**Experiment -8**

**Aim:**

1. Design an inverting and non-inverting amplifier using opamp using an F/B network
2. Determine bandwidth of amplifier using ac analysis
3. Evaluate the open-loop gain. Loop gain and close loop gain of both the amplifier (VFB/VTEST) and do ac analysis
4. Comment on the stability of the feedback amplifier

**Apparatus used:** LTSpice software

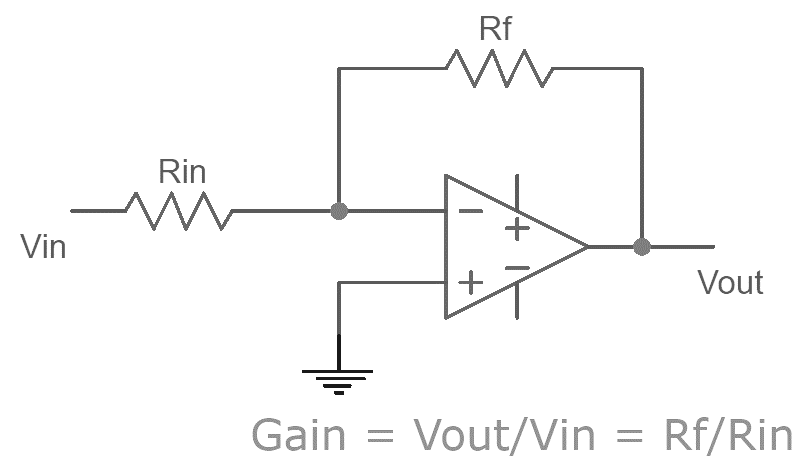
**Theory:**

An**Operational Amplifier,** or op-amp for short, is fundamentally a voltage amplifying device designed to be used with external feedback components such as resistors and capacitors between its output and input terminals

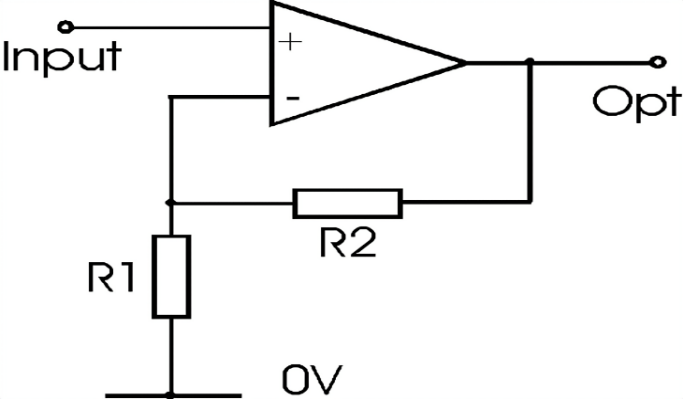
Op-amp Parameter and Idealised Characteristic

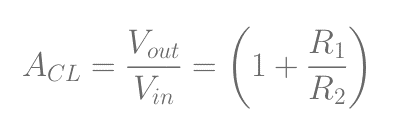
* Open Loop Gain, (Avo): Infinite
* Input impedance, (ZIN): Infinite
* Output impedance, (ZOUT): Zero
* Bandwidth, (BW): Infinite
* Offset Voltage, (VIO): Zero

