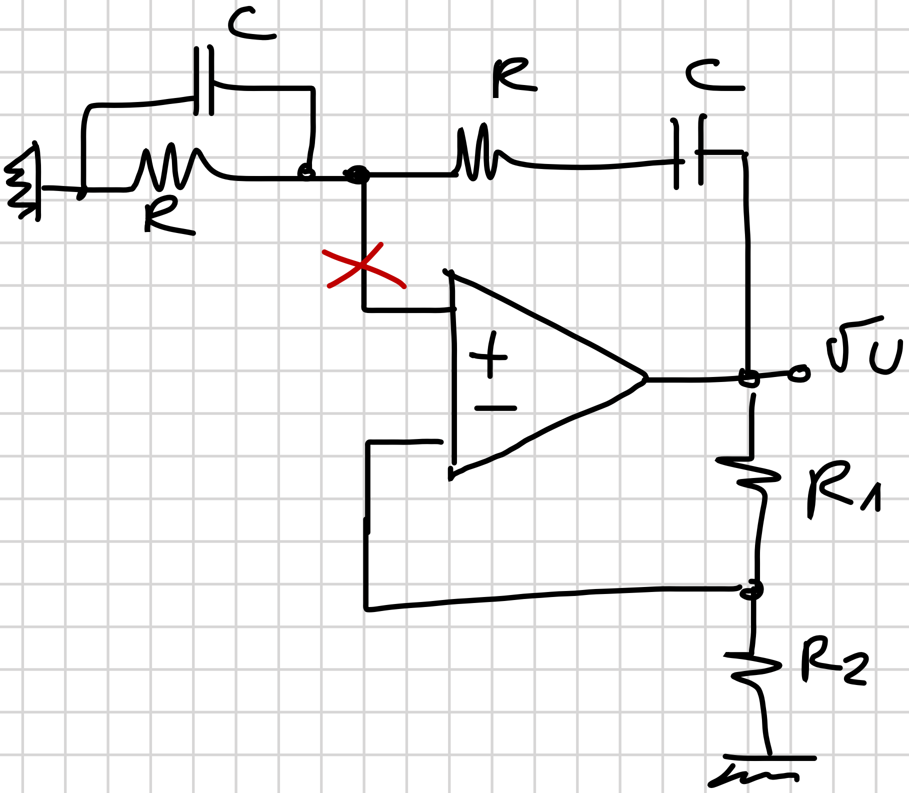
$$|\beta A(jW_0)| = \left(1 + \frac{R_B}{R_A}\right) \frac{R_2 C_1}{R_1 C_1 + R_2 C_2 + R_2 C_1} > 1$$

$$R_B = ? = R_0$$

$$|\beta A(jW_0)| = 2 > 1$$

$$\left[1 + \frac{R_0}{R_A}\left(1 - \frac{V_{UMAX}}{V_0}\right)\right] \cdot \frac{R_2 C_1}{R_1 C_1 + R_2 C_2 + R_2 C_1} = 1$$

$$V_{UMAX} = 2{,}92 \text{ V}$$



$R = 10k\Omega$

$C = 100nF$

$R_1 = 5R_2 e^{-\frac{V_U}{V_M}}$

$R_2 = 1k\Omega$

$V_M = 5,457V$

V_U = AMPIEZZA OSCILLAZIONE

$$\beta A(s) = \frac{RCs}{R^2C^2s^2 + 3RCs + 1}\left(1 + \frac{R_1}{R_2}\right)$$

$$\beta A(j\omega) = \frac{RCj\omega}{1 - R^2C^2\omega^2 + 3RCj\omega}\underbrace{\left(1 + \frac{R_1}{R_2}\right)}_{G}$$

$$\omega_0 = \frac{1}{RC} \Rightarrow f_0 = 159\,Hz$$

$$|\beta A(j\omega_0)| = \frac{6}{3} = 2 > 1$$

$$|\beta A(j\omega_0)| = 1 : \frac{1 + 5e^{-\frac{V_U}{V_M}}}{3} = 1$$

$$V_U = V_M \ln(2,5) = 5V$$