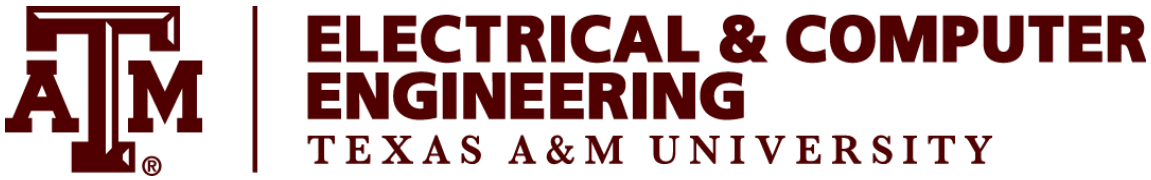

Lab 11: Mosfet Amplifier Configuration

Kylan Lewis
UIN: 719001131
ECEN 325 -501
TA: Jian Shao
Date: 11/14/2020

Simulation

Common-Source Amplifier

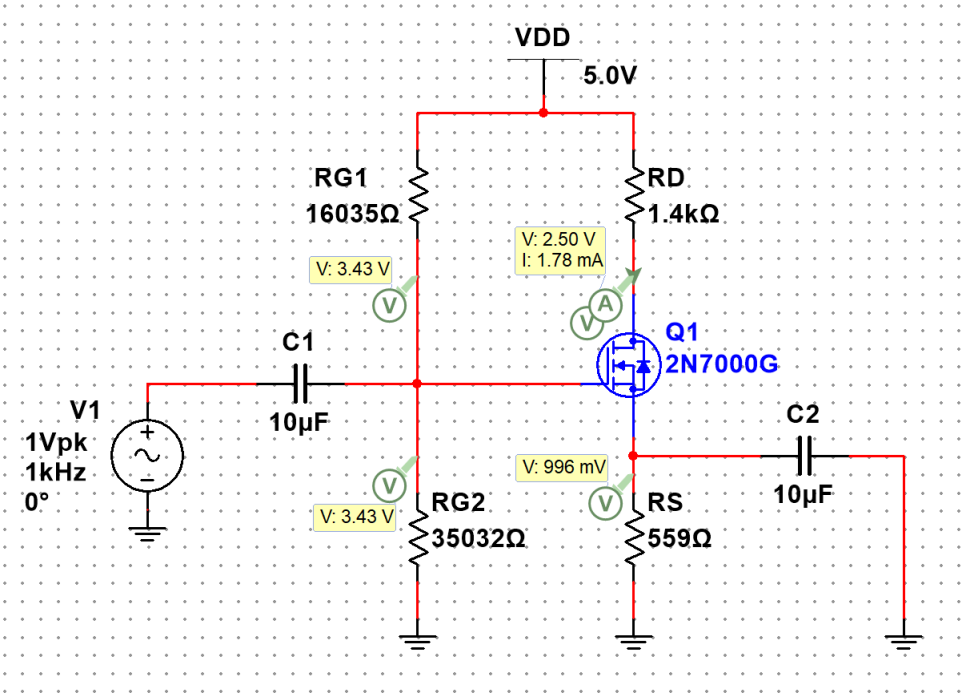

Figure 1: DC Solution for common-source amplifier ▲

