

## Operational Amplifier Circuits I

In this lab, you will get acquainted with essential operational amplifier circuits and parameters.

Your task is to design and build an inverting voltage amplifier using a 741 op-amp and the following resistor:  $R_i = 2.2\text{k}\Omega$ ,  $R_f = 15\text{k}\Omega$ ,  $R_L = 1\text{k}\Omega$ . DC supply voltage is set to  $\pm 12\text{ V}$ .

1. Draw a circuit diagram and build the circuit. Apply a  $500\text{mV}_{\text{p-p}}$ , 1 kHz sinewave signal to the input of the amplifier.
2. Calculate the expected gain ( $A_v$ ) for the amplifier.
3. Measure and record  $V_{\text{in}}$ ,  $V_{\text{out}}$  and  $A_v$ .
4. Compare your calculated value of  $A_v$  with your measured values. What is the difference?
5. Now turn off the power and replace  $R_f$  with a resistor in the range of  $2.2\text{k}\Omega$  to  $39\text{ k}\Omega$ . Record your  $R_f$  and reapply power.
6. Calculate  $A_v$ .
7. Measure  $v_{\text{in}}$ ,  $v_{\text{out}}$  and  $A_v$  and compare your measured  $A_v$  to your calculated  $A_v$ . Is there a significant difference? If yes, how would you explain it?
8. Comparing your measurements with two different feedback resistors, what did you learn? How does the feedback resistor influence your output?
9. Explain the gain-bandwidth product of an amplifier. How can you measure the gain bandwidth product of an amplifier? Explain.
10. Determine the gain-bandwidth product of your amplifier.