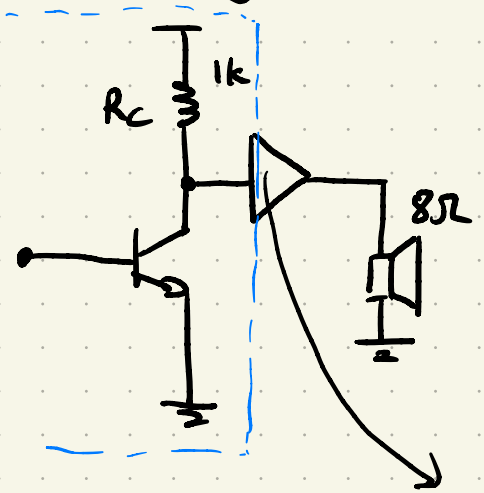
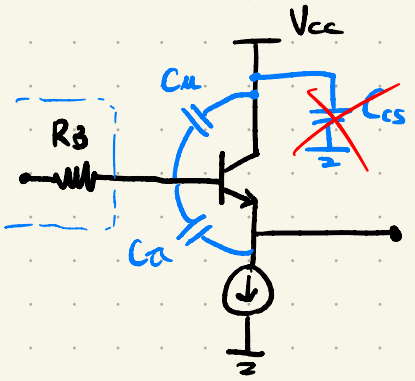
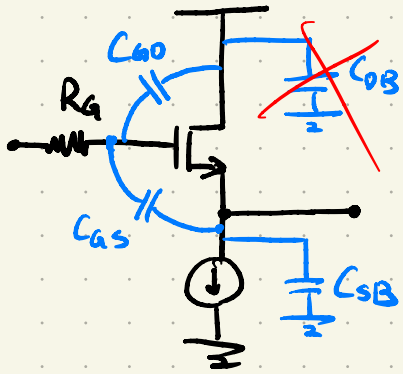
Lec 24

- Frequency Response of Followers
- Input and Output Impedances of Followers

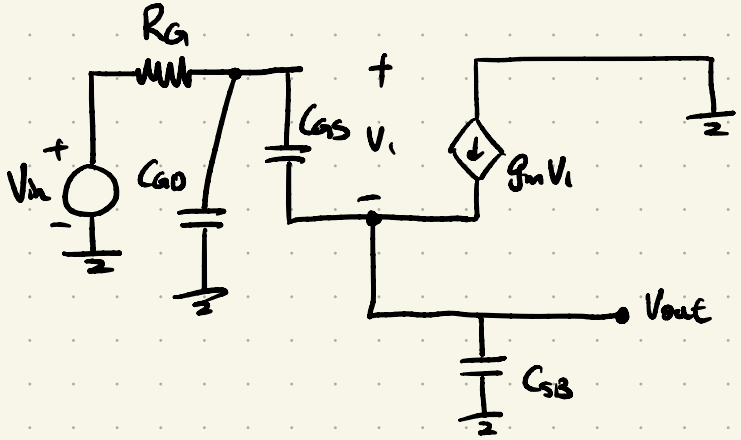
- Frequency Response of Followers







Let's find transfer function:



KCL @ gate:

$$\frac{V_{in} - (V_1 + V_{out})}{R_G} = (V_1 + V_{out}) C_{GD} s + V_1 C_{GS} s$$

KCL @ output:

$$V_1 C_{GS} s + g_m V_1 = V_{out} C_{SB} s$$

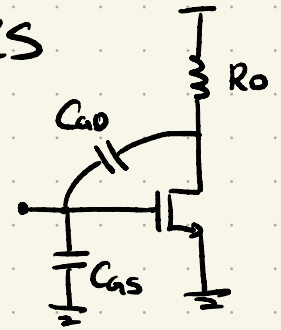
$$\frac{V_{out}}{V_{in}}(s) = H(s)$$

$$= \frac{1}{(C_{GD}C_{GS} + C_{GD}C_{SB} + C_{GS}C_{SB})\frac{R_G}{g_m} s^2 + \left[R_S C_\mu + \frac{C_{GS}}{g_m} + \frac{C_{SB}}{g_m}\right] s + 1}$$

