Pre-Lab 9:
BJT Amplifier Design

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Calculation

$V_{RE} = 1.2V$, $\hat{V}_o = 1.2V$, $R_L = 100$, $A_V = 20$, $\beta = 200$, $N = 20$, $R_i = 1.2k\Omega$

$5 - 1.2 - 1.2 - 0.3 \geq V_{RC} \geq 1.2 \Rightarrow V_{RC} = \boxed{2.3V}$

$\frac{2.3 - 0.7 - 1.2}{R_H} \geq \frac{1.2}{100} \Rightarrow 33.33 \geq R_H \Rightarrow \boxed{R_H = 33.33\Omega}$

$I_{C2} = \frac{2.3 - 0.7}{33.33} = 0.048 = 48mA$

$\frac{20 - 0.048}{200} \leq I_{c1} \leq \frac{200}{1.2k} \frac{1}{\frac{20}{1.2+0.7} + \frac{20}{5-1.2-0.7} + \frac{20}{2.3}} \Rightarrow 4.8mA \leq I_{C1} \leq 6.49mA$

$I_{C1} = 5mA$

$R_C = \frac{2.3}{5mA} = \boxed{460\Omega}$ $R_E = \frac{1.2}{5mA} = \boxed{240\Omega}$ $r_{e1} = \frac{V_T}{I_E} = \frac{0.025 \cdot 240}{1.2} = 5$

$R_G = \frac{460}{20} - 5 = 23 - 5 = \boxed{18\Omega}$

$R_{B1} = \frac{200(5 - 1.2 - 0.7)}{20 \cdot 5m} = \boxed{6.2k\Omega}$ $R_{B2} = \frac{200(5 + 0.7)}{20 \cdot 5m} = \boxed{11.4k\Omega}$

