Laboratory Application Assignment

In this lab application assignment you will examine two relatively simple op-amp circuits: the inverting and noninverting amplifier. In each amplifier circuit you will measure the output voltage, V_{out}, and determine the closed-loop voltage gain, A_{CL}, with different amounts of negative feedback. You will also measure the phase relationship between V_{in} and V_{out} in each type of amplifier.

Equipment: Obtain the following items from your instructor.

- Dual-output variable dc power supply
- Oscilloscope
- Function generator
- DMM
- 741C op amp
- Assortment of carbon-film resistors

Inverting Amplifier

Examine the inverting amplifier in Fig. 33–46. Calculate and record the closed-loop voltage gain, A_{CL}, and output voltage, V_{out}, for each of the following values of feedback resistance, R_F. Note that $V_{in} = 1\ V_{p\text{-}p}$.

$R_F = 4.7\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 10\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 15\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 22\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____

Construct the inverting amplifier in Fig. 33–46. (The IC pin numbers are shown in parentheses.) Set the input voltage, V_{in}, to exactly $1\ V_{p\text{-}p}$. Measure and record the output voltage, V_{out}, for each value of R_F listed below. Then from your measured values of V_{out}, calculate the closed-loop voltage gain, A_{CL}, as V_{out}/V_{in}.

$R_F = 4.7\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 10\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 15\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 22\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____

How do your measured and calculated values compare? _____

With channel 1 of the oscilloscope connected to the input voltage, V_{in}, and channel 2 connected to the output of the op amp, measure and record the phase relationship between V_{in} and V_{out}. $\theta =$ _____

Measure and record the ac voltage at the inverting input (pin 2) of the op amp. $V_{(-)} =$ _____$_{p\text{-}p}$. Explain your measurement.

Noninverting Amplifier

Examine the noninverting amplifier in Fig. 33–47. Calculate and record the closed-loop voltage gain, A_{CL}, and output voltage, V_{out}, for each of the following values of feedback resistance, R_F. Note that $V_{in} = 1\ V_{p\text{-}p}$.

$R_F = 1\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 2\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 10\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____
$R_F = 15\ k\Omega$ $A_{CL} =$ _____ $V_{out(p\text{-}p)} =$ _____

Construct the noninverting amplifier in Fig. 33–47. (The IC pin numbers are shown in parentheses.) Set the input voltage, V_{in}, to exactly $1\ V_{p\text{-}p}$. Measure and record the output voltage, V_{out}, for each value of R_F listed below. Then from your measured values of V_{out}, calculate the closed-loop voltage gain, A_{CL}, as V_{out}/V_{in}.

$R_F = 1\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 2\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 10\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____
$R_F = 15\ k\Omega$ $V_{out(p\text{-}p)} =$ _____ $A_{CL} =$ _____

How do your measured and calculated values compare? _____

With channel 1 of the oscilloscope connected to the input voltage, V_{in}, and channel 2 connected to the output of the op amp, measure and record the phase relationship between V_{in} and V_{out}. $\theta =$ _____

Figure 33–46

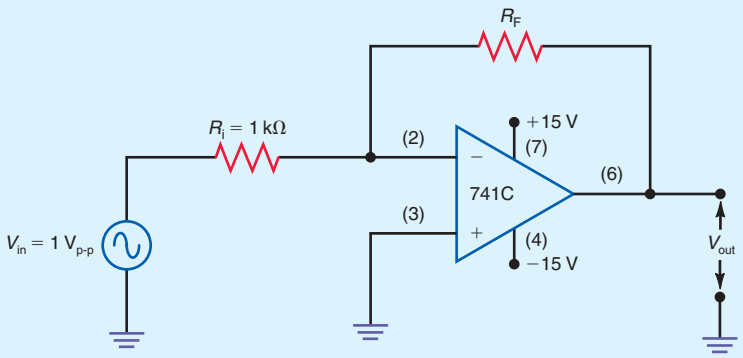
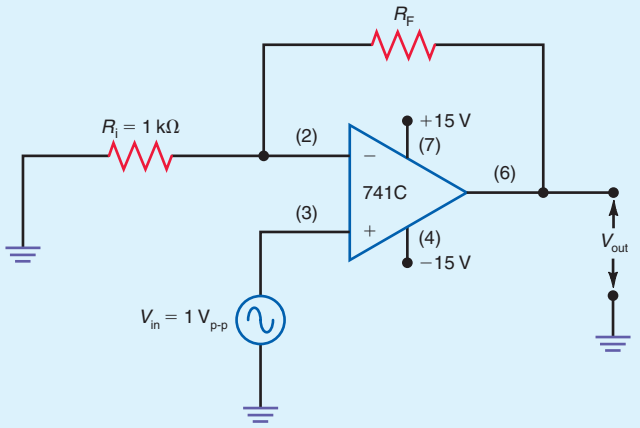


Figure 33–47



Measure and record the ac voltage at the noninverting input (pin 3) of the op amp. $V_{(+)}$ = _____ $_{p\text{-}p}$. Next, measure and record the ac voltage at the inverting input (pin 2) of the op amp. $V_{(-)}$ = _____ $_{p\text{-}p}$. Are these two values the same? _____ If yes, explain why. _____

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