**Inverting amplifier:**

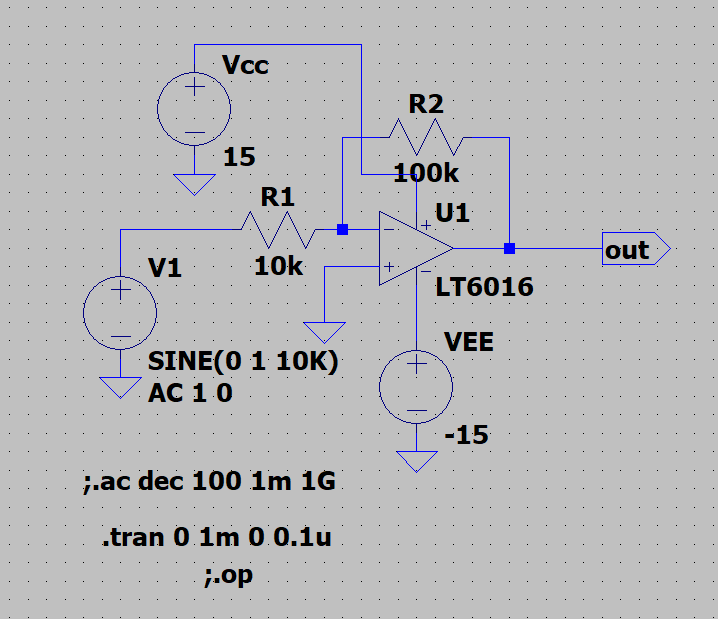


**Non Inverting amplifier:**

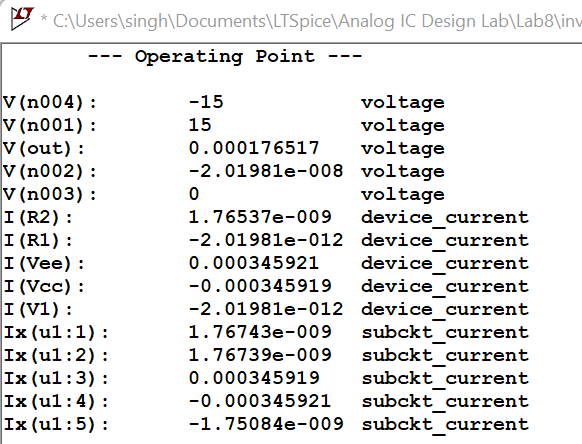




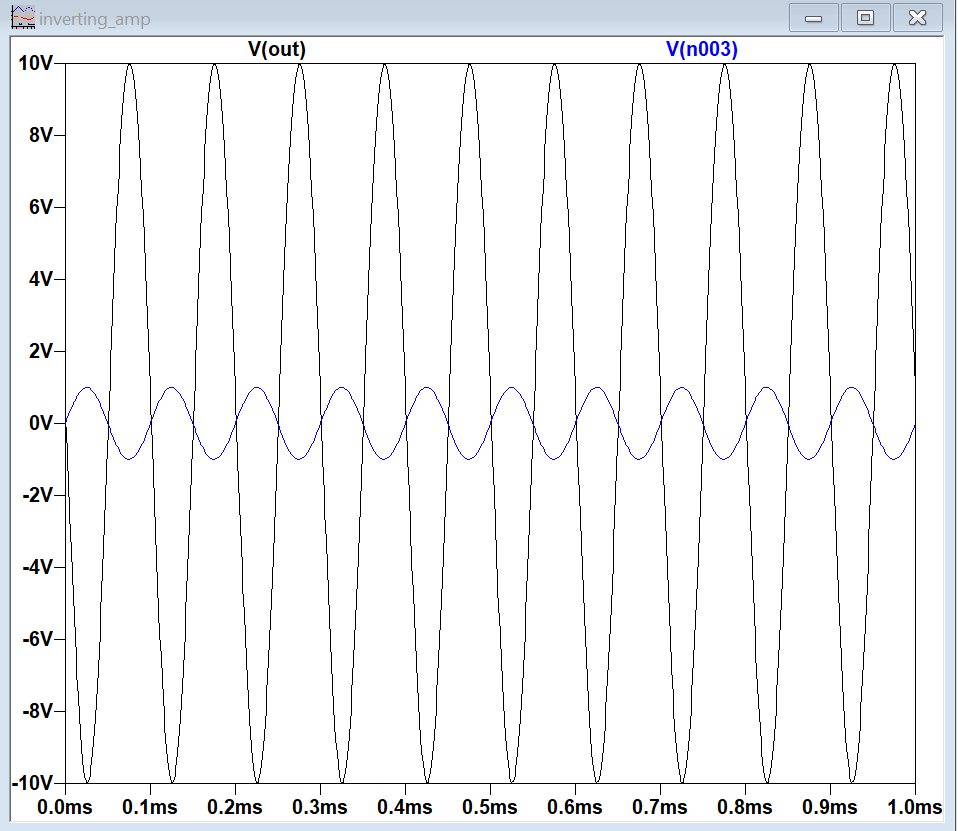
**Circuit Schematic: INVERTING AMPLIFIER:**

