IIT ROORKEE

NPTEL ONLINE CERTIFICATION COURSE

Microelectronics: Devices to Circuits

Frequency Response of CC and SF Configuration

SUDEB DASGUPTA

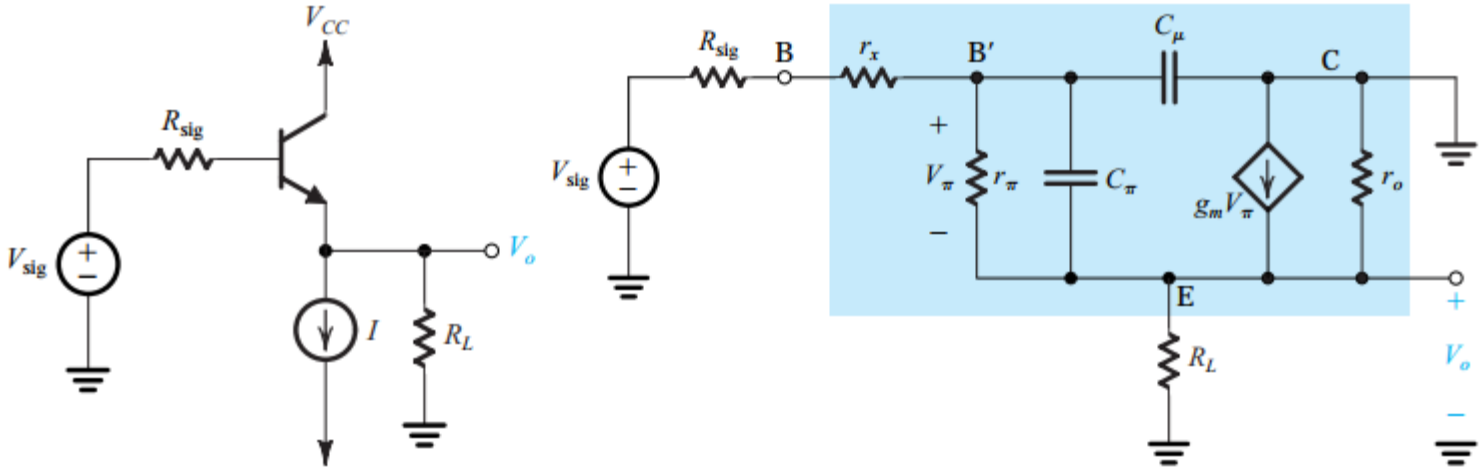
DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING



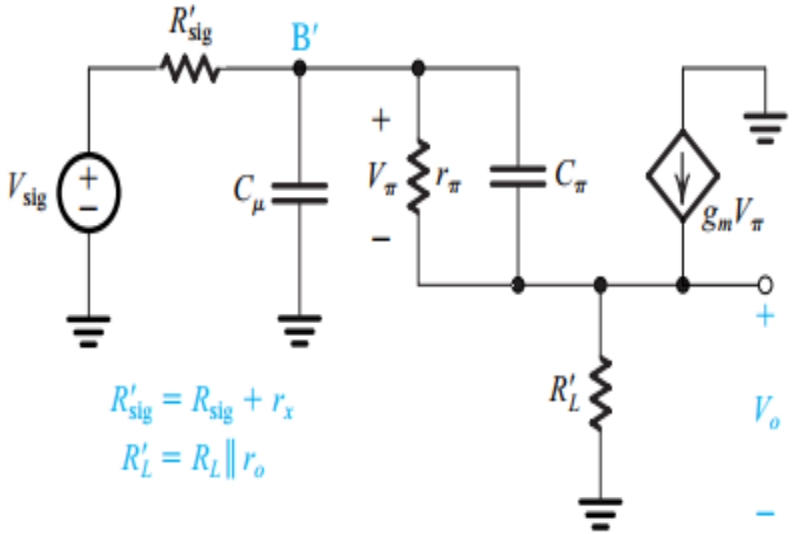
Outline

- High Frequency response of CC (Emitter Follower)
- High Frequency of Source Follower
- Recapitulation

High Frequency response of CC (Emitter Follower)



Source: Microelectronics Circuits, Sedra and Smith, Fifth edition



$$g_m V_\pi + \frac{V_\pi}{r_\pi} + S_Z C_\pi V_\pi = 0$$

$$w_Z = \frac{1}{C_\pi r_e} \qquad S_Z = -\frac{g_m + \left(\frac{1}{r_\pi}\right)}{C_\pi} = -\frac{1}{C_\pi r_e}$$

