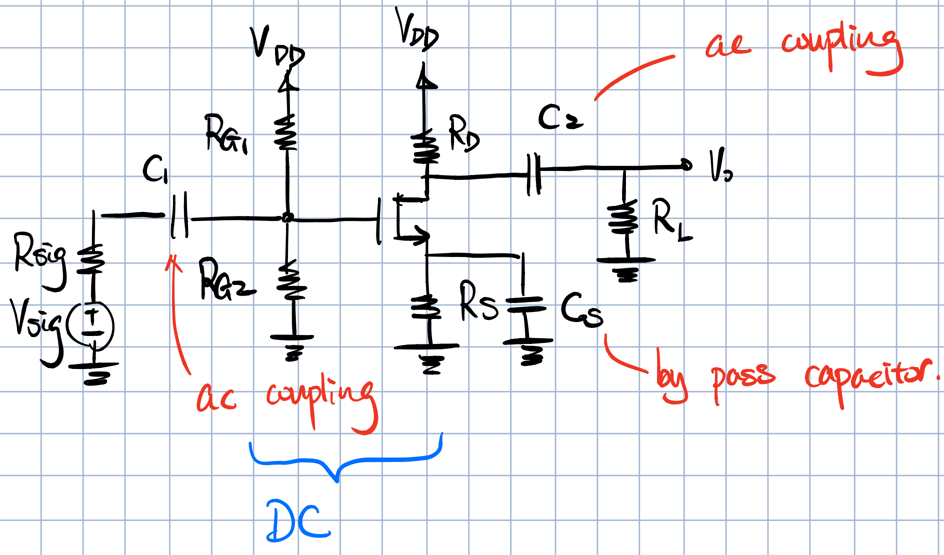
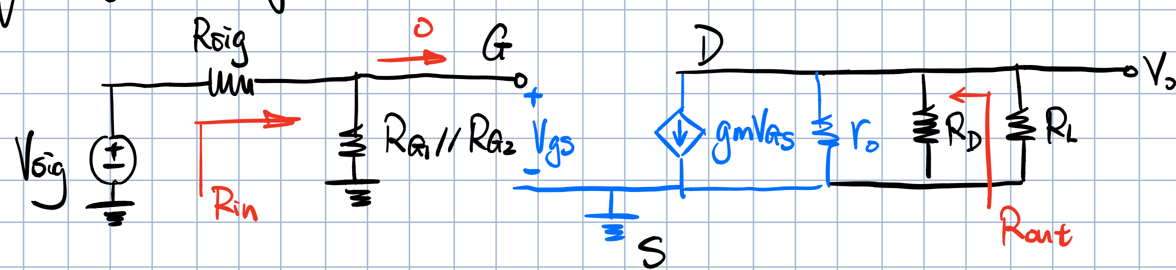
Discrete Amplifier. (CS/CE)



- for signal analysis

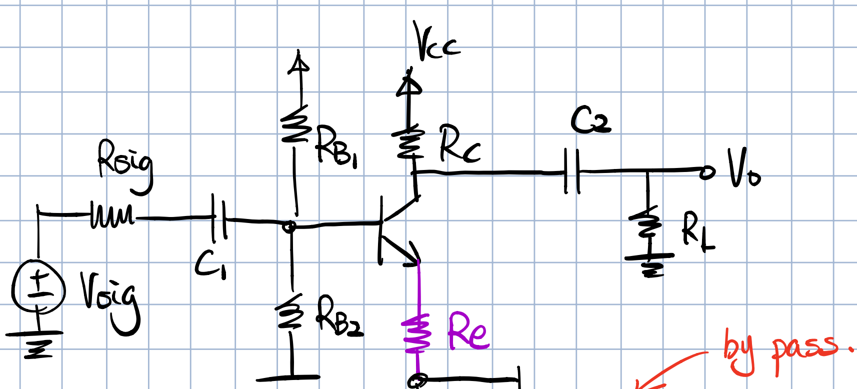


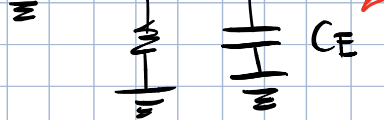
$R_{in} = R_{G_1} // R_{G_2}$ $\qquad$ $R_{out} = r_o // R_D$

$$V_{gs} = \frac{R_{G_1} // R_{G_2}}{R_{sig} + R_{G_1} // R_{G_2}} V_{sig} \qquad V_o = -g_m V_{gs} \, (r_o // R_D // R_L)$$