$V_{RG2} = 3.43V$

$V_{RS} = 0.996V$

$V_{RD} = 5\text{-}2.5 = 2.5V$

$V_{o,dc} = 2.5V$

$I_D = 1.78mA$

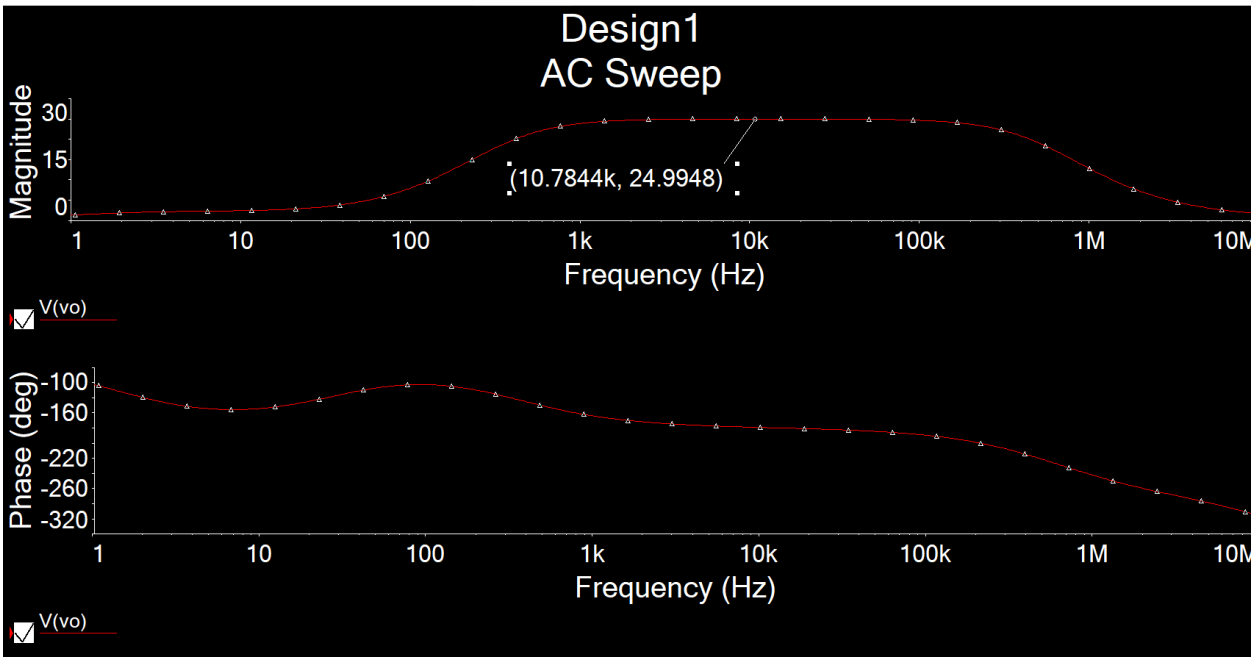

Figure 2.1: AC Simulation of A_V for common-source amplifier ▲

$A_V = 24.9948$

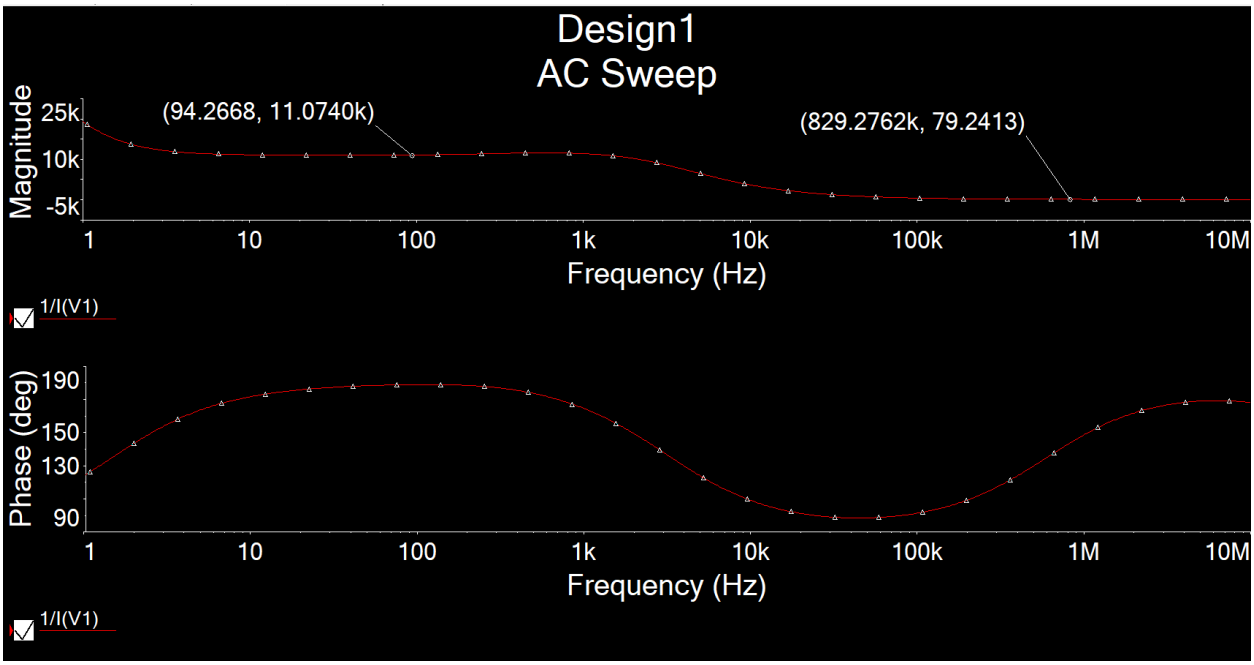

