MANDATORY EXPERIMENTS

Experiment 1

Assume that an op-amp with some unknown performance metrics is available. Propose some experiments to measure

(a) The input resistance of the op-amp.

(b) The output resistance of the op-amp.

(c) The saturation voltage of the op-amp.

(d) The saturation current of the op-amp.

(e) The offset of the op-amp.

(f) The slew rate of the op-amp.

(g) The bandwidth-gain product of the op-amp.

Experiment 2

In a circuit design, we need to cascade an inverting and a non-inverting amplifier to get the overall gain of $G_{tot} = G_{inv}G_{nnv}$.

(a) From analytical point of view, is there any difference to change the order of the cascaded amplifiers?

Experiment 2 continued on next page. . .

(b) From practical point of view, is there any difference to change the order of the cascaded amplifiers? Justify your answer using PSpice simulation.

Experiment 3

Op-amps usually need a pair of positive and negative DC supply voltages $\pm V_s$.

(a) What happens if the absolute values of the supply voltages differ?

(b) Is it possible to use an op-amp with the supply voltages 0 and $+V_s$? Explain.

BONUS EXPERIMENTS

Experiment 4

A Zener diode is a special type of diode designed to be used with a positive voltage at the cathode with respect to the anode; when connected this way, the diode is said to be reverse biased. For low voltages, the diode acts like a resistor with a small linear increase in current flow as the voltage is increased. Once a certain voltage (V_{BR}, known as the reverse breakdown voltage or Zener voltage of the diode) is reached, the voltage does not significantly increase further, but essentially any current can flow up to the maximum rating of the diode (75 mA for a 1N750, whose Zener voltage is 4.7 V). Now, consider the circuit of Fig. 1 having a 1N750 Zener diode.

(a) Assuming $V_{bat} = 9$ V, find R_{ref} for 50 percent of the maximum rated current as a rule of thumb.

(b) Calculate the output voltage of the Op Amp, v_{out}.

(c) Tune the circuit by assigning proper values to R_1 and R_f to provide a 10 V regulated output voltage.

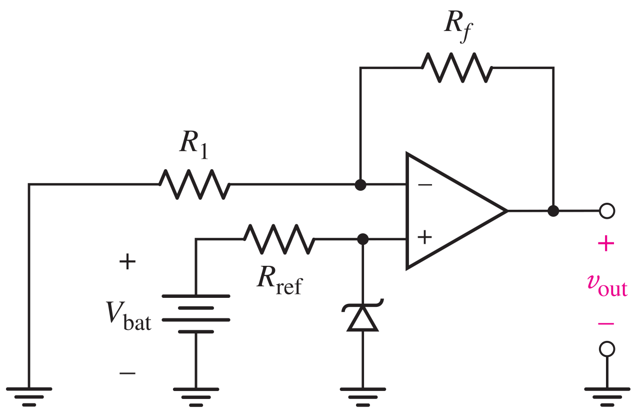

Figure 1: An Op Amp-based regulated voltage source.

Experiment 5

Return your answers by filling the LaTeX template of the manual.