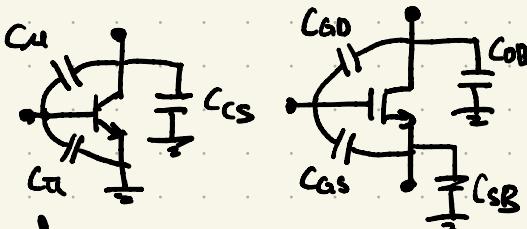


Lec 21.

- General Procedures for Computation of Freq. Response
- Frequency Response of CE / CS stage

Review

- ① Caps of Transistors



- ② some caps can be merged

- ③ some caps experience miller effect

- General Procedure for Freq. Resp. Computation

- ① Draw the circuit

- ② Draw all of the device capacitances

- ③ Remove or merge capacitors

- ④ Compute the transfer function: $H(s)$

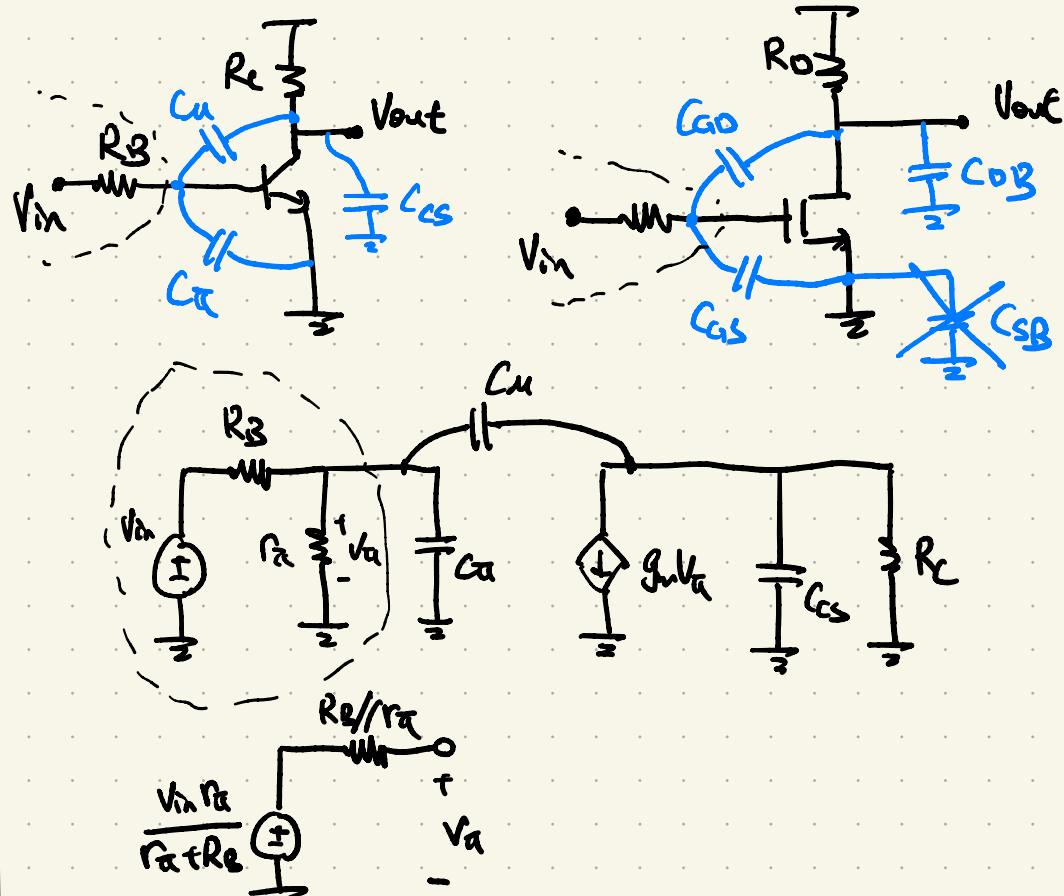
- ⑤ $|H(s=j\omega)| \Rightarrow$ plot

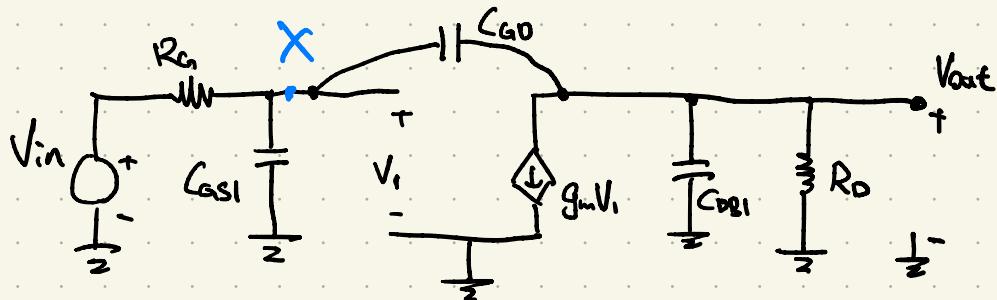
Instead: Find poles
by inspection

Preview of our Analysis

CE/CS	CB/CG	Follower	Cascade	Diff. Pair

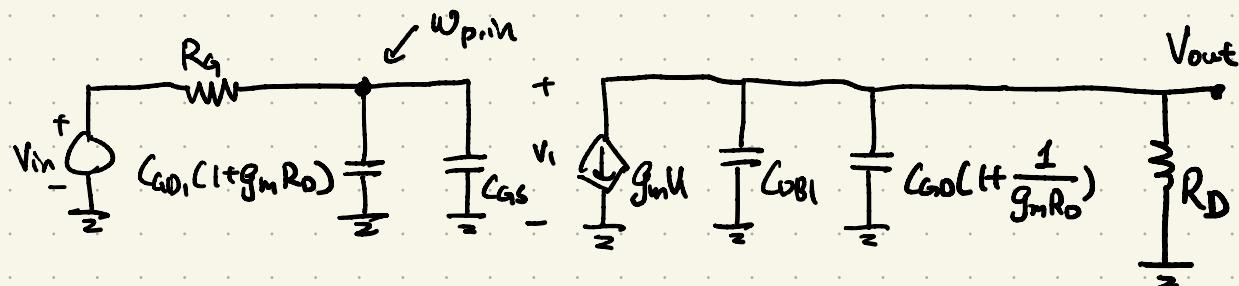
CE / CS Stage Freq. Response





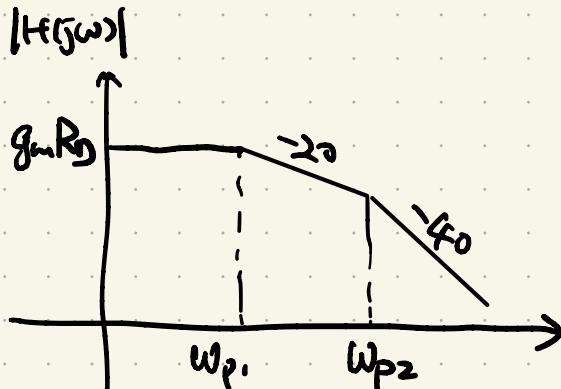