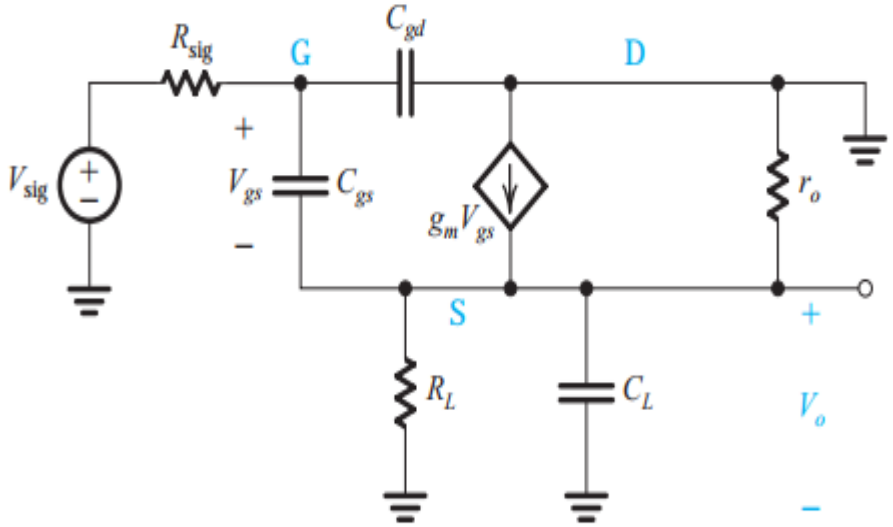
$$R_\pi = \frac{R'_{sig} + R'_L}{1 + \frac{R'_{sig}}{r_\pi} + \frac{R'_L}{r_e}}$$

$$f_H = \frac{1}{2\pi\left(C_\mu R_\mu + C_\pi R_\pi\right)}$$

$$R_\mu = R'_{sig} \| \left[r_\pi + (\beta + 1) R'_L\right]$$

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

High Frequency of Source Follower



$$A_M = \frac{(R_L \parallel r_0)}{(R_L \parallel r_0) + \left(\frac{1}{g_m}\right)}$$

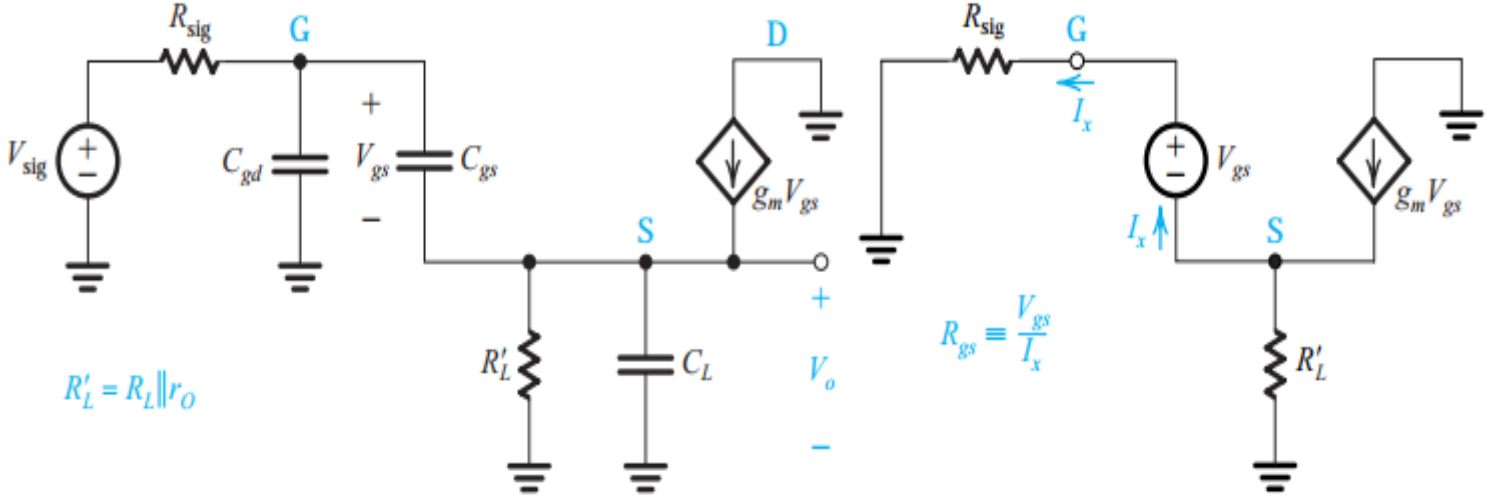
$$S_Z = -\frac{g_m}{C_{gs}}$$

$$R_0 = \left(\frac{1}{g_m} \parallel r_0\right)$$

$$f_H = \frac{1}{2\pi\left(C_{gd}R_{sig} + C_{gs}R_{gs} + C_L R_{C_L}\right)}$$

$$R_{gd} = R_{sig} \qquad R_{gs} = \frac{R_{sig} + R_L'}{1 + g_m R_L'} \qquad R_{C_L} = R_L \parallel r_0 \parallel \frac{1}{g_m}$$

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition



Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

Recapitulation

- The CC and SF ,Both have voltage gain that is less than but close to unity.
- The advantage of CC and SF is their high input resistance and low output resistance.
- CC and SF used as the output stage of a multistage amplifier.
- The emitter follower is a wide-bandwidth circuit.

Source: Microelectronics Circuits, Sedra and Smith, Fifth edition

Thank You