Prob. 1

This circuit is most closely approximated by a series voltage configuration. The feedback network is:

\[ \begin{align*}
    & V_1 + \frac{I_2}{47k2} - V_2 \\
    & V_1 \quad = \quad 100m2 \\
    & I_1 - \quad - I_2
\end{align*} \]

For this configuration we use h parameters.

So, \( f = h_{12} = \frac{V_i}{V_e} \bigg|_{I_1=0} = \frac{100}{47000} = \frac{1}{470} \)

f relates a feedback voltage \( V_{fb} \) to \( V_{out} \). (\( V_{col} \))

Prob. 2

This circuit is most closely approximated by a parallel voltage configuration. The feedback network is:

\[ \begin{align*}
    & V_1 + \frac{I_2}{100k2} - V_2 \\
    & V_1 \quad = \quad 100m2 \\
    & I_1 - \quad - I_2
\end{align*} \]

For this configuration we use y parameters.

So, \( f = y_{12} = \frac{I_1}{V_e} \bigg|_{V_1=0} = -1 \quad \text{100k} \)

The small signal model is:
The small-signal model looks like:

Represent in terms of parameters:

\[ Y_{11} = \frac{I_1}{V_1} \bigg|_{V_2 = 0} = \frac{1}{9.7k} \]

\[ Y_{22} = \frac{I_2}{V_2} \bigg|_{V_1 = 0} = \frac{1}{13.2k} \]

\[ Y_{12} = \frac{I_1}{V_2} \bigg|_{V_1 = 0} = \frac{1}{(13.2k)(10k)(19.7k)} = -0.0515 \times 10^{-3} \]

To find 'a' we use the circuit:

\[ a = \frac{V_o}{I_S} = -(75.7)(0.2)(851) = -12.880 \times 10^{-3} \]

\[ Z_{in} = 75.7 \Omega \]

\[ Z_{out} = 930 \Omega \]

\[ Z_{in} = \frac{Z_{in}}{1 + a} = \frac{75.7}{1.064} = 45.5 \Omega \]

\[ Z_{out} = \frac{Z_{out}}{1 + a} = \frac{930}{1.064} = 879 \Omega \]
Prob. 4

a) According to the plot, the amplifier is unstable and has a phase margin of \( \phi = -202.5 + 180 = -22.5^\circ \).

b) The pole frequency \((10^3)\) should be lowered to about 20 rps to achieve a phase margin of \(+45^\circ\) (as shown in the plot).

Prob. 5

[Graph of a waveform with labeled axes and time]