

### **Lab 3**

#### **Linear regulators - part 2**

In this lab you will build a better discrete component regulator and configure an IC regulator with a bypass transistor.

#### **Pre-lab**

1. Design the discrete component regulator, including a selection of the maximum and foldback current and associated components.
2. Consider how adding a output resistor on the op-amp might limit the op-amp current.
3. Design the LM 317 circuit including selection of the resistor.

#### **A better linear regulator**

1. Begin with the linear regulator from the previous lab and improve it by adding an op-amp to drive the output transistor (the circuit will look like the 723 regulator).
2. Verify that the output voltage equals the Zener voltage.
3. Add a foldback current limiter. Select the maximum current and the foldback current. The op-amp can supply a significant amount of current which may bypass through the current limiter transistor to the output. Try adding a resistor on the op-amp output to limit the current. Does that work?

#### **Bypass transistor**

4. Use the LM 317 5 V regulator circuit from the previous lab, and add a bypass PNP transistor which turns on at a small current, 10 to 20 mA.
5. Measure the current through the LM 317 and through the transistor for several different loads to verify the operation.