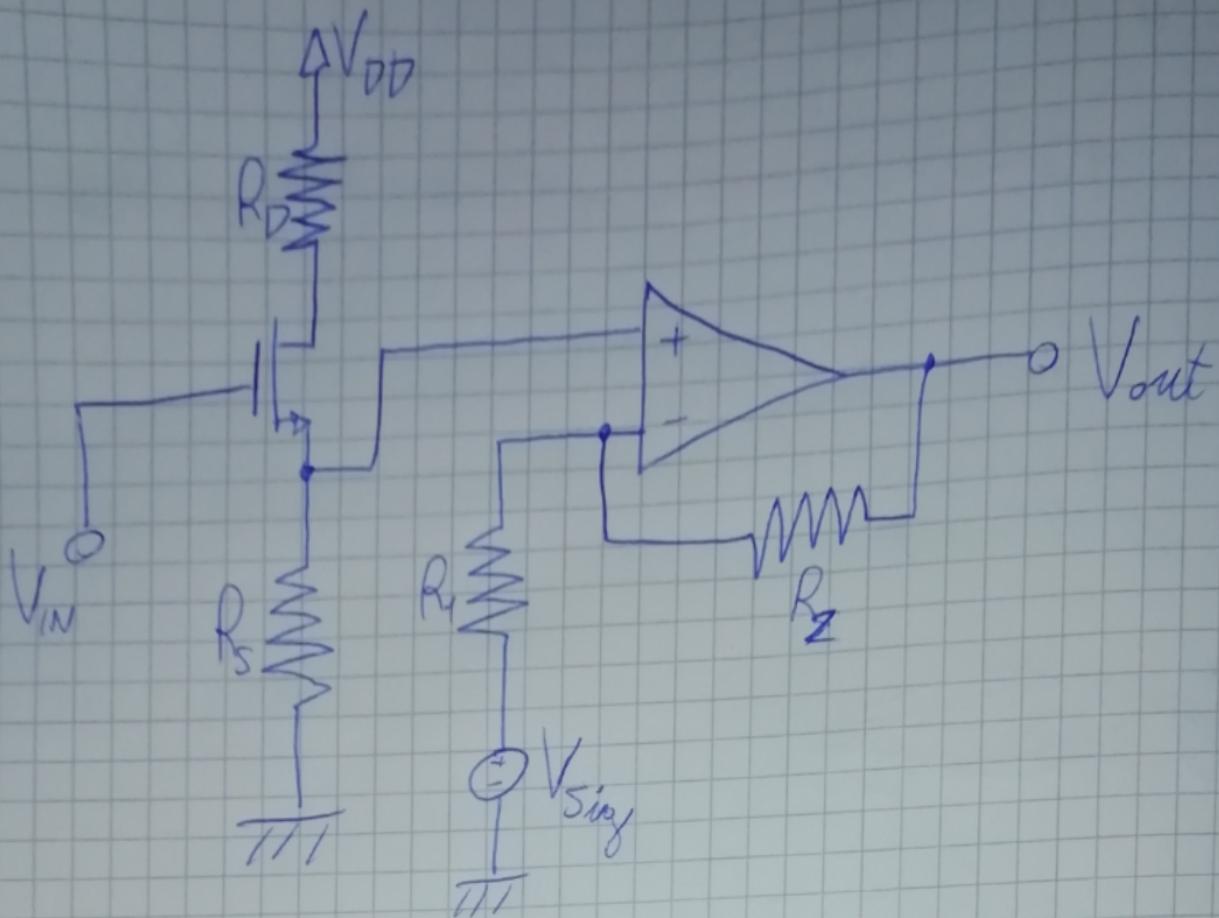


ESEMPIO 10

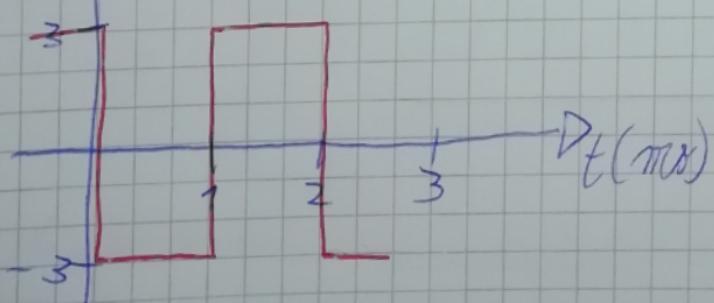


$$M = \left\{ V_t = 1V; K = 0,5 \frac{mA}{V^2}; \lambda = 0 \right\}$$

$$V_{DD} = 10V \quad R_1 = 1k\Omega \quad R_2 = 5k\Omega \quad R_D = 3k\Omega$$

$$R_s = 2k\Omega \quad U^+ - U^- = 10V$$

$V_{IN}(V)$



V_{sig} generatore sinusoidale, valore medio nullo, ampiezza 200mV e $f = 1\text{kHz}$