Figure 2.2: AC Simulation of R_i for common-source amplifier ▲

$R_i = 11.0740k\Omega$

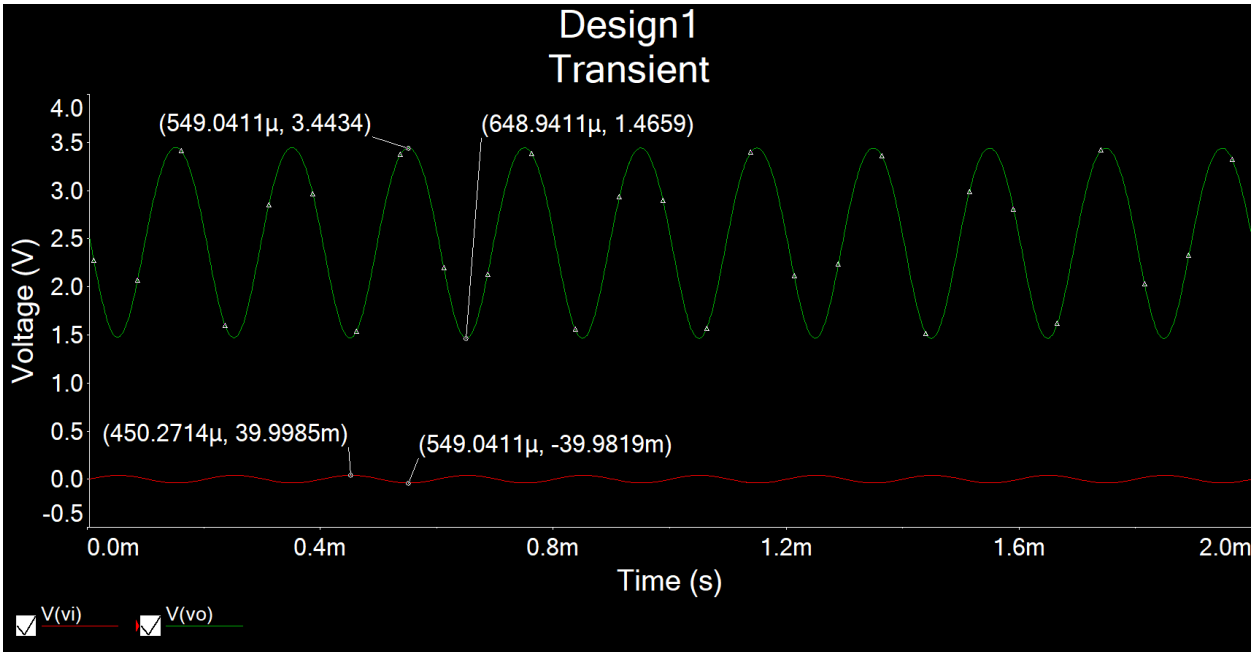

Figure 3: Time-domain waveform of V_i = 40mV for common-source amplifier ▲

$$A_V = \frac{3.4434-1.4659}{0.039-(-0.039)} = 25.35 \approx 25$$

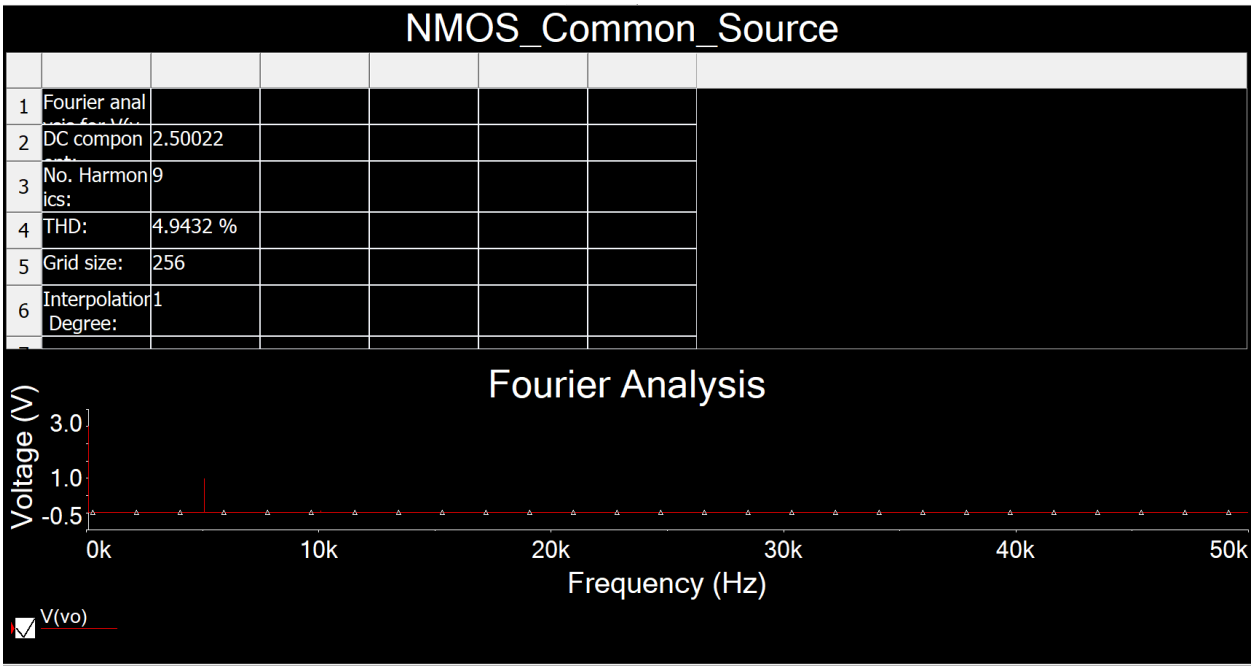

