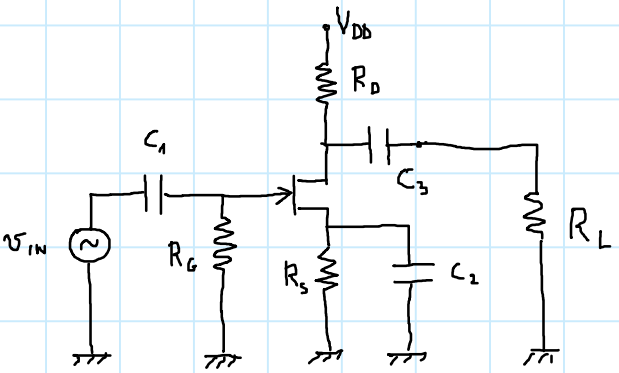
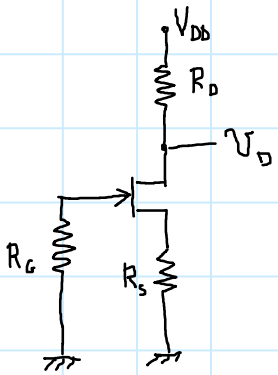
METODO ANALITICO

JFET 12



PER IL CIRCUITO STATICO



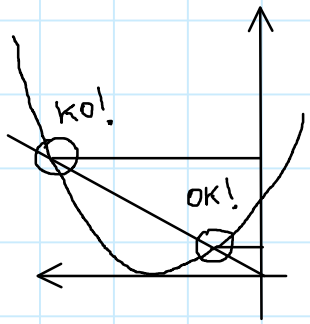
Posso scrivere: $I_D = I_{DSS}\left[1 - \frac{V_{GS}}{V_{GS\,OFF}}\right]^2$

$V_{GS} = -R_S I_D$

$I_D \overset{\sim}{=} I_{DSS}\left[1 + \frac{R_S I_D}{V_{GS\,OFF}}\right]^2$

$I_D = I_{DSS}\left[1 + 2\frac{R_S I_D}{V_{GS\,OFF}} + \frac{R_S^2 I_D^2}{V_{GS\,OFF}^2}\right]$

$\frac{R_S^2 I_{DSS}}{V_{GS\,OFF}^2} I_D^2 + \left(\frac{2 R_S I_{DSS}}{V_{GS\,OFF}} - 1\right) I_D + I_{DSS} = 0$



Ricavo solo 1 sol.: $I_{D1} = \frac{-b - \sqrt{\Delta}}{2a}$

Noto I_D ricavo V_D:

$V_D^S = V_{DD} - V_S = V_{DD} - R_S I_D$

PER IL CIRCUITO DINAMICO:

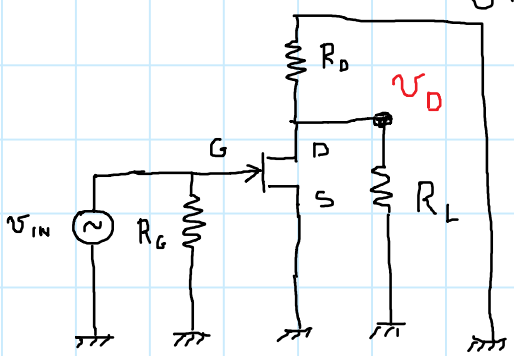
GUADAGNO DI TENSIONE

$A_V = \frac{v_{DS}}{v_{GS}}$

$g_{FS} = \frac{\Delta I_D}{\Delta V_{GS}} \Rightarrow g_{FS} = \frac{i_D}{v_{GS}} \rightarrow \begin{cases} v_{GS} = \frac{i_D}{g_{FS}} \\ v_D = -R_D i_D \end{cases}$

REGIME STATICO — REGIME DINAMICO

Quindi $A_V = \frac{-R_d \cancel{i_D}}{\cancel{i_D}/g_{fs}} = -R_d \cdot g_{fs}$ (*)



$v_{GS} = v_{IN}$

$v_D^d = v_{DS} = A_V \cdot v_{GS} \overset{(*)}{=} -R_D g_{FS} v_{IN}$

IN ASSENZA DI R_L

$= -R_D \| R_L \, g_{FS} \cdot v_{IN}$

CON CARICO.