$A_{V2} = \frac{33.3 \| 100}{5 + (33.3 \| 100)} = 0.833$

$R_{i2} = (200 + 1)(5 + (33.3 \| 100)) = 6.029k\Omega$

Simulation

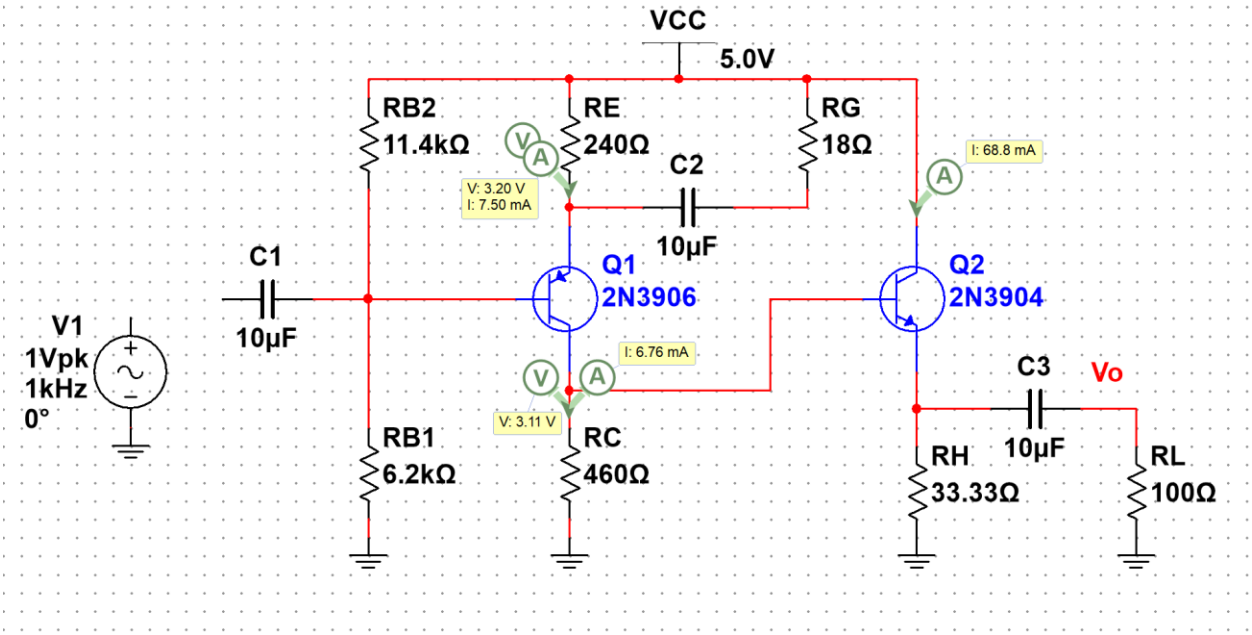

Figure 1: DC solutions