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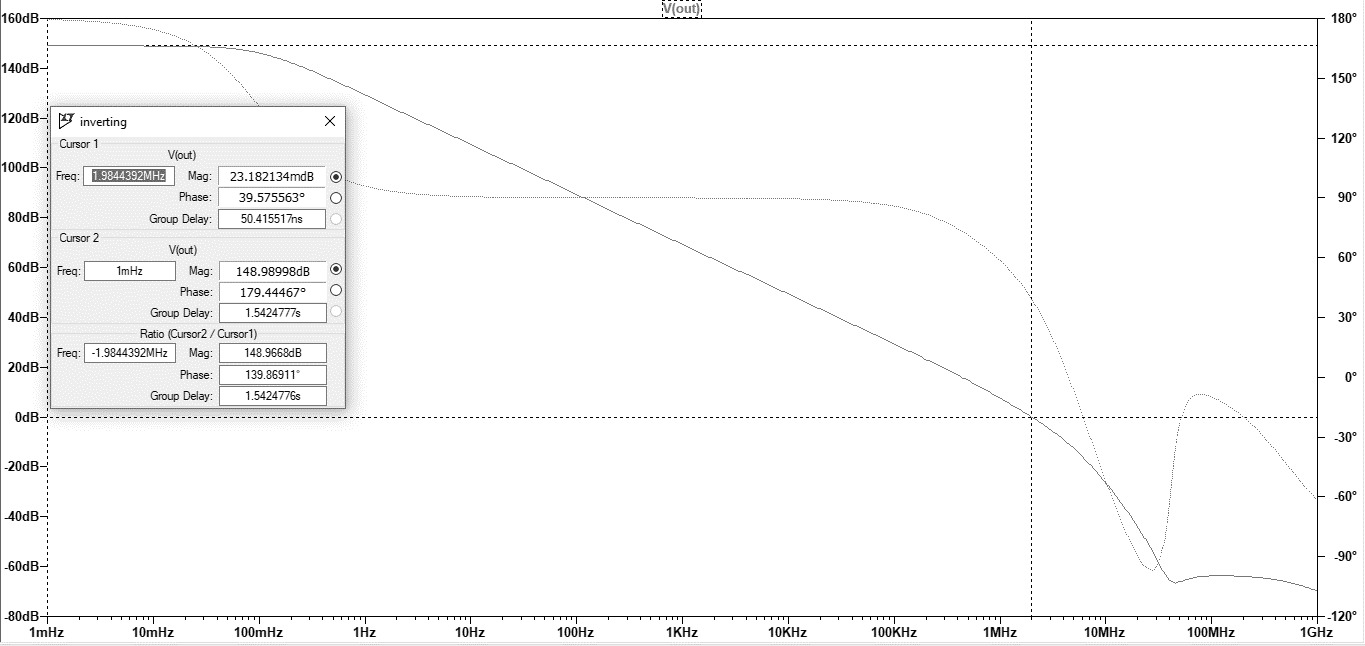
**DC operating Point:**

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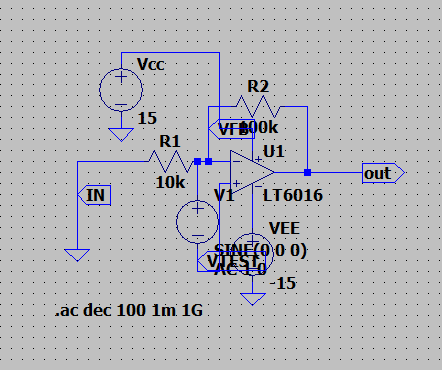
**Output Waveform: Transient response:**

