AQA A-Level Physics

13.4 Operational amplifier

Flashcards

How can the gain of an operational amplifier be controlled?

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By negative feedback; if some of the output voltage is fed back to the inverting input then the voltage gain can be altered to a lower value.

How does the inverting amplifier make use of negative feedback?

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It amplifies signals by a factor equal to the ratio of the feedback resistance to the resistance of the input resistor at the inverting input, the output is inverted:

$$A_{CL} = V_{out} / V_{in} = -R_f / R_{in}$$

How is the closed loop gain given for a non-inverting amplifier?

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$$A_{CL} = V_{out} / V_{in} = 1 + (R_f / R_1)$$

Where R_f and R_1 are resistors that form a potential divider network in negative feedback.

State one use of operational amplifiers.

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They can be configured to add two or more voltages and to subtract one voltage from another.

State the equation used for summing amplifier configurations.

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$$V_{out} = -R_f\left(\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3}\right)$$

Image: Collins

The Vs represent the 3 inputs to the inverting input and the Rs are the input resistors. R_f is the feedback resistor.

How is V_{out} for a difference amplifier configuration given?

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$$V_{out} = (V_+ - V_-)\frac{R_f}{R_1}$$

What is meant by virtual earth and virtual earth analysis?

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The input to the inverting input is a virtual earth as, although it isn't connected directly to 0V (earth), its value is very close. Virtual earth analysis is using a virtual earth (steady reference potential without being connected to a reference potential) to analyse a circuit.

Define the gain-bandwidth product.

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Gain x bandwidth = constant

Bandwidth means the range of frequencies for which the gain is uniform.

Unit: Hz.