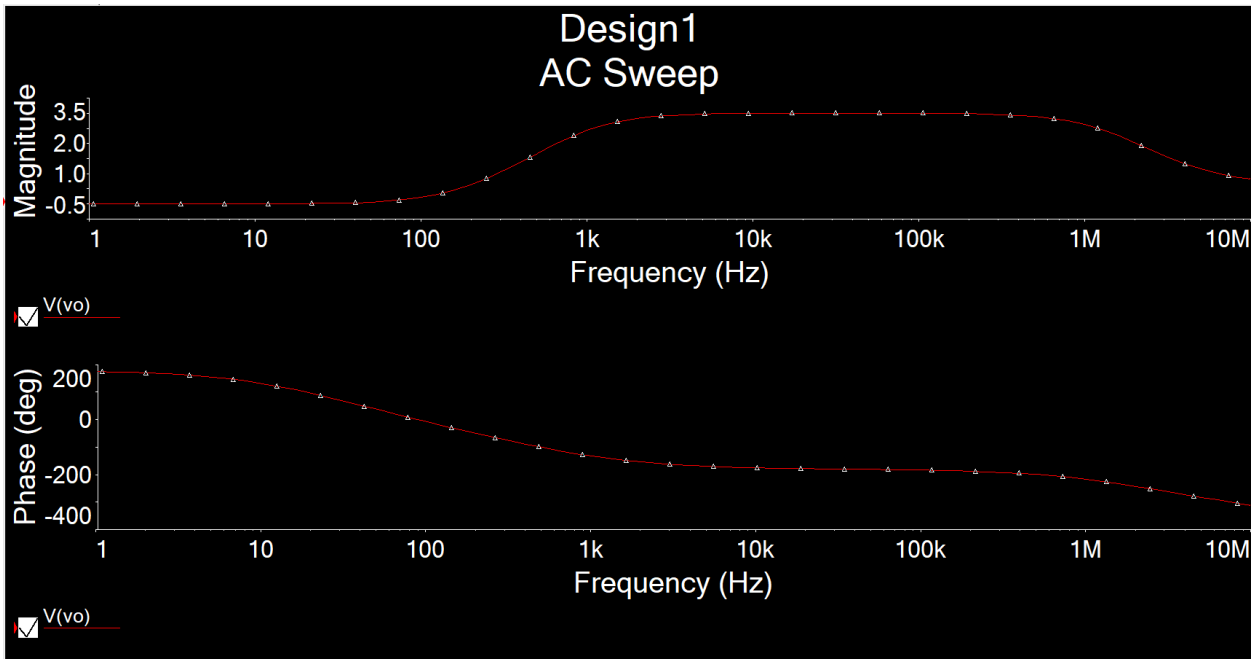

Figure 2-1: Av

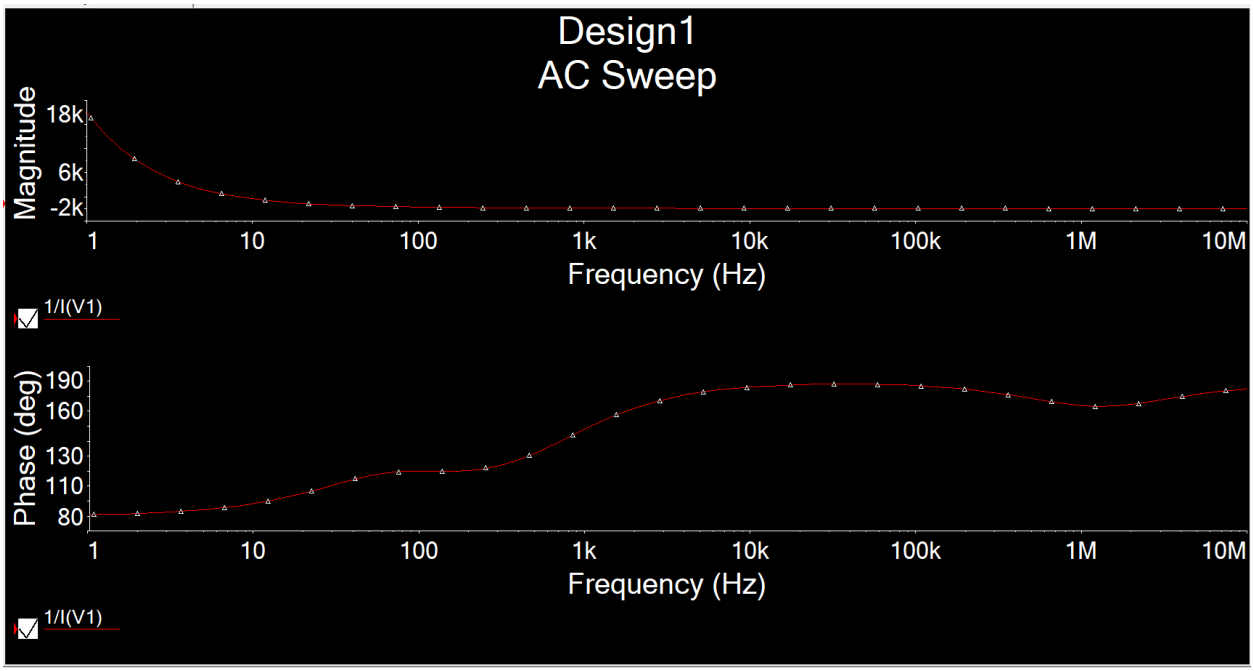

Figure 2-2: Ri

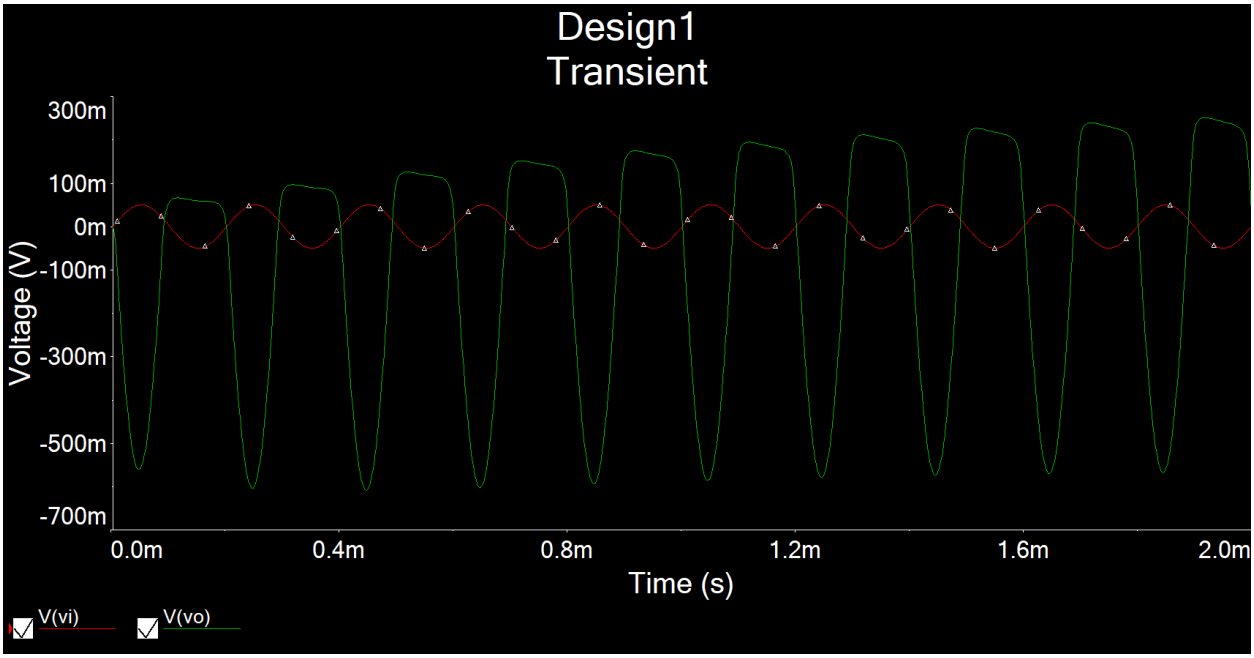

Figure 3: Time-domain waveform

