Lab 6 Op-Amp Closed Loop Configurations

Unity Gain Amplifier (Voltage Follower)

1. Assemble the circuit in Fig. 1:

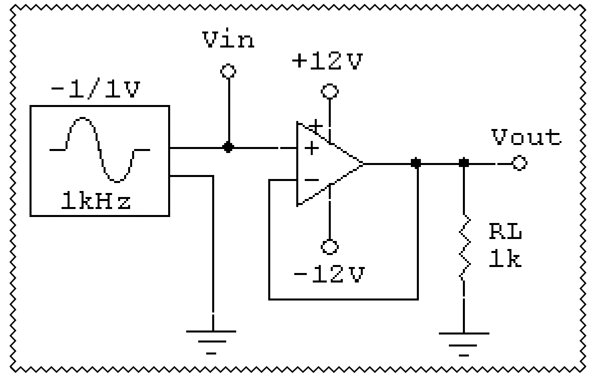

Fig. 1

2. Apply a sine wave of $4V_{PP}$ at 1kHz.

3. Place channel 1 of the oscilloscope at V_{IN} and channel 2 at V_{OUT}.

4. Measure the gain: $A_V = \frac{V_{OUT}}{V_{IN}} =$

5. Observe the output; is the output in phase with the input? Is there any distortion?

6. Assume that the unity-gain frequency (F_U) equals 1MHz, then calculate the bandwidth:

$$BW = \frac{F_U}{A_V} =$$

Non-Inverting Amplifier

7. Assemble the circuit in Fig. 2:

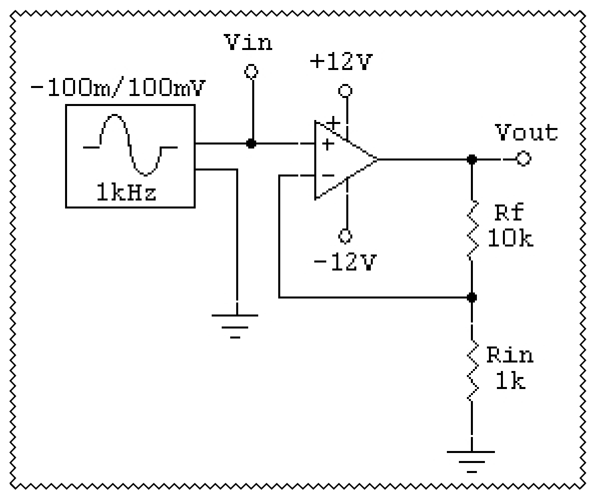

Fig. 2

8. Apply a sine wave of $200mV_{PP}$ at 1kHz.

9. Calculate the gain: $A_V = \frac{R_F}{R_{IN}} + 1 =$

10. Place channel 1 of the oscilloscope at V_{IN} and channel 2 at V_{OUT}.

11. Measure the gain: $A_V = \frac{V_{OUT}}{V_{IN}} =$

12. Do the calculated and measured values of the gain match? Is there any distortion?

13. Choose a new value for R_F so that the gain is approximately 47.

14. Insert the new resistor into the circuit.

15. Again measure the gain A_V=

16. Are V_{IN} and V_{OUT} in phase? Do the calculated and measured values of gain match? Is any distortion observed?

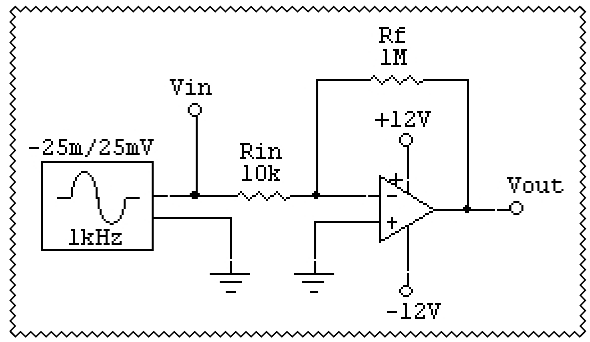

Fig. 3

Inverting Amplifier

17. Assemble the circuit in Fig. 3: Apply a sine wave of 1kHz at 50mV$_{PP}$.

18. Calculate the gain: $A_V = \frac{R_F}{R_{IN}} =$

19. Calculate V_{OUT}: $V_{OUT} = A_V * V_{IN} =$

20. Calculate the bandwidth: $BW = \frac{F_U}{A_V} =$