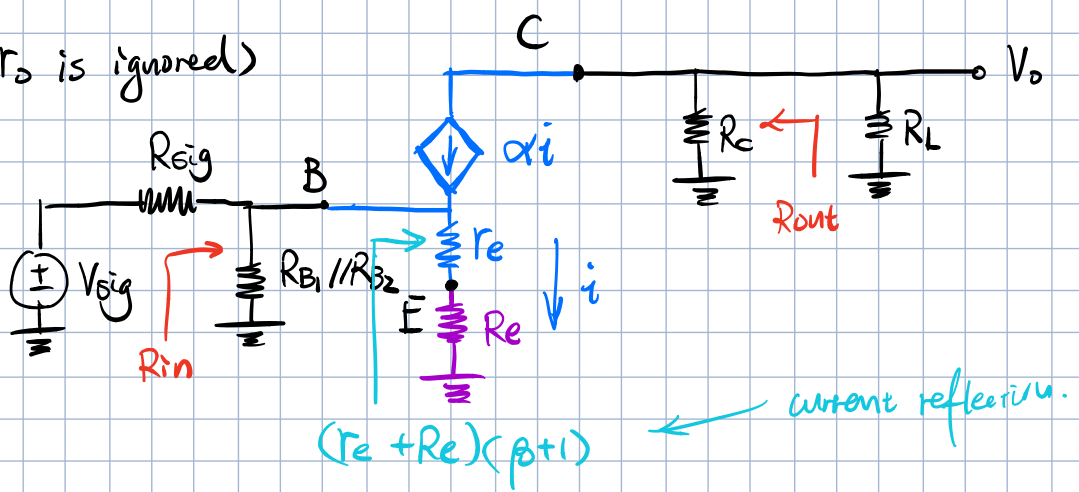
$$\boxed{\left| \text{voltage gain} \right| = \frac{V_o}{V_{sig}} = -\frac{R_{G_1} // R_{G_2}}{R_{sig} + R_{G_1} // R_{G_2}} g_m (r_o // R_D // R_L)}$$

CE with partial R_E (degenerator CE)





(r_o is ignored)



$$R_{in} = R_{B1}//R_{B2} // (r_e+R_e)(\beta+1)$$

$$R_{out} = R_C$$

$$V_o = -\alpha i (R_C // R_L)$$

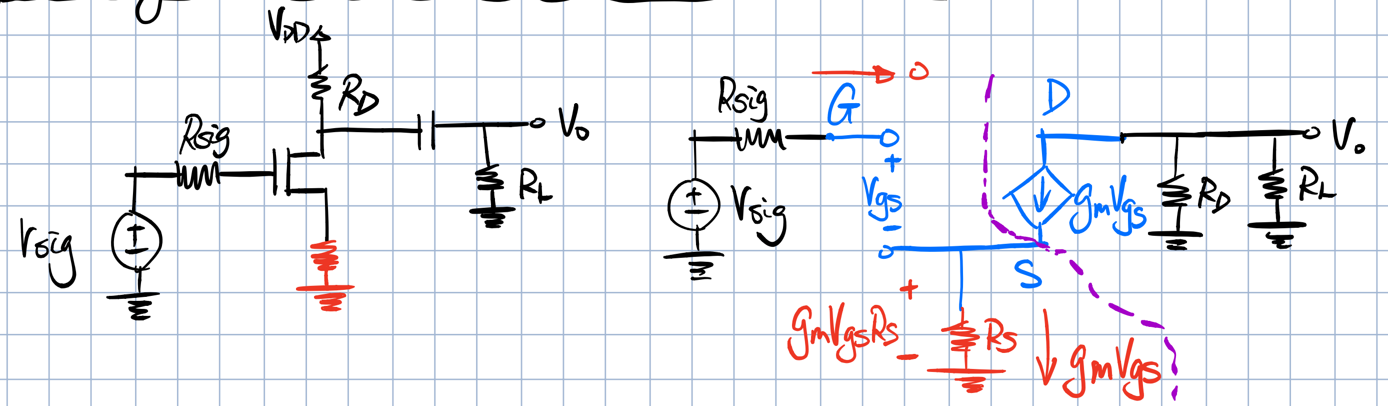
$$V_B = \frac{R_{in}}{R_{sig}+R_{in}} V_{sig}, \quad i = \frac{V_B}{r_e+R_e}$$

emitter resistance.

emitter current.

$$\text{voltage gain} = -\alpha \frac{R_{in}}{R_{sig}+R_{in}} \times \frac{R_C//R_L}{r_e+R_e}$$

with hybrid-π model, on CS with R_S



$$V_{sig} = V_G = V_{gs} + g_m V_{gs} R_S$$

$$V_{gs} = \frac{V_{sig}}{1+R_S g_m}$$

$$V_o = -g_m V_{gs} (R_D // R_L)$$

$$= -g_m (R_D // R_L) \frac{V_{sig}}{\quad}$$

$g_m (R_D // R_L)$ $\quad$ $1+R_S g_m$

$$\text{Voltage gain} = \frac{V_o}{V_{sig}} = \frac{-g_m (R_D // R_L)}{1 + R_S g_m}$$