Lecture 25

• Last time:
  – Two-port small-signal models of amplifiers

• Today:
  – Finish methods for finding two-port model parameters
  – Start common-source amplifier

Finding the Voltage Gain $A_v$

Key idea: the output port is open-circuited and the source resistance is shorted

\[
A_v = \frac{v_{out}}{v_{in}} \quad R_L = 0, \quad R_z \to \infty
\]
Finding the Current Gain $A_i$

Key idea: the output port is shorted and the source resistance is removed

$$A_i = \frac{i_{out}}{i_{in}} \quad R_s \to \infty, \, R_L = 0$$

Finding the Transresistance $R_m$

$$R_m = \frac{v_{out}}{i_{in}} \quad R_s \to \infty, \, R_L \to \infty$$
Finding the Transconductance $G_m$

$$G_m = \frac{\left. i_{out}\right|_{v_{in}}}{v_{in}} \bigg|_{R_S = 0, R_L = 0}$$

First Example: the Common-Source Amplifier (again)

What about the load resistor?
DC Bias

Load line analysis:

Load-Line Analysis to find $Q$

![Graph showing load-line analysis](image)
DC Transfer Function

Small-Signal Analysis
Two-Port Parameters:

Find $R_{in}$, $R_{out}$, $G_m$