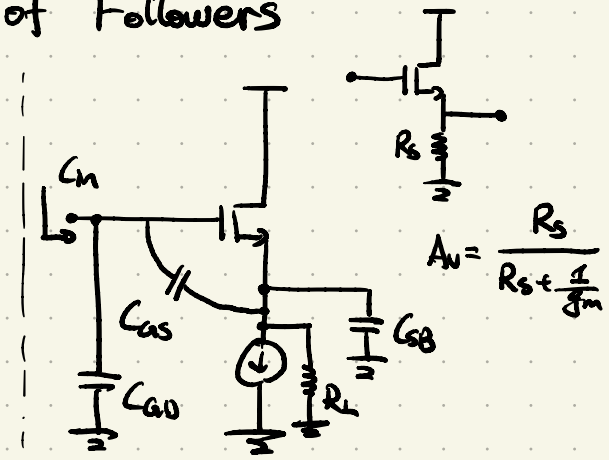
(Inspection Analysis is not accurate for followers)

- Input Capacitance of Followers

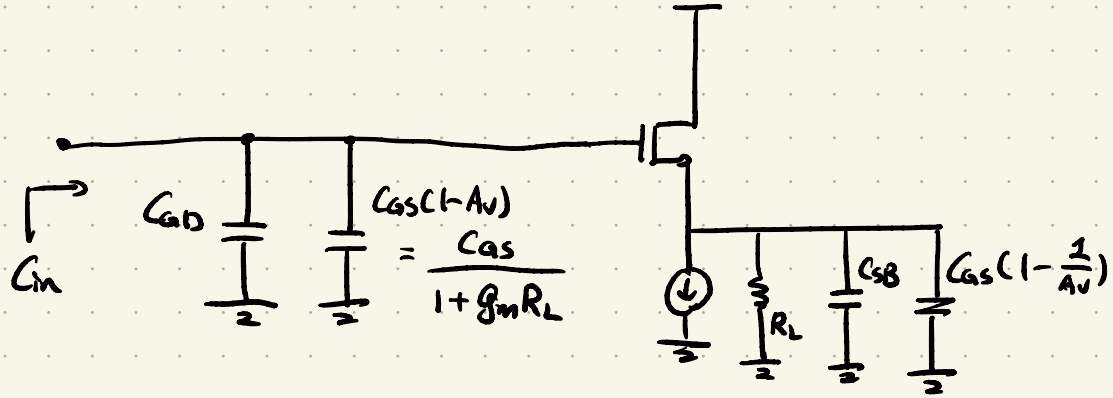
CS



$C_{in} = C_{GS} + C(1+g_m R_D) C_{GD}$

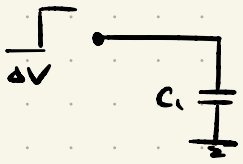


$A_V = \dfrac{R_S}{R_S + \frac{1}{g_m}}$

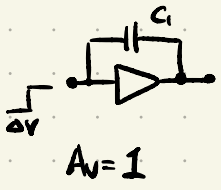


$C_{in} = C_{GD} + \dfrac{C_{GS}}{1+g_m R_L}$

Example Intuitively explain why the input capacitance of the source follower is less than C_{GS}.



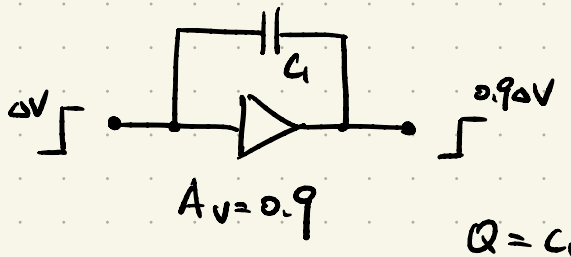
$Q = C_1 \Delta V$



$A_V = 1$

$Q = 0$

C_1 is "boot strapped"

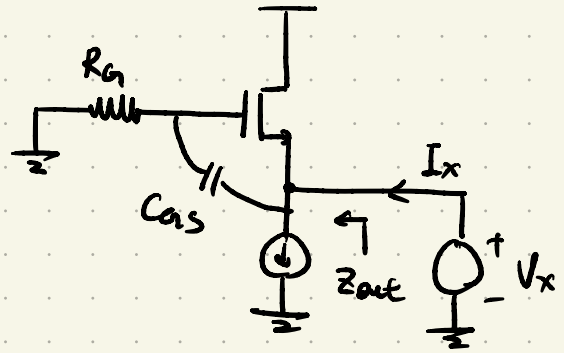


$A_V = 0.9$

$Q = C_1 \cdot 0.1\Delta V$

$C_{in} = 0.1\, C_{in}$

• Output Imp. of Followers:



$\dfrac{V_x}{I_x} = \dfrac{1 + g_m R_G s}{C_{GS} s + g_m}$