ENEE 307: Lab 4 Upgrades, Fall 2022

Common Emitter Amplifier Frequency Analysis Using CoolSPICE

1) Input the NPN CE Amp in Figure 4.11 from the lab manual using the schematics editor in CoolSPICE. Use the following component values: R1=9k, R2=1k, Rs=1k, Rc=10k, Re=1k, RL=1MEG, C1=0.1uF, C2=0.1uF, Ce=10uF, Vcc=15V, Vs=0.01Vac.

Click on the BJT so that the BJT window opens and then click on the 'Show Model' button. Find the entry:

.model 2N3904

In the file that opens, copy the values for Bf (that's beta), Cjc (that's Cμ) and Cje (that's Cπ), what values do you have for these parameters?

a) By hand, calculate the DC bias conditions for this circuit, (Ic, Ie, Vc, Vb, Ve, gm).

b) Calculate the midband small signal voltage gain of this circuit (Am). (Careful, Re is shorted by Ce at midband.)

c) Using the SCTCA approximate the low frequency pole of this circuit.

d) Using the OCTCA approximate the high frequency pole of this circuit.

e) Sketch the magnitude of the small signal voltage gain versus frequency using a Bode plot.

2) CoolSPICE

a) Run the circuit on CoolSPICE using the AC Run analysis method. Also, make sure that the input voltage (Vs) is taken from the SourceV – DC AC in the Analog Library in CoolSPICE.

b) Make sure you use a large enough frequency range that you see a typical amplifier gain curve like in Fig. 4.1 of the lab manual.

c) Plot the output versus frequency on both a dB scale and a linear scale for they Voltage (y) axis. For the frequency (x-axis) use a log scale, typically ranging from 100Hz to 100MHz.

d) How does the SPICE solution differ from your analytical approximations?