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EEE412 Lab #2 Preliminary Work

"I completed this homework assignment independently."

Question #1

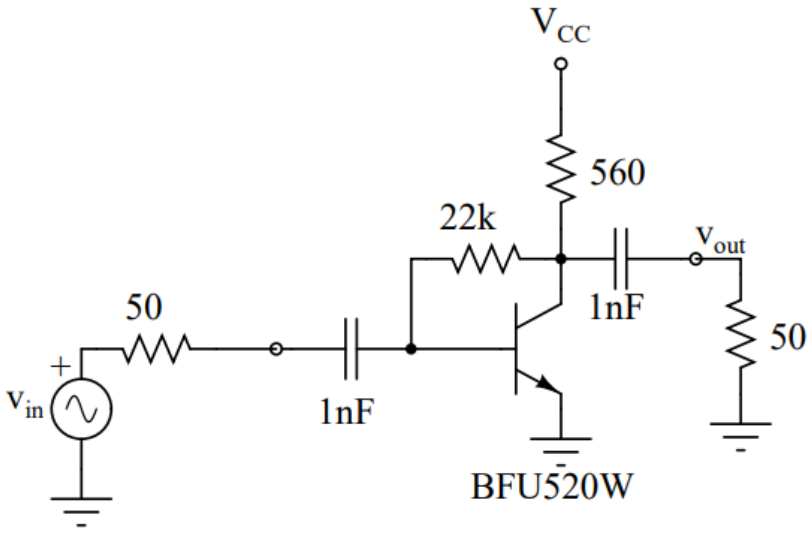

Fig. 1: Amplifier circuit

In this question, three variables are present, frequency (fr), voltage source (Vcc), and input power level (pin) in dBm. The frequency is determined to be 100MHz. A voltage sweep is done from 5V to 12V with 0.1V steps. Fig. 1 is the amplifier circuit that is given to be created in the ADS. Fig. 2 shows the designed amplifier circuit in ADS.

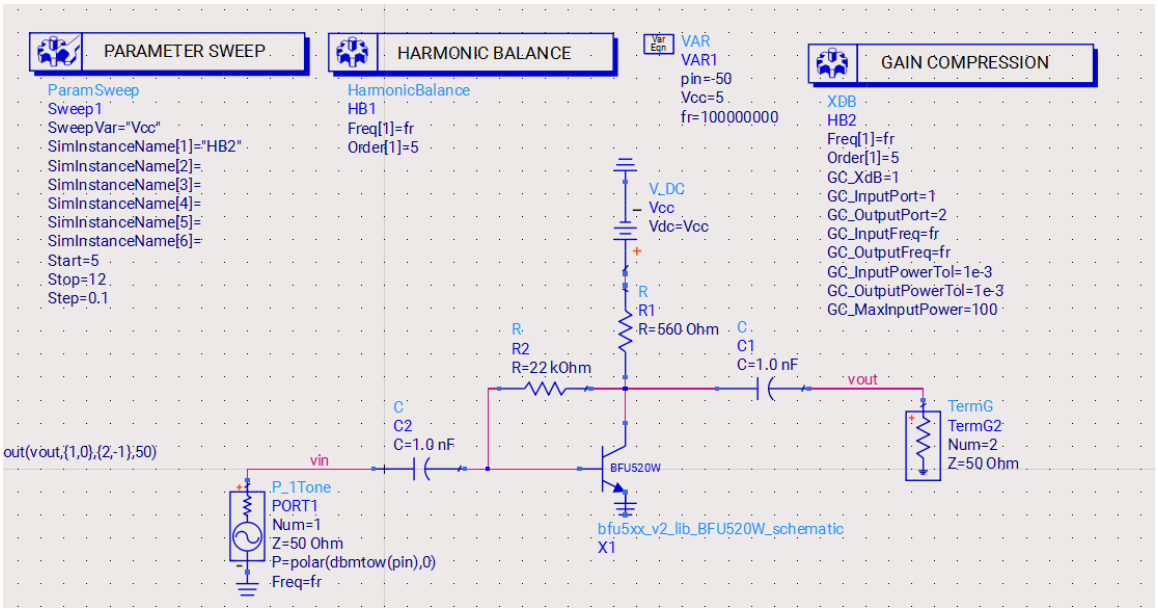

Fig. 2: Designed circuit in ADS

1dB compression point is plotted with respect to changing Vcc values. Fig. 3 shows the corresponding plot. It starts at -4.050dbM with Vcc = 5V and ends at 4.601dbM with Vcc = 12V.

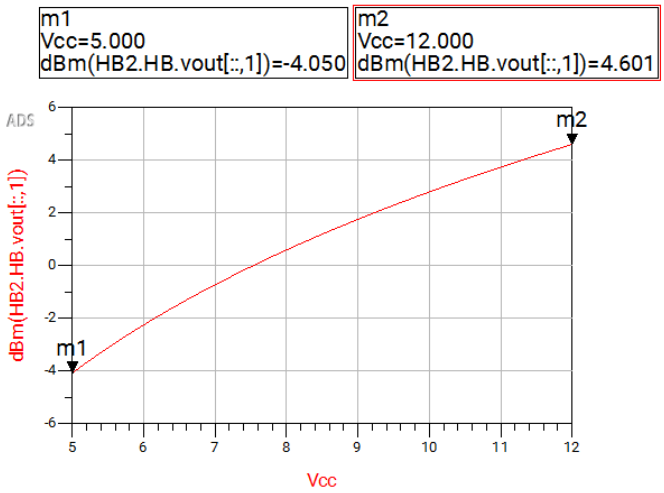

Fig. 3: P1dB vs Vcc plot

P_{1dB} can also be plotted with time domain waveforms of the output voltage with respect to changing Vcc values. Fig. 4 shows the related plot.

