Topic 21 Electronics

Summary

- A comparator incorporating an operational amplifier (op-amp) enables a particular voltage level to be monitored, indicating whether the voltage is above or below a specified value.
- Low-value potential differences may be amplified using an amplifier incorporating an op-amp.
- Negative feedback reduces the gain of an amplifier but provides stability and increased bandwidth.
- The gain of an inverting amplifier is $-R_F/R_{in}$
- The gain of a non-inverting amplifier is $(1 + R_F/R_1)$
- A relay is used to control a large-value current/voltage by means of the low current/voltage output of a processing unit.
- A light-emitting diode (LED) is used to indicate the state (high or low, on or off) of the output of a processing unit.
- Digital and analogue meters may be used to measure the output of a processing unit. Meters need to be calibrated in order to measure the quantity that is being monitored.

Definitions and formulae

- Properties of an ideal amplifier:
- infinite input impedance
- zero output impedance
- infinite open-loop gain
- infinite bandwidth
- infinite slew rate.
- Op-amp used as a comparator $V_{out} = A_0(V^+ - V^-)$
- Voltage gain = V_{out}/V_{in}
- Negative feedback reduces the overall gain of an amplifier circuit to be less than the open-loop gain.
- Negative feedback increases the bandwidth, reduces distortion and gives greater stability.
- Gain of inverting amplifier $V_{out}/V_{in} = -R_F/R_{in}$
- Gain of non-inverting amplifier $V_{out}/V_{in} = 1 + (R_F/R_1)$