Figure 4: Total harmonic distortion (THD) for common-source amplifier ▲

THD = 4.9432% ≤ 5%

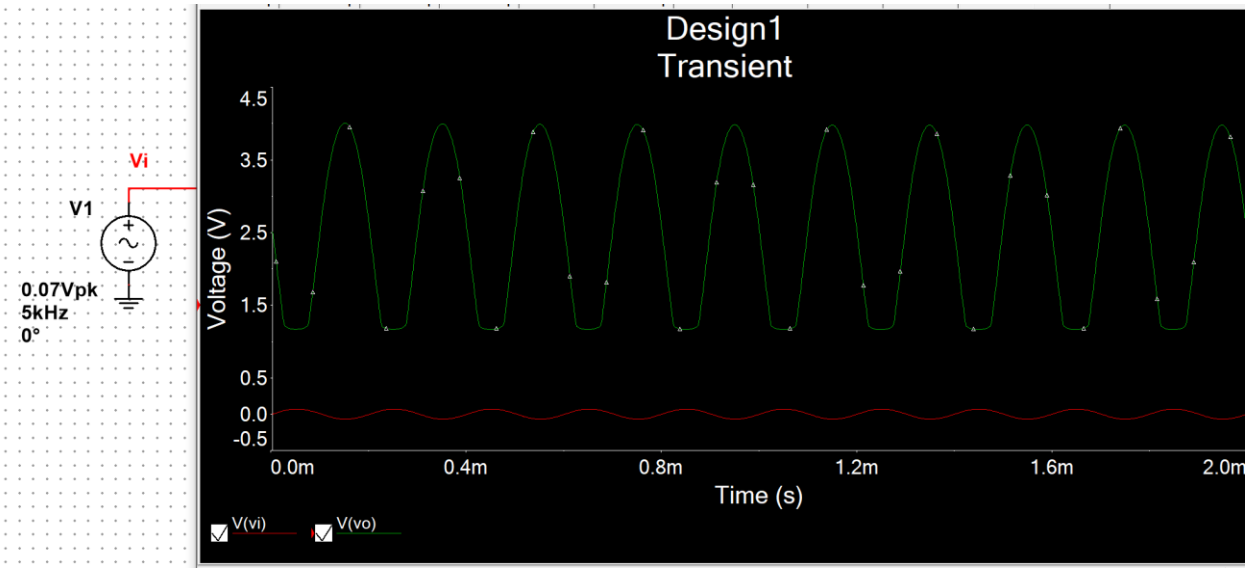

Figure 5: Clipping voltage for common-source amplifier ▲

Clipping voltage = 70mV

Common-Drain Amplifier

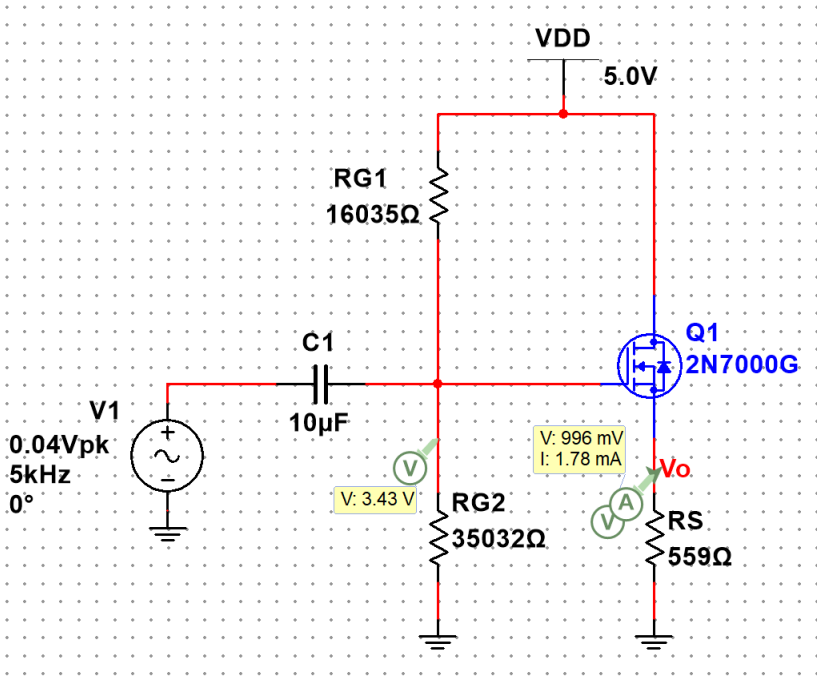

