Small Signal Analysis

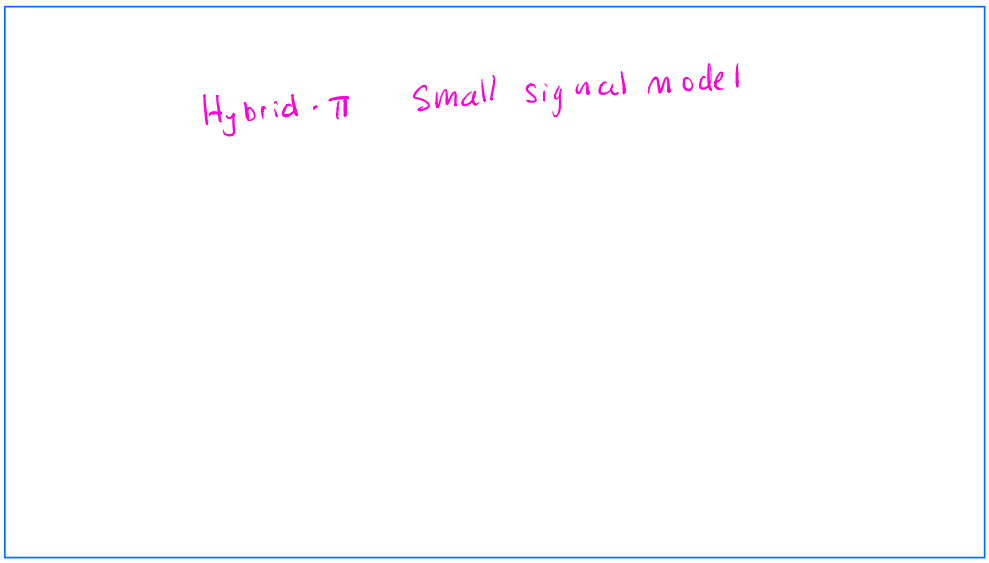
$$i_D = k'_n \frac{W}{L}\left[v_{gs}\left(V_{GSQ} - V_t\right)\right]$$

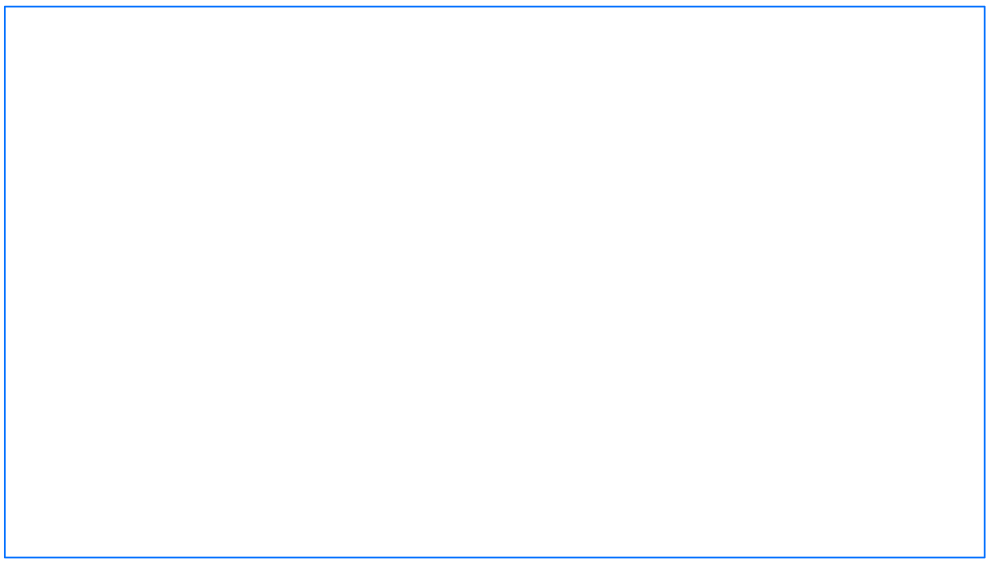
now v_{GS} and i_D are linearly related due to small signal.

$g_m \equiv$ mosfet transconductance

$A_V = -g_m R_D$

Hybrid-π small signal model

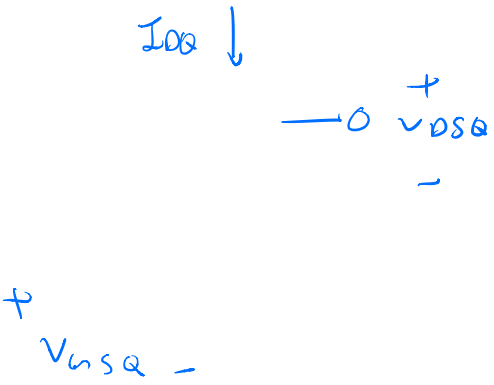




Example

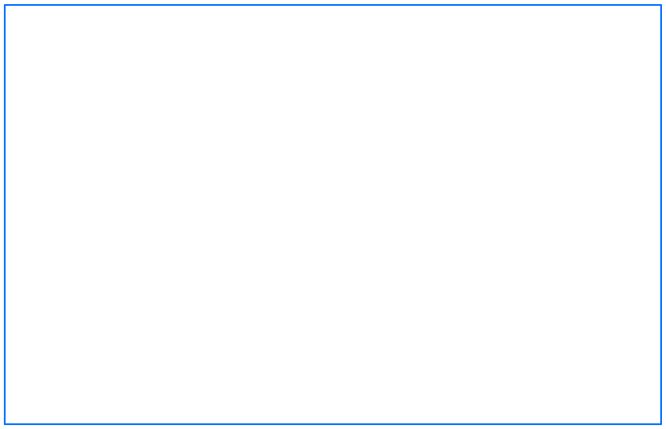
① DC operating First

Find I_{DQ}; V_{DSQ}; V_{GSQ}



② Small Signal analysis

- At AC, DC voltage supply → Ground.
- Capacitors will look like shorts.



$R_G = 10M\Omega$ $R_D = 10K\Omega$

G

S

D

$R_L = 10K\Omega$

$R_o \parallel R_D \parallel R_L$

$(47.2 \parallel 10 \parallel 10)$

$R_{eq} = 4.52 k\Omega$

$A_v = -3.3 v$

Finding input resistance

i_i →

V_o

④ max swing.

↑ v_o ↑ v_i

largest input signal and keep in saturation w/o distorting output.

$$V_i = \frac{V_t}{1 + |A_V|}$$