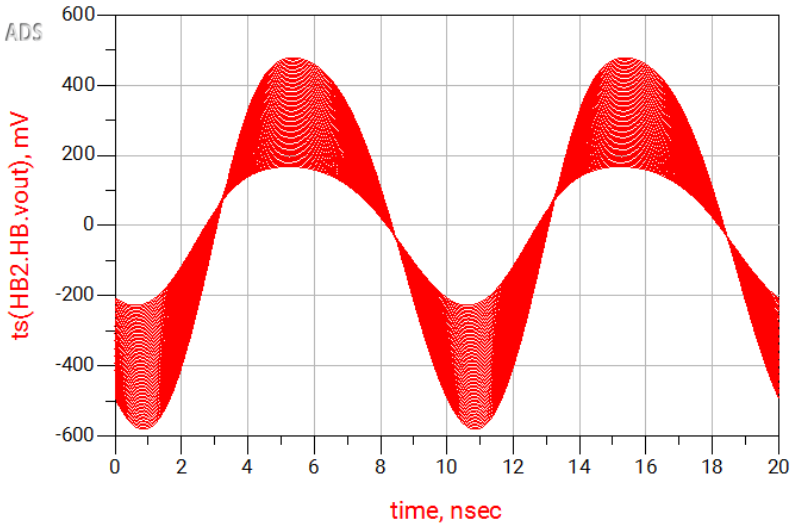

Fig. 4: Time-domain waveforms of the output voltage at the P_{1dB} point for changing Vcc values

Question #2

In this part, OIP3 value of the circuit is observed with different input power levels in dBm. As mentioned, the chosen frequency value is 100MHz. The input DC voltage is chosen to be 6V. The input power levels start from -50dBm and ends at -10dBm. For the OIP3, two different cases are analyzed, $2f_1$-f_2 and $2f_2$-$2f_1$. To have two sine waves at the input, the input excitation is changed to P_ntone. The first sine wave has a frequency of 100MHz, and the second sine wave has a frequency of 101MHz. The new version of the amplifier circuit is demonstrated in Fig. 5.

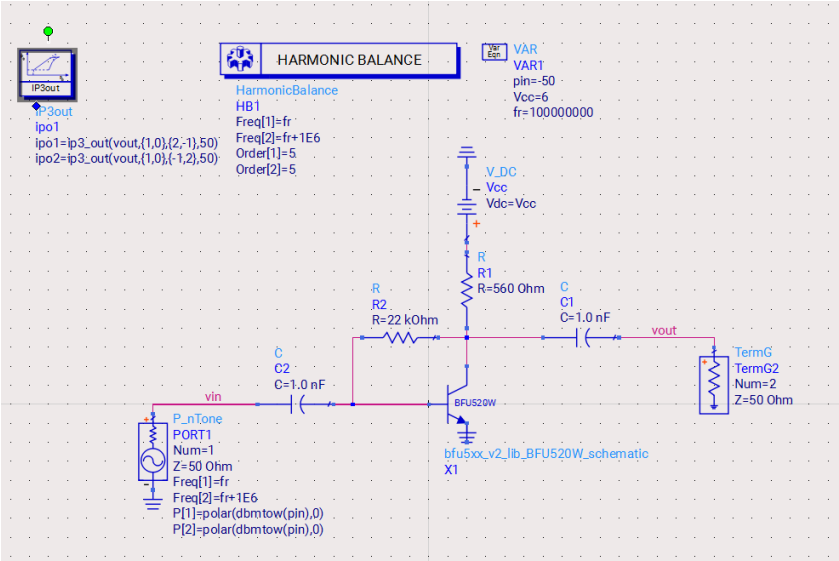

Fig. 5: Amplifier circuit to measure OIP3

The figure below shows both ipo1 ($2f_1$-f_2) and ipo2 ($2f_2$-f_1) with respect to changing pin (-50dBm to -10dBm) values.

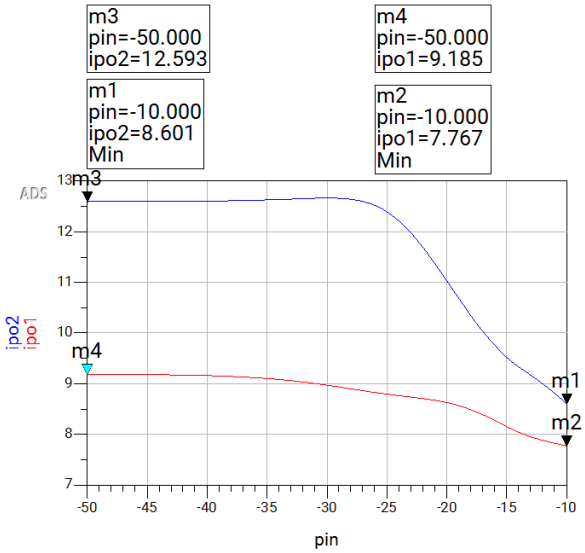

Fig. 6: OIP3 values versus different input signal power levels

As seen from Fig. 6, red curve demonstrates $2f_1$-f_2 and blue curve demonstrates $2f_2$-f_1. From -50dBm to -30dBm, OIP3 value nearly remains constant, but further increasing the pin value, amplifier starts to saturate, the gain drops and distortion increases.