Basic OP-Amp circuits

Practical exercise in Analog Electronics

Abstract

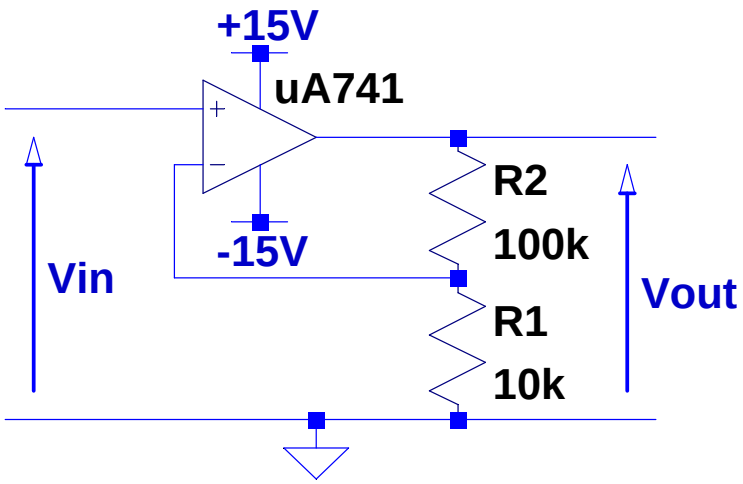
In this lab the most basic OP-Amp circuits should be connected and characterized. Some fundamental non ideal properties of the OP-Amp will also be characterized.

1 Basic OP Amp circuits

In this lab the most commonly used OP circuits should be connected, measured on and analyzed. The influence of some of the non-ideal properties of the OP-Amp is also investigated.

1.1 Non Inverting Amplifier and Frequency response

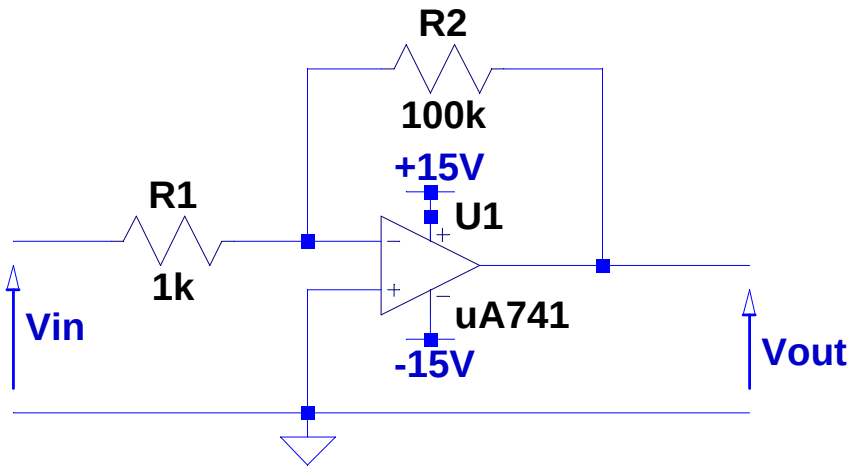
With this circuit the non inverting amplifier should be characterized and verified and the frequency response should be characterized.



- Connect the non inverting amplifier according to the figure
- Connect the signal generator to *Vin*. Set the amplitude to 100mV peak-to-peak and the frequency to 500 Hz.
- Connect the oscilloscope probes to *Vin* (Ch1) and *Vout* (Ch2).
  - **Calculate the theoretical amplification and verify that against measurements.**
- Set the oscilloscope in XY-mode.
  - **Draw *Vout=f(Vin)*. Explain what you see.**
- Set the oscilloscope in normal (timebase) mode.
- Sweep the frequency from 1Hz and until the gain drops to zero for the values 1, 2, 5, 10, 20, 50, 100,… Hz.
  - **Draw the transfer function *H(f)*. Use a dB scale for the y-axis and a logarithmic frequency scale.**
  - **Determine the cut-off frequency, f_c and the unit gain frequency f_T from the graph. Compare with theoretical values.**
- **Draw the waveform for *Vout=f(t)* at the cut-off frequency, normalize the amplitude to 1.**
- **Draw *Vout=f(Vin)* using the XY-mode for the same frequency.**
- Increase the input voltage to 200mV peak-to-peak.
- Repeat the frequency sweep as above.
  - **Draw all the three graphs as above in the same diagram as before.**
  - **Determine the cut-off frequency and compare with theoretical value.**
- **Explain the results you have achieved. Comment observed difference in all graphs.**

1.2 Inverting Amplifier and Offset compensation

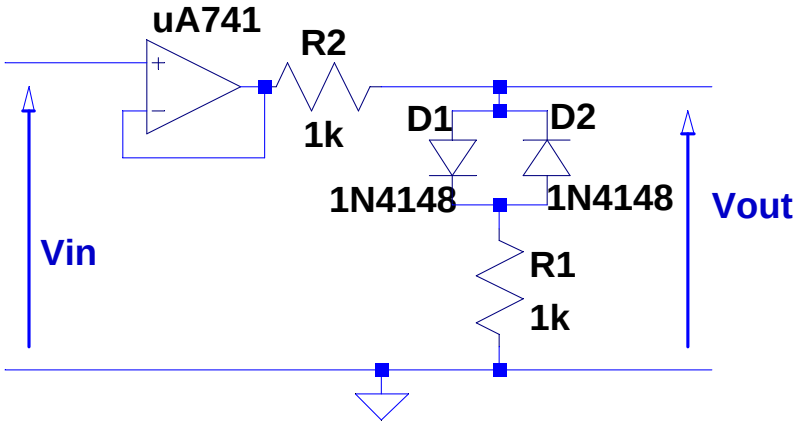
With this circuit the inverting amplifier and the influence of off-set should be studied.



- Connect the inverting amplifier according to the figure
- **Calculate the theoretical gain and verify it against the measured gain. Present both values.**
- Ground *Vin* and measure *Vout*.
  - **Explain by theoretical calculations which offset are dominating, V_{IO} or I_{IO} and present the values using the values given in the data-sheet.**
- **Compensate the offset by adding an external potentiometer according to the data-sheet.**

1.3 Voltage follower and feed-back

This circuit uses a voltage follower driving a non-linear circuit. Feed-back should be used to improve the linearity for the circuit.



- Connect the voltage follower with additional load circuit according to the figure
- Connect the signal generator to *Vin*. Set the amplitude to 5V peak-to-peak and the frequency to 500 Hz.
- **Draw the waveform for *Vin=f(t)* and *Vout=f(t)*.**
- **Draw *Vout=f*(*Vin*) using the XY-mode for the same frequency.**
- Use the principle of feed-back to eliminate the nonlinear response.
- **Draw the waveform and *Vout=f*(*Vin*) in the same graphs as before.**

2 Documentation

The lab should be documented as a in word or some other word-processor. Graphs for *H(f)* should be computer generated with either excel, Matlab or software you choose. Graphs which is copied from the oscilloscope can either be hand-drawn, photographed or drawn in some software.

Good Luck

/Kent