Studiare saturazione transistor nei casi
 $V_{IN} = 3V$ e $V_{IN} = -3V$

$$V_{GS} = V_G - V_S = V_{IN} - V_S = V_{IN} - i_D R_S$$

$$V_G = V_{IN}$$

$$V_S = i_D R_S$$

$$B_{DS}$$

$$\begin{cases} i_D = K(V_{GS} - V_t)^2 \end{cases}$$

$$\begin{cases} V_{GS} = V_{IN} - i_D R_S \end{cases}$$

$$V_{IN} = 3V$$

$$V_{GS} = 3 - 2\left(\frac{1}{2}\left(V_{GS} - 1\right)^2\right) = 3 - \left(V_{GS}^2 - 2V_{GS} + 1\right)$$

$$V_{GS} = 3 - V_{GS}^2 + 2V_{GS} - 1$$

$$-V_{GS}^2 + V_{GS} + 2 = 0$$

$$V_{GS}^2 - V_{GS} - 2 = 0 \quad \Delta = 1 + 8 = 9$$

$$V_{GS,1,2} = \frac{1 \pm 3}{2} = \begin{cases} +2V > V_t = 1V \\ -1V < V_t = 1V \end{cases}$$

$$V_{GS} = 2V$$

$$i_D = \frac{1}{2} \left(2 - 1 \right)^2 = \frac{1}{2} \left(1 \right)^2 = 0,5 \text{ mA}$$

$$V_S = i_D R_S = \frac{1}{2} \cdot 2 = 1V$$

$$V_{IN} = -3V$$

$$V_{GS} = -3 - R \left(\frac{1}{R} \left(V_{GS} - 1 \right)^2 \right) = -3 - \left(V_{GS}^2 - 2V_{GS} + 1 \right)$$

