EXPERIMENT NO. 2
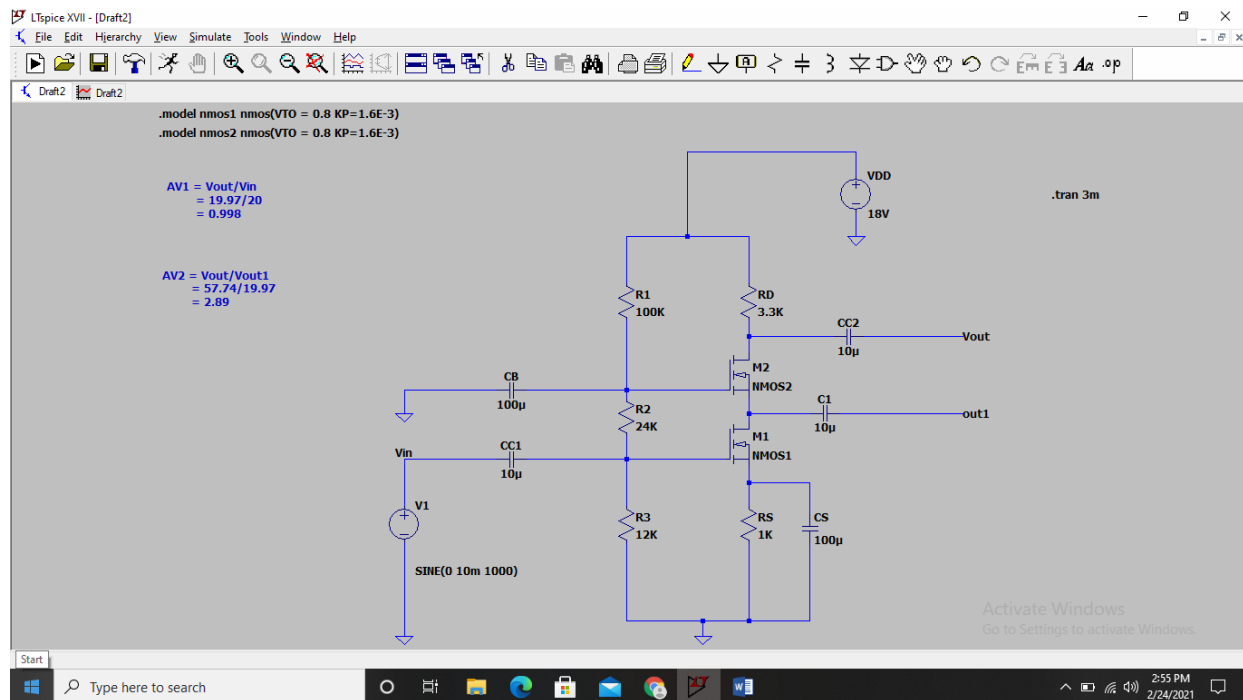
AIM: To determine voltage gain of CS-CG MOSFET Cascode amplifier using LTspice

Software Required: Ltspice

Circuit diagram:

Introduction:

An important amplifier configuration is known as cascode amplifier. It consists of a common-source (CS) stage followed by a common-gate (CG) stage as shown in figure. The common-source configuration presents a relatively high input resistance to the signal source.

The common-gate configuration presents a very low input resistance. By replacing the drain resistance R_D in the CS amplifier stage with a common gate CG amplifier stage, the CS-CG configuration virtually eliminates the Miller effect. This will lead to higher 3dB frequency than is possible with a simple common-source amplifier. An extension in the upper cutoff frequency is achieved without reducing the midband gain, since the drain of Q2 carries a current almost equal to the drain current of Q1. Another reason for extending the upper cutoff frequency is that, in the CG configuration the Miller effect does not exist and does not limit the high-frequency response. Notice that the effective load resistance seen by the CS transistor Q1 is very low and equal to the input resistance of the CG transistor Q2. The transistor Q2 acts as a current buffer or an impedance transformer.
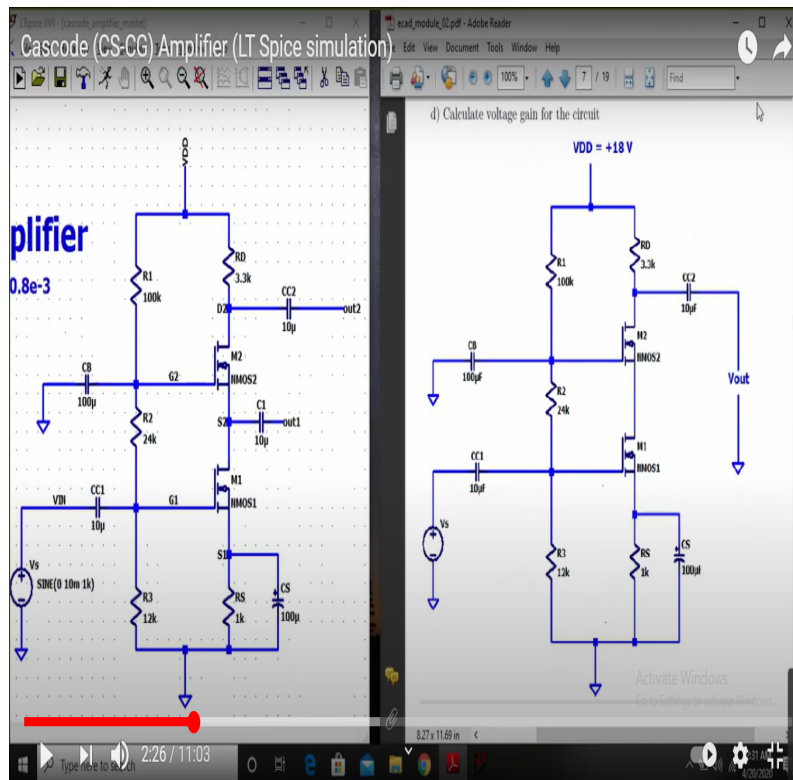
Experiment Procedure:

1) Open New Schematics, Use the components icon to enter the components menu and select a component/device. Place the component/device on your schematics

2) Place all the required component/device on your schematics, assign value and names by double click. Click on wire icon to connect the components.

3) Set input as AC signal with 10mV at 1KHz. Also click on Edit- Text- Spice directory and set NMOS parameters.

4) Now go to Edit Simulation cmd and select transient of 3ms

5) Save the schematics in the desired folder and click on Run icon to stimulate the circuit.

6) A new output window will pop out. Add plots and trace input voltage Vin, output voltage of stage 1 Vout1 and output voltage of stage 2 Vout.

7) Now left click twice on Vout1 and Vout to note the peak to peak voltage.

OBSERVATION:

The output of stage 1 i.e. Vout 1 is out of phase with input and has gain approximately equal to 1. The output of stage 2 is in phase with its input and overall gain is gain of stage 2.

CALCULATIONS:

$AV1 = Vout/Vin$

$= 19.97/20$

$= 0.998$

$AV2 = Vout/Vout1$
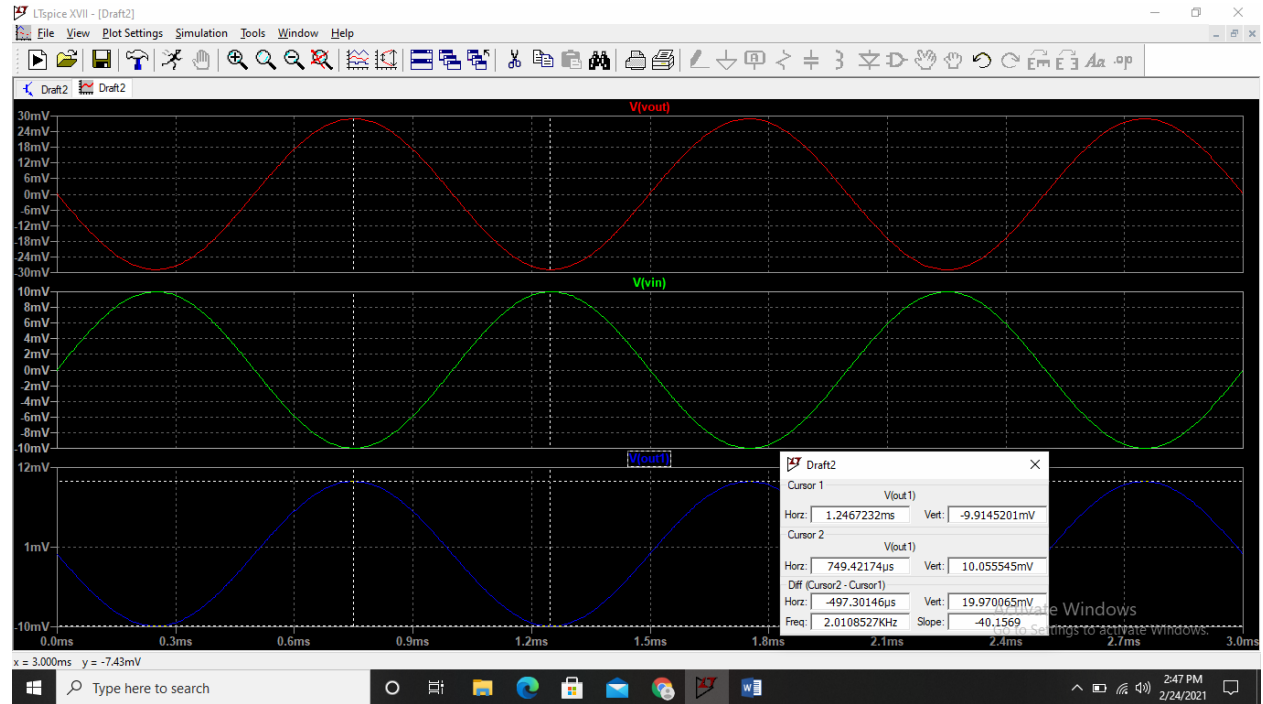
$= 57.74/19.97$

$= 2.89$

$AV = AV1 \times AV2$

$= 2.88$

CONCLUSION:

The voltage gain of first stage i.e. of CS is unity and the actual gain of the cascode amplifier is provided by second stage i.e. CG stage.

Result:

Finding amplitude of output of stage 1(Vout1) to calculate AV1

Finding amplitude of output of stage 2(Vout) to calculate AV2