(I’ve worked on the values of Rc but still can’t find unclipped waveform)

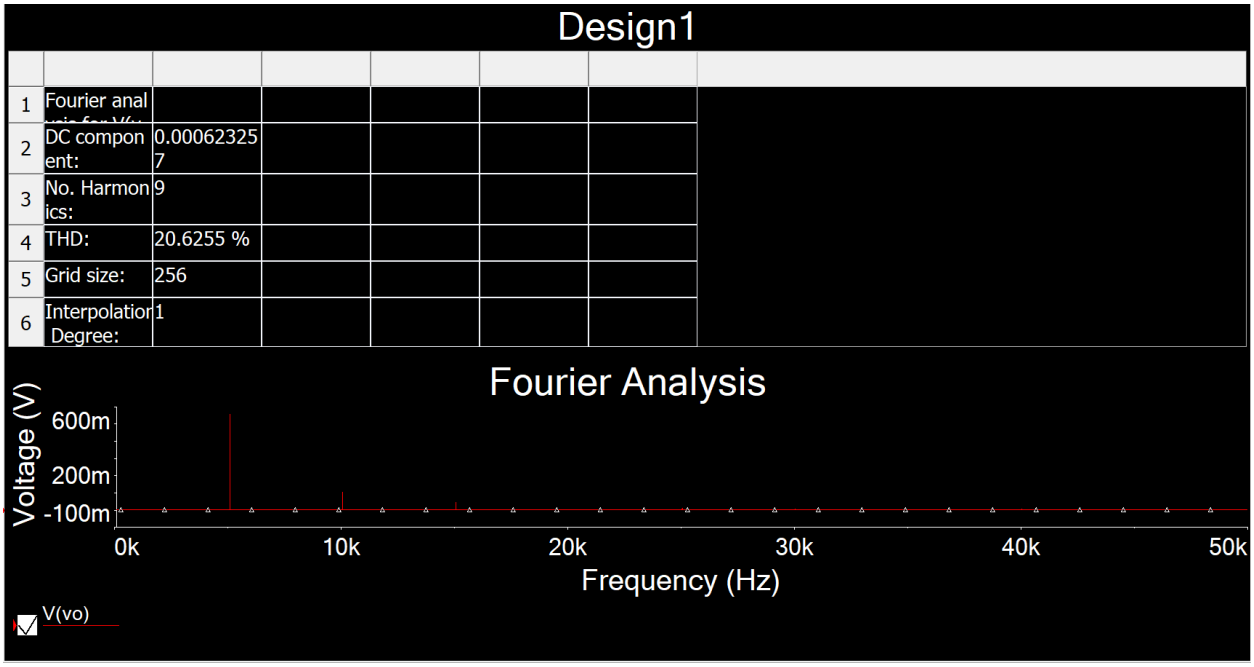

Figure 4: THD

(Since the time-domain waveform is off, the THD value is also off)