Figure 6: DC Solution for common-drain amplifier ▲

V_{RG2} = 3.43V

V_{RS} = 0.996V

I_D = 1.78mA

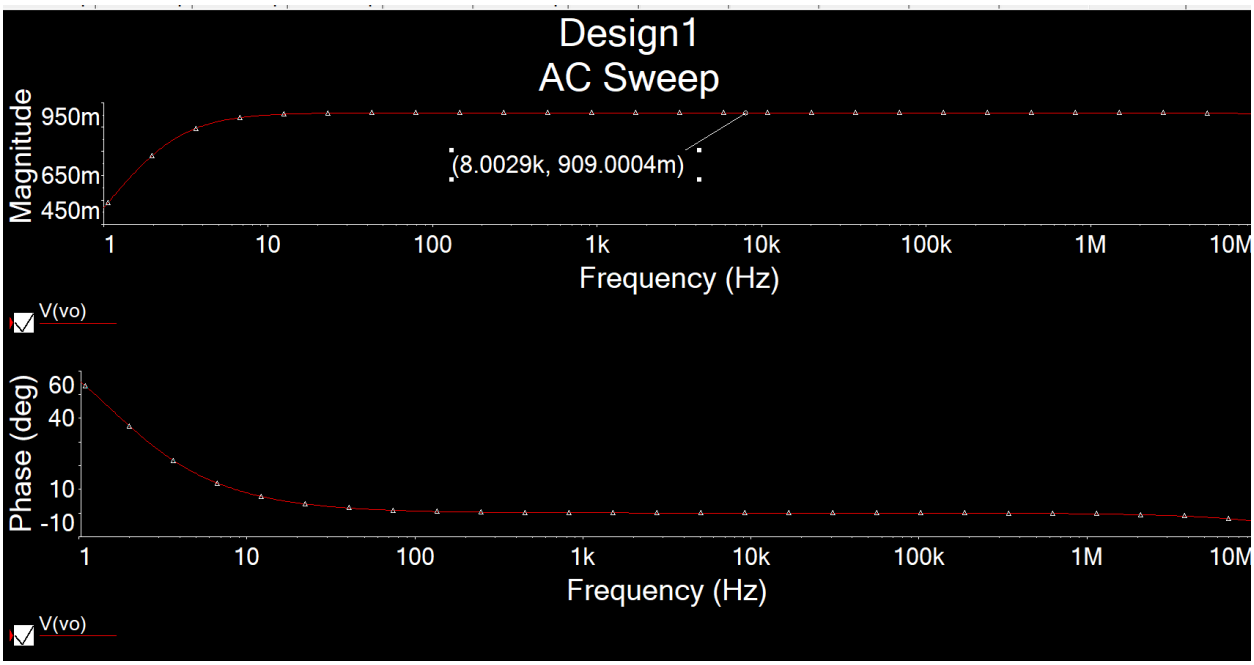

Figure 7.1: AC Simulation of A_V for common-drain amplifier ▲

$A_V = 0.909$

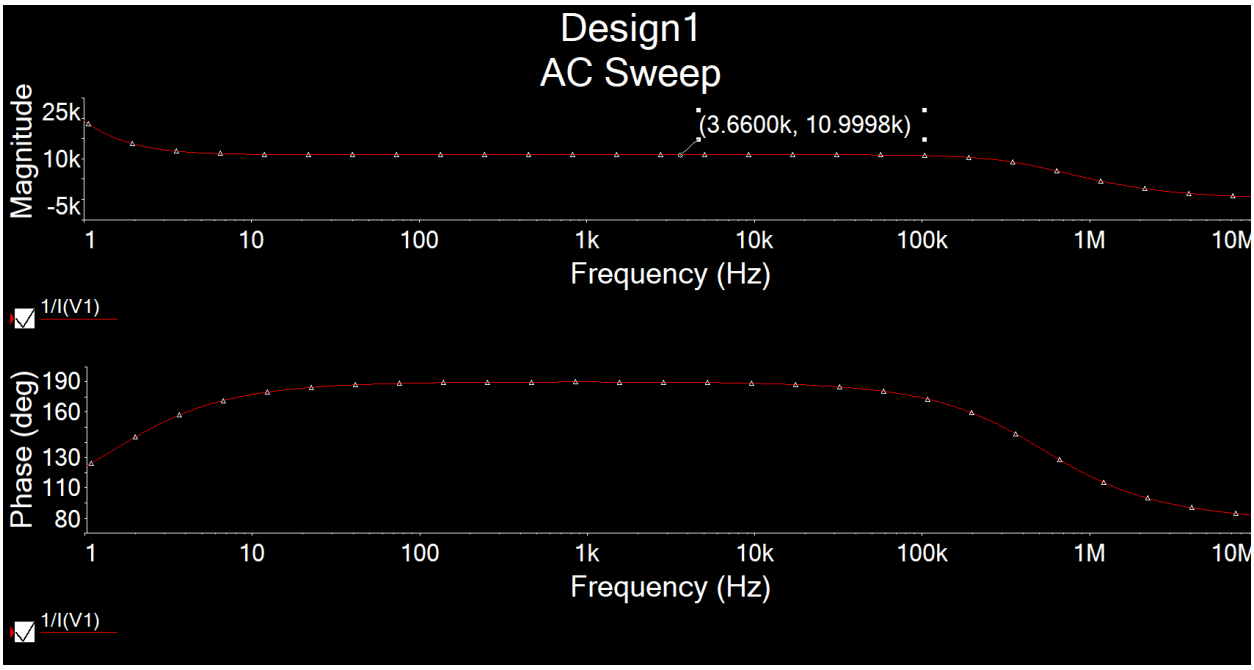