21. Place channel 1 of the oscilloscope at V_{IN} and channel 2 at V_{OUT}.

22. Measure the gain: $A_V = \frac{V_{OUT}}{V_{IN}} =$

23. Do the calculated and measured values of gain match. Are V_{IN} and V_{OUT} in phase?

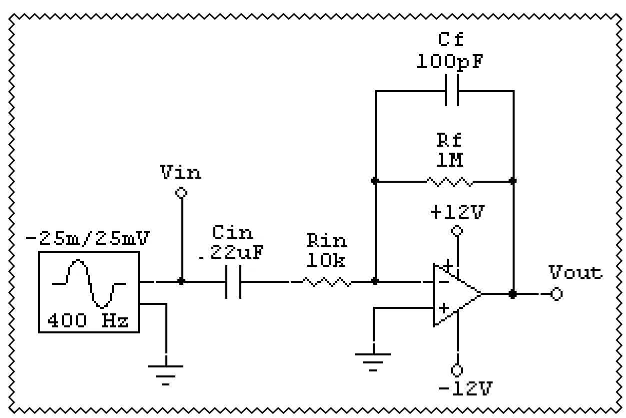

Fig. 4

Frequency Effects

24. Modify the previous circuit as in Fig. 4:

25. We need to limit the bandwidth of the circuit. The low frequency cut-off is determined by C_{IN} and R_{IN}. Calculate the frequency:

$$F_L = \frac{1}{2\pi R_{IN} C_{IN}} =$$

26. The high frequency cut-off is determined by C_F and R_F; calculate this frequency:

$$F_H = \frac{1}{2\pi R_F C_F} =$$

27. Apply a sine wave of 400H_Z at 50mV_{PP}. Place channel 1 of the oscilloscope at V_{IN} and channel 2 at V_{OUT}. If V_{IN} is 50mV_{PP}, measure the value of V_{OUT}. V_{OUT} = ______ (Let this be the maximum value of V_{OUT}.)

28. Begin at 400H_Z and increase the frequency of the signal generator until V_{OUT} drops to .707 of the maximum value of V_{OUT}. Note the high frequency F_H = _______

29. Return to 400HZ and decrease the frequency of the signal generator until V_{OUT} drops to .707 of the maximum value of V_{OUT}. Note the low frequency F_L = ________

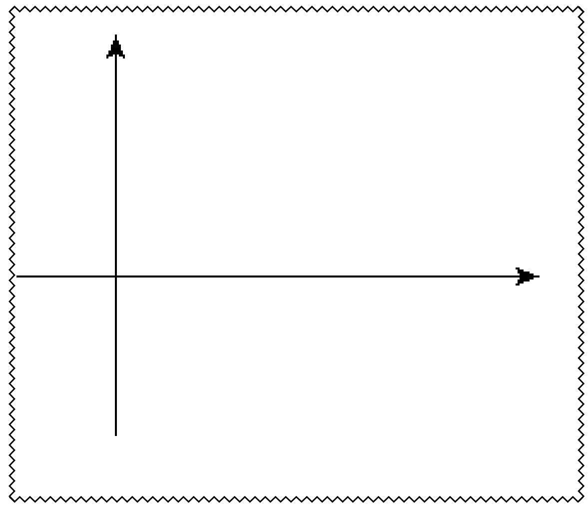

Fig. 5

30. Create a Bode plot in Fig. 5 and indicate the maximum amplitude of V_{OUT} and the two "corner" frequencies, F_L , F_H and the bandwidth (BW.)

31. How the does the bandwidth of the modified circuit compare to the bandwidth calculated in Step 20?