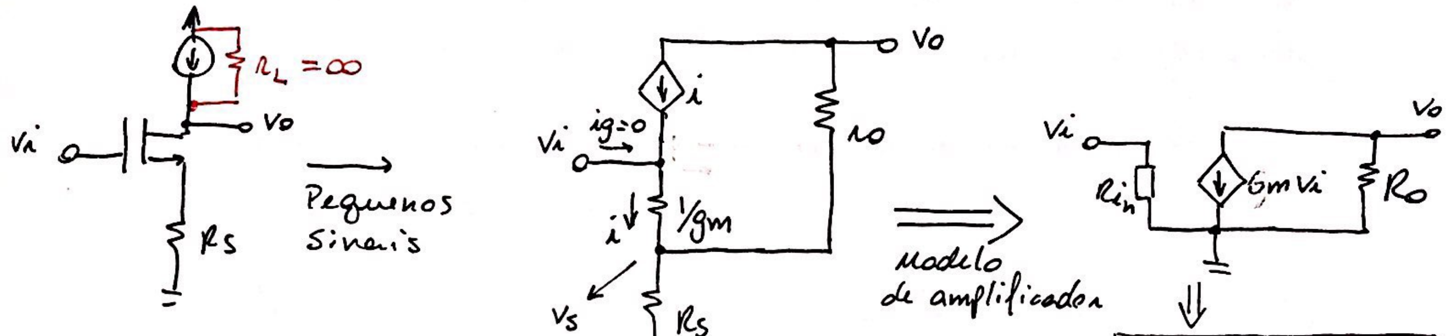
Nota de aula CEA

- **Análise Amplificador CS com R_S:**

① Modelagem amplificador de transcondutância:

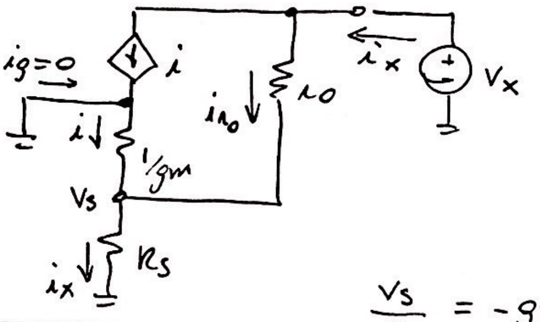


$$\boxed{V_o = -G_m R_o \cdot V_i}$$

- Como se trata de um Mosfet:

$$\boxed{R_{in} = \infty}$$

- R_o →



$$i_x = i + i_{ro}$$

$$i_x = V_s / R_s$$

$$i = -V_s / (1/g_m)$$

$$i_{ro} = \frac{V_x - V_s}{r_o}$$

$$\frac{V_s}{R_s} = -g_m V_s + \frac{V_x - V_s}{r_o}$$

$$\frac{V_x}{r_o} = V_s \left(\frac{1}{R_s} + \frac{1}{r_o} + g_m \right)$$

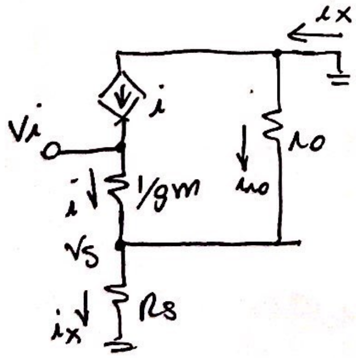
$$V_x = V_s \left(\frac{r_o + R_s + g_m R_s r_o}{R_s} \right)$$

$$\boxed{V_s = \left[\frac{R_s}{r_o + R_s + g_m r_o R_s} \right] \cdot V_x}$$

$$i_x = \frac{V_s}{R_s} = \frac{V_x}{r_o + R_s + g_m r_o R_s}$$

$$\boxed{R_o = \frac{V_x}{i_x} = r_o + R_s + g_m r_o R_s}$$ → se $g_m r_o \gg 1$ $$\boxed{R_o \triangleq r_o (1 + g_m R_s)}$$

- G_m → $i_x = i + i_{ro}$ → $i_x = V_s / R_s$; $i = \frac{V_i - V_s}{1/g_m}$; $i_{ro} = \frac{-V_s}{r_o}$



$$\frac{V_s}{R_s} = g_m (V_i - V_s) - \frac{V_s}{r_o} \Rightarrow V_s \left(\frac{1}{R_s} + \frac{1}{r_o} + g_m \right) = g_m V_i$$

$$V_s = \frac{g_m R_s r_o \cdot V_i}{R_s + r_o + g_m R_s r_o} \rightarrow i_x = \frac{V_s}{R_s} = \frac{g_m r_o \cdot V_i}{R_s + r_o + g_m R_s r_o}$$

$$\boxed{G_m = \frac{i_x}{V_i} = \frac{g_m r_o}{R_s + r_o + g_m R_s r_o}} \rightarrow \boxed{A_v = \frac{V_o}{V_i} = -G_m R_o = -g_m r_o}$$