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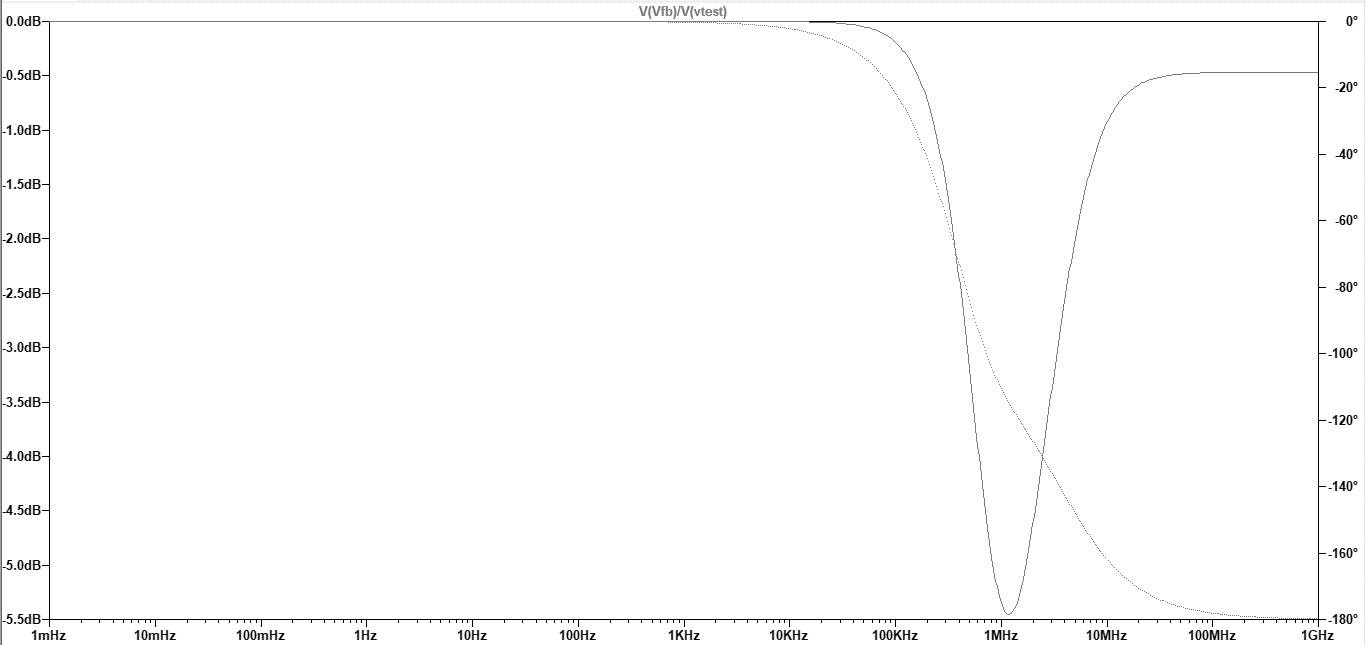
**AC response:**



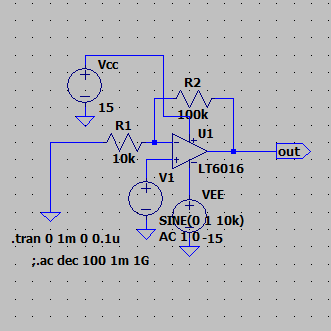
**Inverting amplifier with VTest input**

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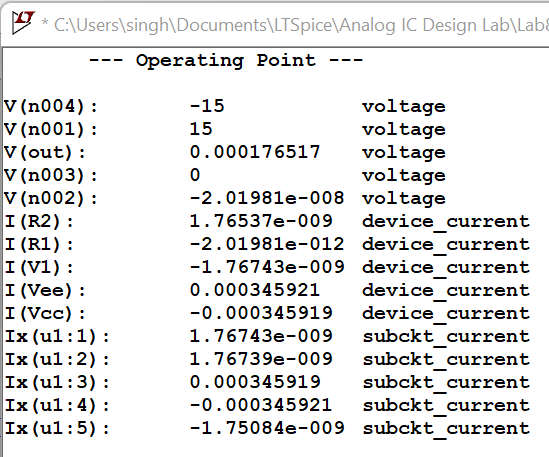
**Waveform:**