Figure 7.2: AC Simulation of R_i for common-drain amplifier ▲

$R_i = 10.9998k\Omega$

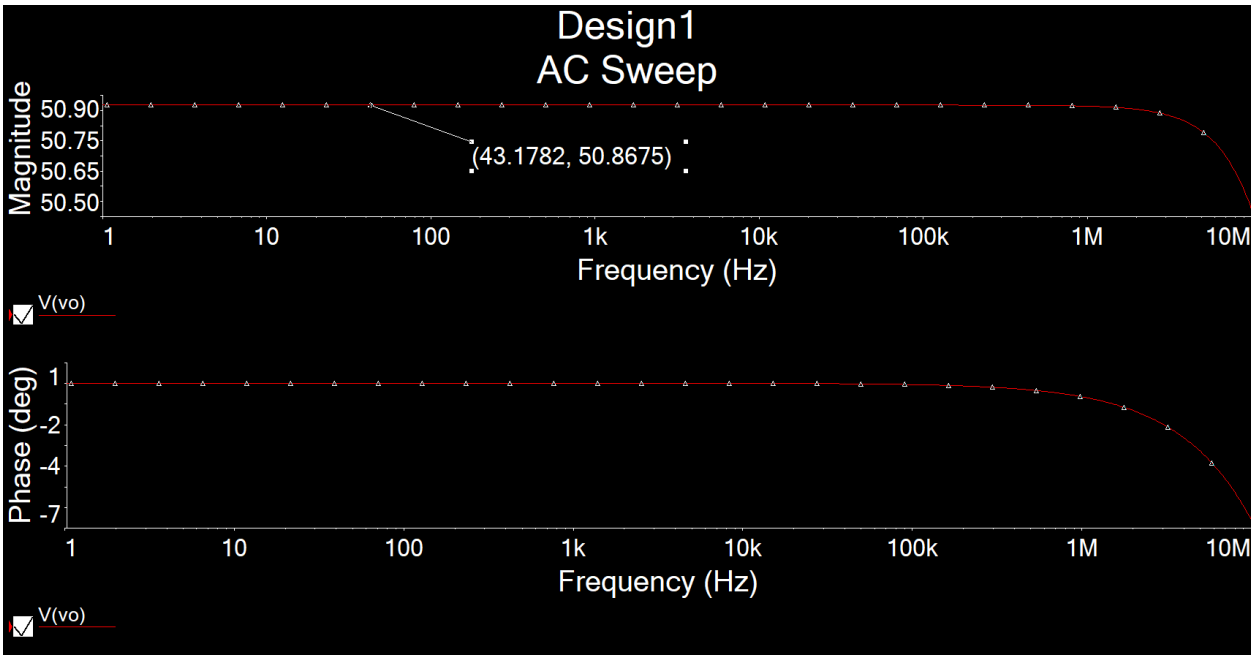

Figure 7.3: AC Simulation of R_o for common-drain amplifier ▲

$R_o = 50.8675\Omega$

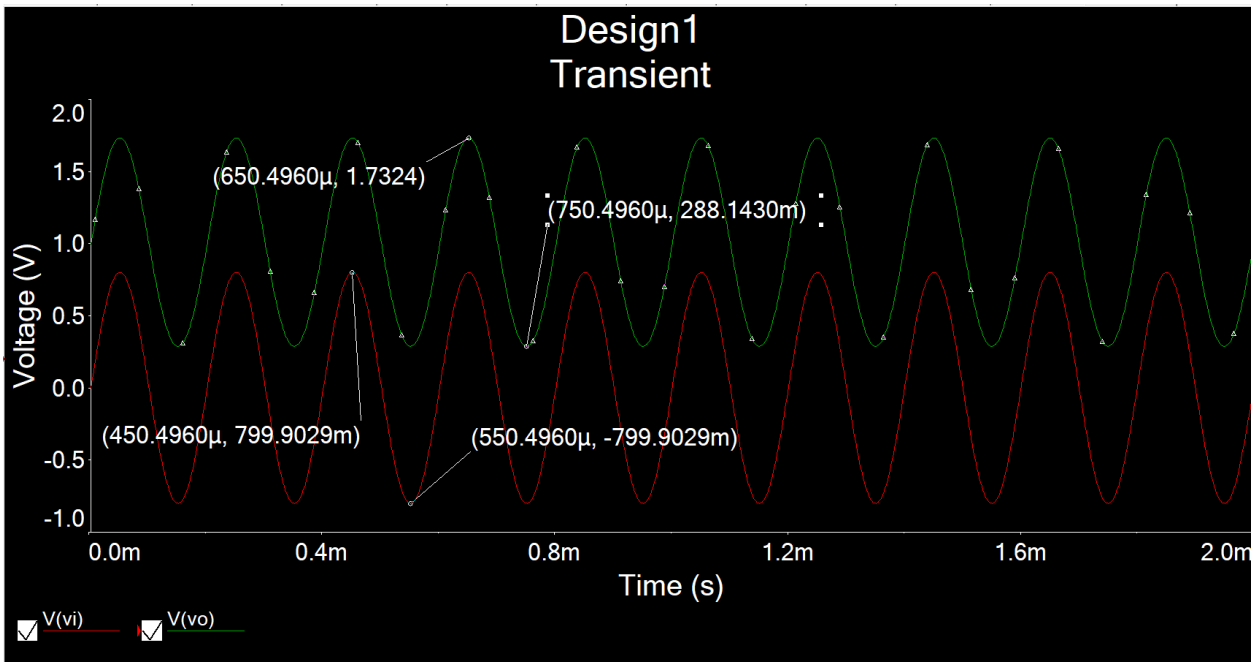

Figure 8: Time-domain waveform of $V_i = 0.8V$ for common-drain amplifier ▲