$$V_{GS} = -3 - V_{GS}^2 + 2V_{GS} - 1$$

$$-V_{GS}^2 + V_{GS} - 4 = 0$$

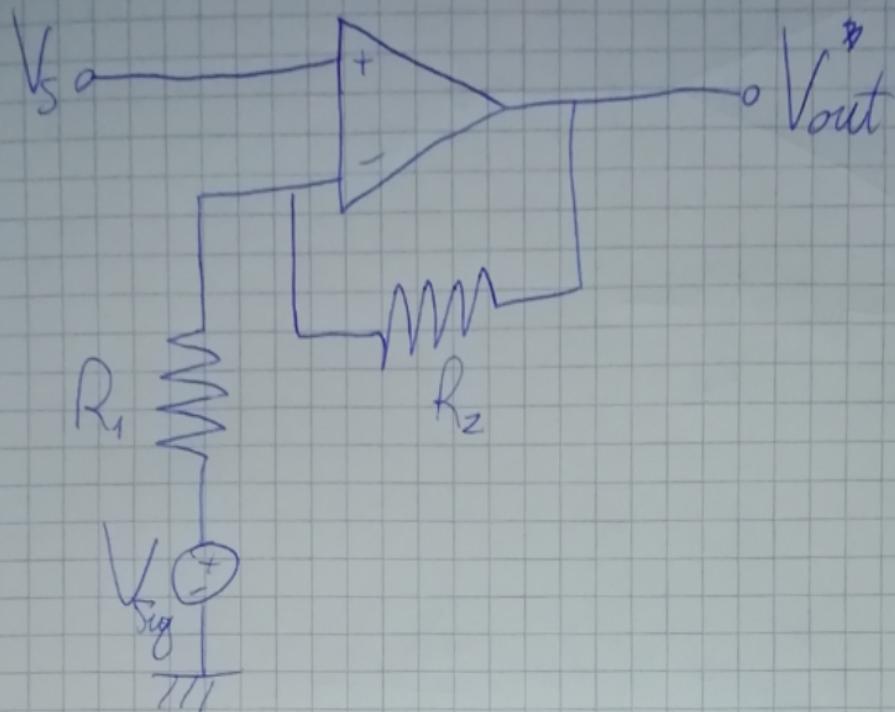
$$V_{GS}^2 - V_{GS} + 4 = 0$$

$$\Delta = 1 - 16 = -15$$

-transistor interzettek

$$V_S = 0V$$

Studio il rimanente circuito



Applico sovrapposizione degli effetti

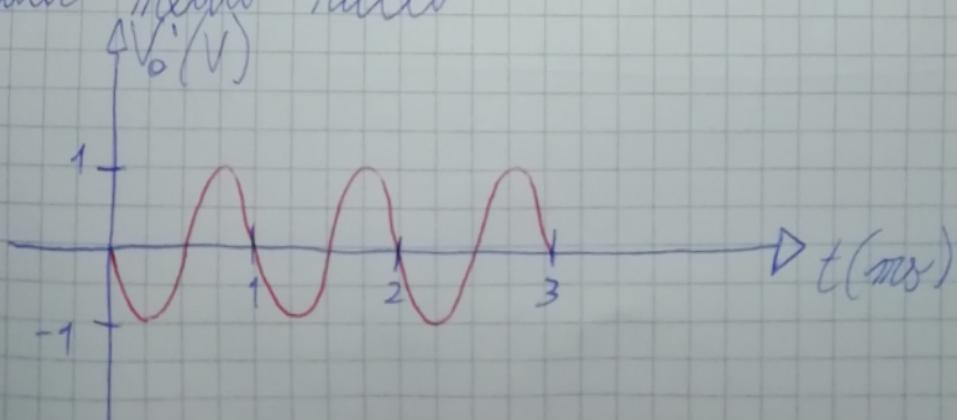
Annullo V_s , il risultato amplificato del segnale sarà un segnale sinusoidale con

$$f = 1 \text{ KHz}$$

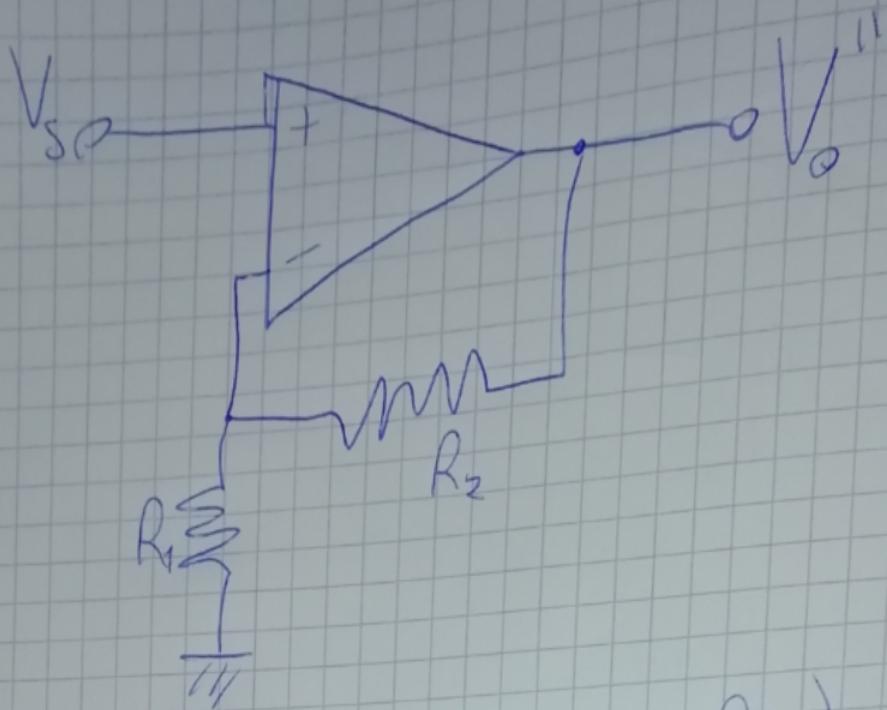
~~amplifica~~ ampiezza \mathcal{A} indicata con \mathcal{A}

$$\mathcal{A}_{out} = \mathcal{A} \left(-\frac{R_2}{R_1} \right) = 0,2 \cdot (-5) = -1V$$

valore medio nullo



Annullo V_{sig}



$$V_S = 12 \text{ V} \rightarrow V_{out} = V_S \left(1 + \frac{R_2}{R_1}\right) = 6 \text{ V}$$

$$V_S = 0 \text{ V} \rightarrow V_{out} = 0 \text{ V}$$

$V_{out}(V)$

grafico
totale