$v_D = V_D^S + v_D^d$

JFET 13

Applicazione del metodo analitico al circuito già esaminato

$$\begin{cases} I_D = I_{DSS}\left[1 - \dfrac{V_{GS}}{V_{GS(OFF)}}\right]^2 & Parabola \\ I_D = -\dfrac{1}{R_S}V_{GS} & Retta \end{cases}$$

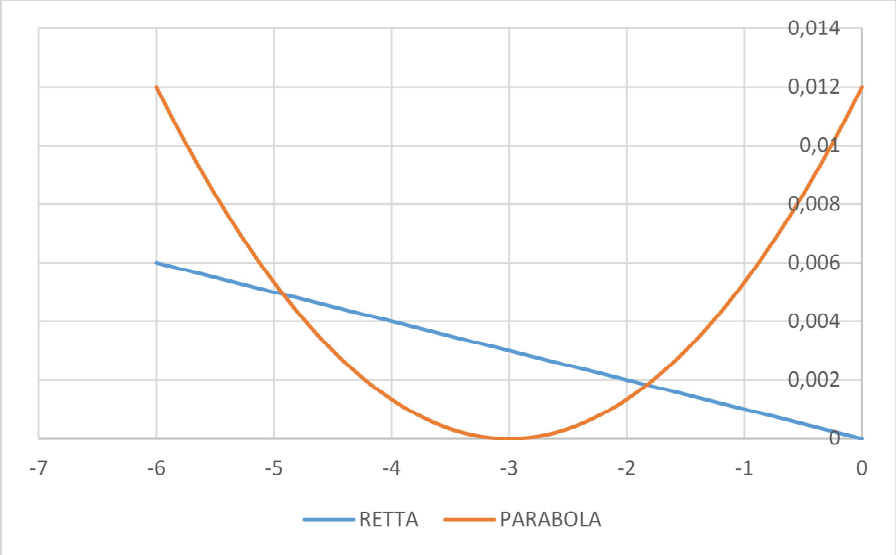
$$\underbrace{\frac{R_S^2 I_{DSS}}{V_{GS(OFF)}^2}}_{a} I_D^2 + \underbrace{\left(\frac{2R_S I_{DSS}}{V_{GS(OFF)}} - 1\right)}_{b} I_D + \underbrace{I_{DSS}}_{c} = 0$$

R_S =	1,00E+3
$V_{GS(OFF)}$ =	-3
I_{DSS} =	12,00E-3

a =	1,33E+3
b =	-9
c =	12,00E-3

I_{D1} =	~~4,92E-3~~
I_{D2} =	1,83E-3

$V_{GSQ} = -R_S I_{D2}$ =	-1,83
$V_{D(statico)} = V_{DD} - R_D I_{D2}$ =	7,98



Per il JFET 2N3819 g_{fso} = 5,5mS (DATA SHEET) → 7,8 (SIMULAZIONE)

$$g_{fs} = g_{fso}\left[1 - \frac{V_{GS}}{V_{GS(off)}}\right] = \underset{7,8\,m}{5,5m}\left[1 - \frac{-1,83}{-3}\right] = \underset{3,042\,m}{2,145mS}$$

$$v_D^d = -\frac{R_D R_L}{R_D + R_L} g_{fs} v_{IN} = -\frac{2,2k \cdot 10k}{12,2k} \cdot \underset{3,042\,m}{2,145m} \cdot v_i \cong \underset{-5,5}{-3,87} \cdot v_{IN}$$

$$v_D = V_D^s + v_D^d = 7,89 - 5,5 \cdot 100m\,\mathrm{sen}(\omega t) = 7,89 - 0,5\,\mathrm{sen}(\omega t)$$