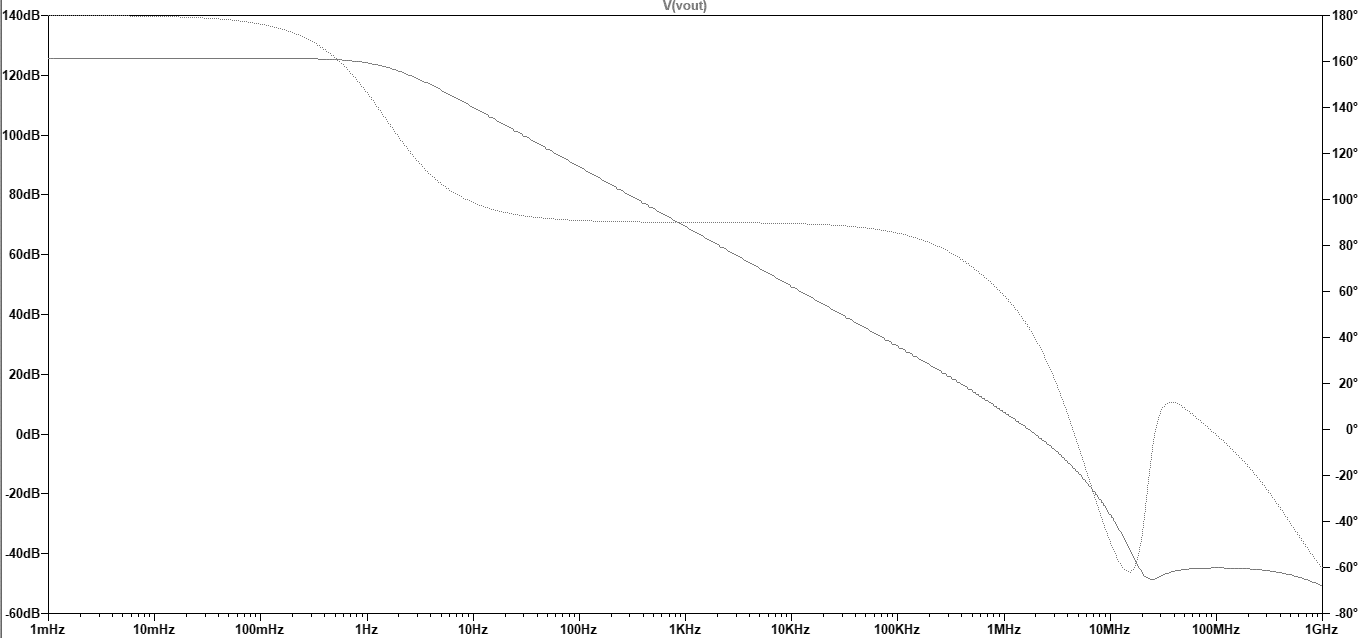
**NON-INVERTING AMPLIFIER: Open-Loop**

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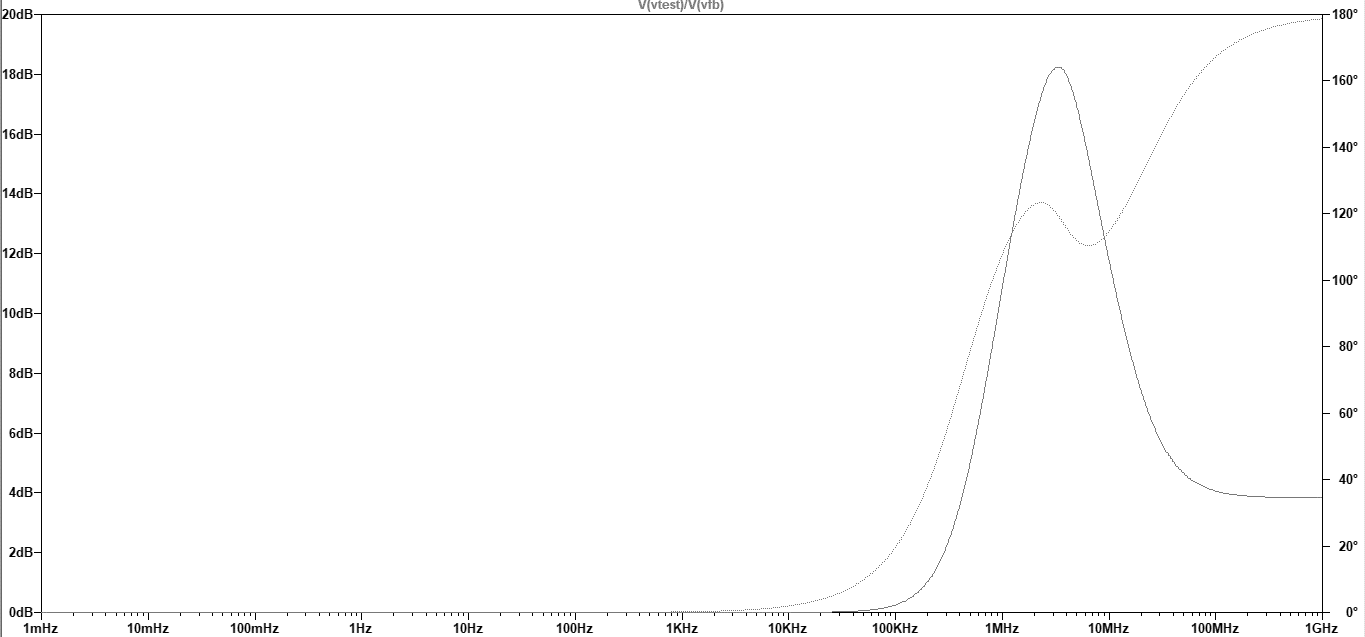
**Operating point:**