Approach I: finding the poles by inspection

Apply Miller's Theorem to C_{GD1} :



$$w_{p,in} = \frac{1}{R_g [C_{GD1}(1+g_m R_d) + C_{GS}]} \quad \text{at } V_d = 0$$

$$w_{p,out} = \frac{1}{R_d [C_{BS1} + C_{GD1} \cdot C(1 + \frac{1}{g_m w_0})]} \quad \text{at } V_d = V_{out}$$



Approach II: Exact Analysis

KCL @ Output:

$$\frac{V_{out}}{R_d} + V_{out} C_{BS1} s + g_m V_i + (V_{out} - V_i) C_{GD1} s = 0$$

$$\text{KCL @ } X: \frac{V_{in} - V_i}{R_g} = (V_i - V_{out}) C_{GD1} s + V_i C_{GS} s$$

$$\text{zero: } w_2 = \frac{g_m}{C_{GD1}}$$

↓ very high freq

⇒ typically unimportant

$$(C_{GS} s - g_m) R_d$$

$$[C_{GS} C_{GD1} + C_{GS} C_{BS1} + C_{GD1} C_{BS1}] R_d R_o s^2 + [(C_{GD1}(1+g_m R_d) + C_{GS}) R_g + R_o (C_{BS1} + C_{GD1})] s + 1$$

"Dominant Pole" Approximation:

$$w_{p1} \ll w_{p2}$$