Operational Amplifiers II

Equipment

- Protoboard Workstation
- Digital Oscilloscope

Objective

Understand operational amplifiers (op amps)

- Negative feedback circuits with reactive elements
- Comparators
- Positive feedback and hysteresis

Conceptual (C-level)

Explain these practical op amp suggestions.

- Using a diode to connect an op amp to its negative voltage supply.
- Placing bypass capacitors from the op amp supply voltages to ground.

A simple op amp (with no feedback) really just compares the voltages present at its inputs. Assume you have an op amp with one input held at ground and the other input has a triangular wave applied to it.

- Sketch the output waveform.
- Modify your proposed circuit to create hysteresis. Sketch the output waveform.
- Explain the benefits of hysteresis.

Basic Lab (B-level)

Construct an integrator (see figure 7.15)

- Verify your circuit - quantify the output with your chosen RC value

Construct a differentiator (see figure 7.16)

- Verify your circuit - quantify the output with your chosen RC value

Construct an inverting comparator circuit with hysteresis (see figure 7.30)

- Verify your circuit - quantify the output

NOTE: Using a waveform generator with triangle, square and sine waves is very useful.

Advanced/Extended Lab (A-level)

Investigate the voltage and current offset compensation for an op amp (see section 7.10). Include schematic diagrams and quantitative measurements.

- Determine and compensate for the offset current.
- Determine and compensate for the offset voltage.

Theoretically analyze, demonstrate and characterize exponential and logarithmic amplifiers. You will need to use the exponential diode current-voltage law (which is also the basis of the Ebers-Moll transistor model).

Substitutions may be considered.