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**AC response:**

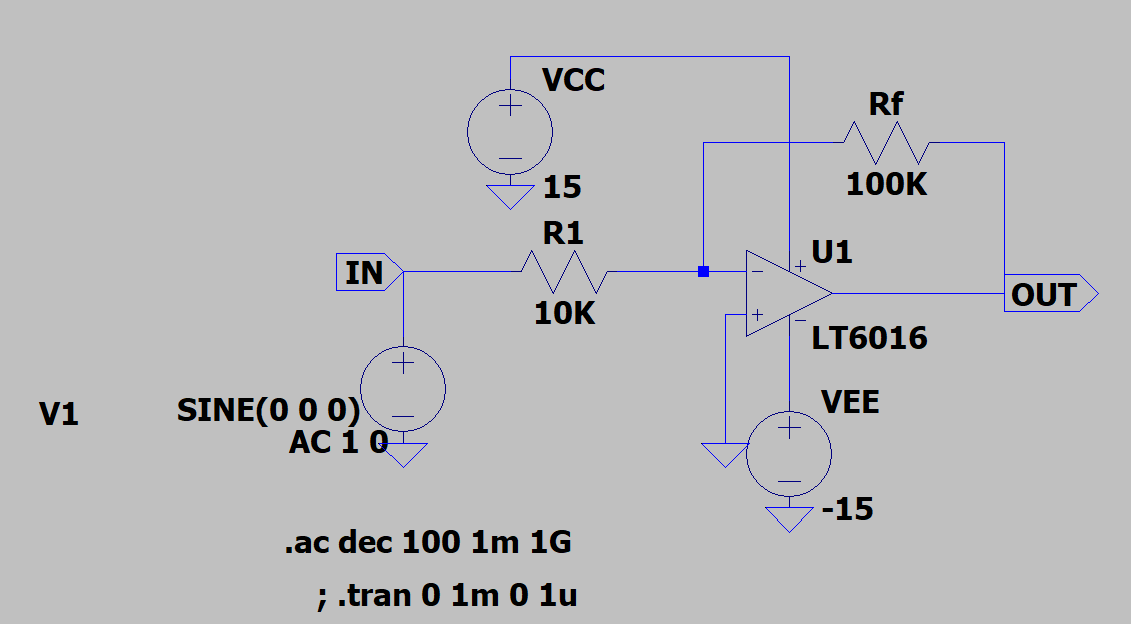


Vfb / VTest

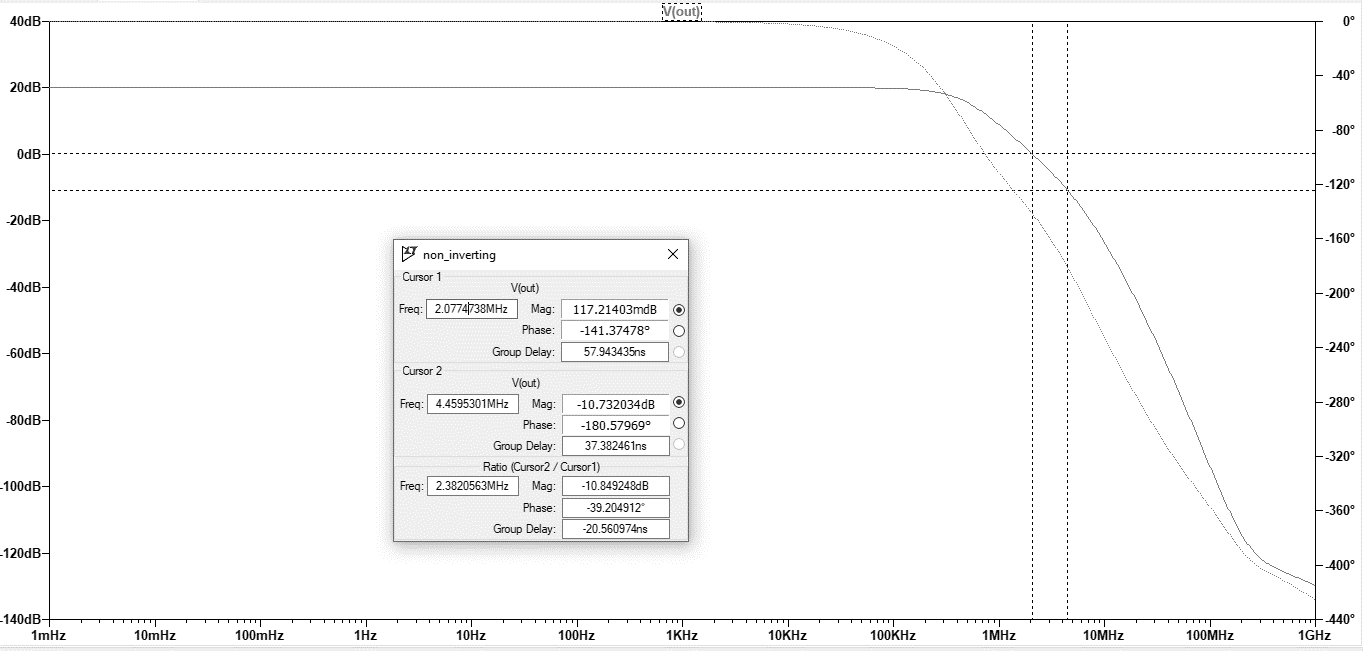


**CLOSED-LOOP:**

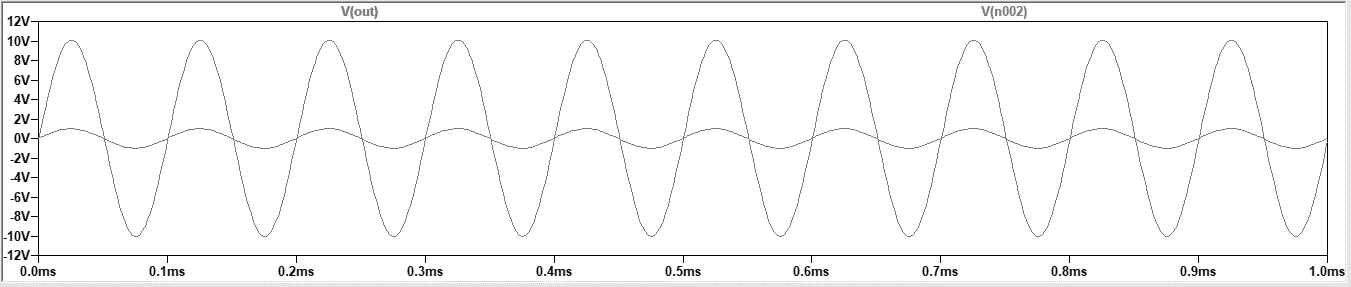
**CIRCUIT:**



**OUTPUT:**



**TRANSIENT:**



**Observation:**

**Open-loop:**

Wgc = 1.984MHz. The phase doesn’t cross -180 degrees so the system is stable.

**Closed loop:**

Wgc = 2.07 MHz, Wpc = 4.45 MHz.

Wgc < Wpc, so the system is stable.

Phase Margin = -39.2 degrees

Gain Margin = 10dB

Closed loop gain = 10

**Result:**

The Experiment has been performed with both configurations of OpAmp and found to be correct.