ECE2101L
Electrical Circuit Analysis II Laboratory

Lab 1
Positive and Negative Gain Op Amp Circuits

Report

Choi Tim Antony Yung

Willis Nguyen
Phineas Cozmiuc

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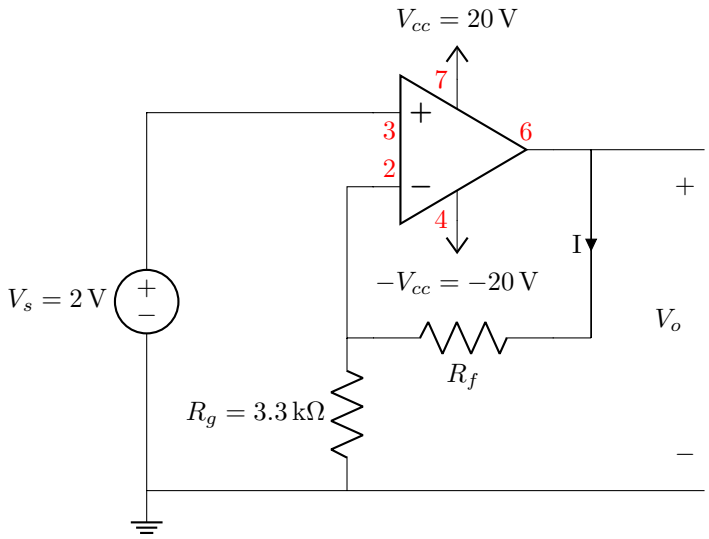
Objective

The objective of this lab is to explore the behavior of an operation amplifier (op amp) with a positive or negative gain.

1 Basic characteristics of positive-gain op amp circuit



Procedure

A circuit was set up following the above schematic, with $V_s = 2.0115\,\mathrm{V}$, $V_{cc} = 20\,\mathrm{V}$ and $-V_{cc} = -20\,\mathrm{V}$ supplied by a DC power supply and a DC dual power supply with the COM port of both power supplies connected to the ground of circuit. For each value of R_f, V_o was measured with the positive terminal of a digital multimeter (DMM) connected to pin 6 of LM741 chip, the output of the op amp, and negative terminal of DMM connected to ground, and the current I was then measured with the positive terminal of DDM connected to pin 6 of LM741 and negative terminal connected to R_f.

Result

R_f	G calculated	V_o measured	I measured
3.3 kΩ	2	4.0153 V	0.602 mA
3.9 kΩ	2.18	4.3768 V	0.602 mA
4.7 kΩ	2.42	4.8045 V	0.602 mA

Analysis

Assuming ideal op amp, no current flow into the inverting input of op amp, and therefore current flowing across R_g must be the same as I, current flowing across R_f, by KCL. As the current flowing across R_g is $\frac{V_-}{R_g} = \frac{V_s}{R_g}$ which does not depend on the value of R_f, I must remain constant as well.

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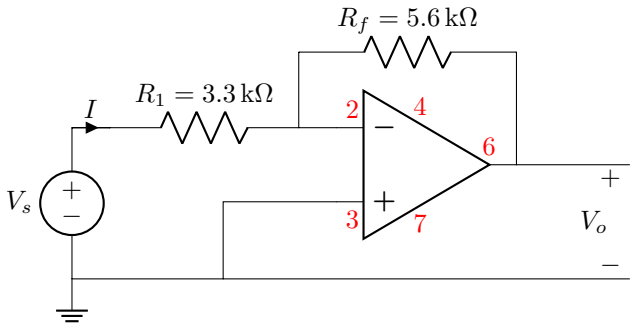

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Result

$$R_f = 5.6\,\mathrm{k\Omega}$$

$$G_{calc} = -1.697$$

V_s nominal	V_s measured	V_o calculated	V_o measured	G measured	I measured	Error
0 V	0.002 V	−0.003 V	0.019 V	9.500	0 µA	659.82%
1 V	1.011 V	−1.716 V	−1.631 V	-1.613	289 µA	4.93%
2 V	2.065 V	−3.504 V	−3.346 V	-1.620	594 µA	4.52%
3 V	3.037 V	−5.154 V	−4.931 V	-1.624	878 µA	4.32%
4 V	4.054 V	−6.880 V	−6.600 V	-1.628	1175 µA	4.06%
5 V	4.964 V	−8.424 V	−8.089 V	-1.630	1441 µA	3.97%

Analysis

The RMS value of V_o was measured to be 11.947 V, which is a positive value. The op amp circuit did indeed invert the sinusoidal voltage. However, the calculation of the RMS value concern simply the amplitude of the sinusoidal output, and results in a positive value.