$$A_V = \frac{1.7324-0.2881}{0.7999-(-0.7999)} = 0.903$$

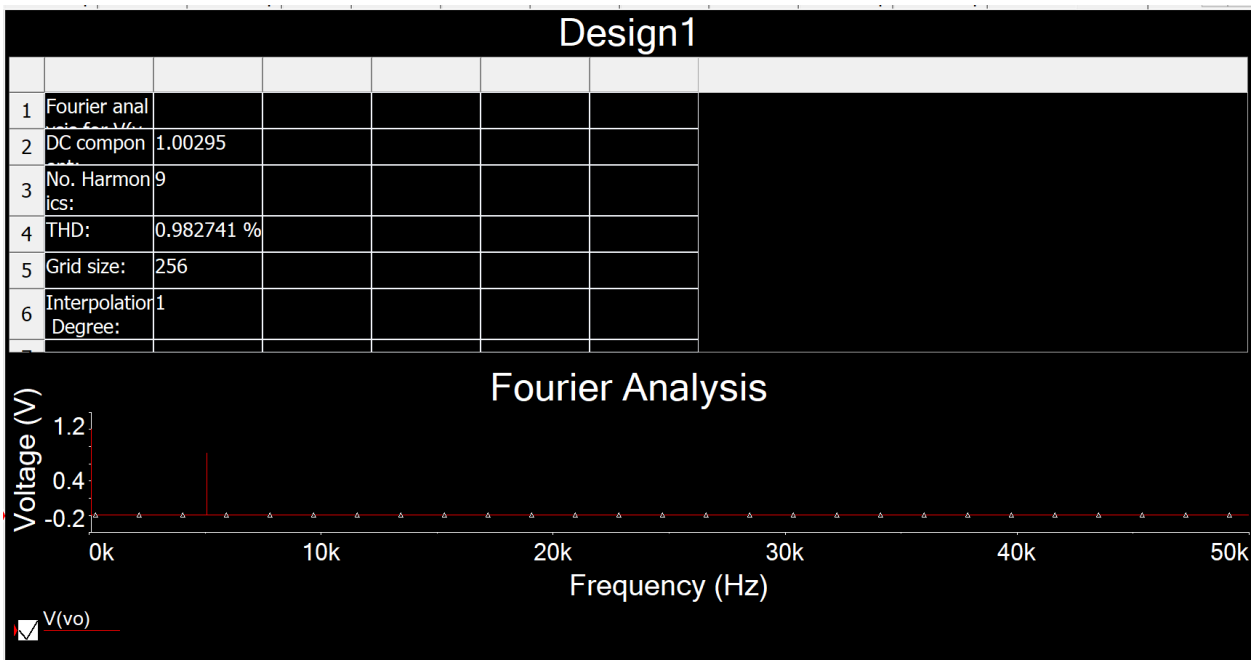

Figure 9: Total harmonic distortion (THD) for common-drain amplifier ▲

THD = 0.983%

TA Question:

How can you improve the linearity of the common source amplifier?

To improve the linearity of the common source amplifier, one should manipulate the V_{RD}. As this value directly impacts the linearity and signal swing at the output of the amplifier. Furthermore we seek a $V_{RD} = V_{DD} - V_o - V_{RS} - V_{OV}$. Or slightly less.