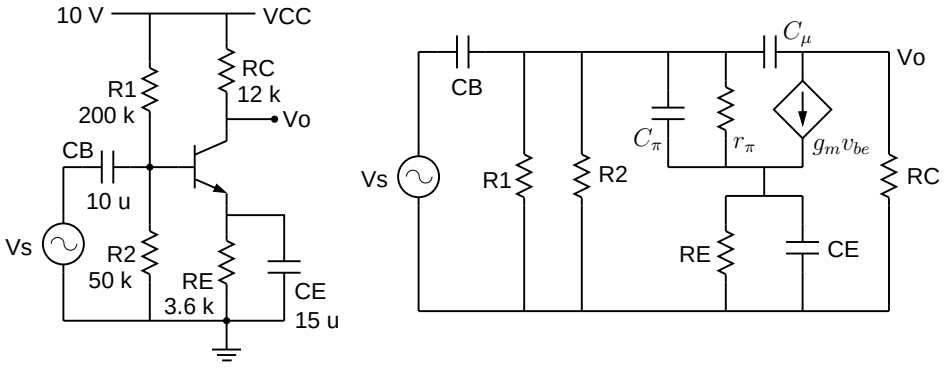
bjt_ce_amp.sqproj

Description



Shown in the figure is a common-emitter amplifier and its small-signal equivalent circuit. The midband gain of the circuit is given by $A_V = -g_m R_C$. The capacitors C_B and C_E influence the low cut-off frequency f_L whereas the device capacitances C_π and C_μ influence the high cut-off frequency f_H.

Exercise Set

1. For the given component values, calculate the bias current I_C and the midband gain A_V. Verify with simulation results.

2. Change C_B from $10\,\mu F$ to $20\,\mu F$, and observe its effect on f_L.

3. Change C_E from $15\,\mu F$ to $30\,\mu F$, and observe its effect on f_L.

4. The capacitance C_μ is directly proportional to the BJT parameter `cjc` (collector junction capacitance at zero bias) [1]. Increase the value of `cjc` by a factor of 2, and observe its effect on f_H.

5. Perform transient simulation with a $1\,\mathrm{m}V$ sinusoidal input with $f = 1\,\mathrm{kHz}$ and observe the output voltage. Verify that the gain matches with that obtained by AC simulation. Repeat for $f = 100\,\mathrm{Hz}$.

6. If only a part of R_E (say, $3\,\mathrm{k}$ out of $3.6\,\mathrm{k}$) is bypassed, how will it affect I_C and A_V? Verify with simulation.

References:

1. P. Antognetti and G. Massabrio, *Semiconductor device modeling with SPICE,* McGraw-Hill: New York, 1988.