

$$A_{cl} = 1 + \frac{R_f}{R_i}$$

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Operational Amplifiers

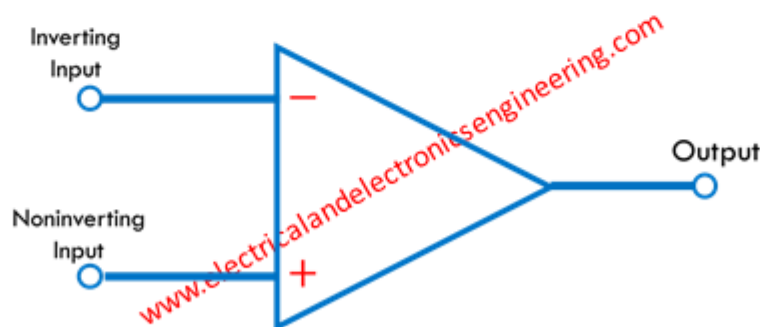
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Operational Amplifier

The operational amplifier is a three terminal voltage amplification device which is widely employed in electronic circuits.

Operational amplifier is usually employed with external components such as resistors and capacitors that are connected between its input and output terminals. Using different configurations an op-amp can be used to perform mathematical operations such as addition, subtraction, integration, and differentiation. This is the reason for giving name operational amplifier.

The figure below displays the schematic diagram of operational amplifier.



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Basic Terms

Voltage Gain

The ratio of output voltage to input voltage is known as voltage gain

$$A_v = \frac{V_o}{V_{in}}$$

Input Impedance

The input impedance is the impedance seen by source driving that input of op amp. A low impedance is not good and can have adverse effect on output of amplifier.

Bandwidth

The useful range of frequencies for which the input passes to output

Output Impedance

The output impedance is the internal output impedance that causes a voltage drop within the op-amp. An op-amp is desired to possess small output impedance so that it doesn't drive the load



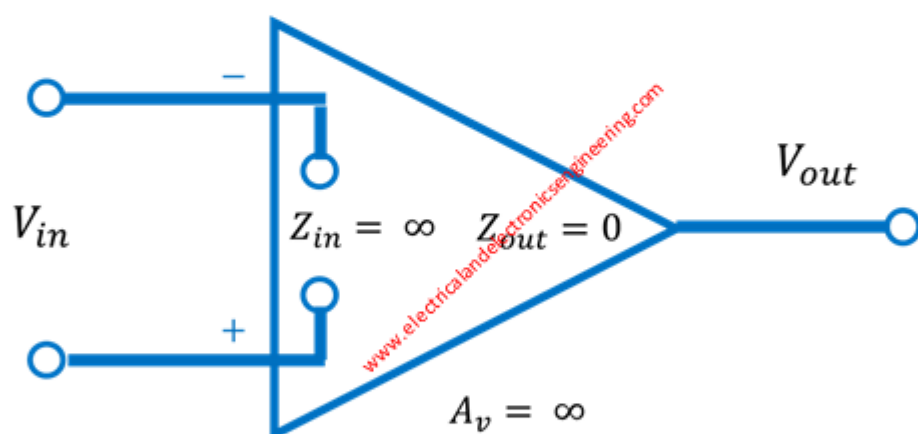
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The Ideal Op-Amp

The ideal op-amp posses following characteristics:

1. Infinite Voltage Gain
2. Infinite input impedance
3. Infinite bandwidth
4. Zero Output Impedance



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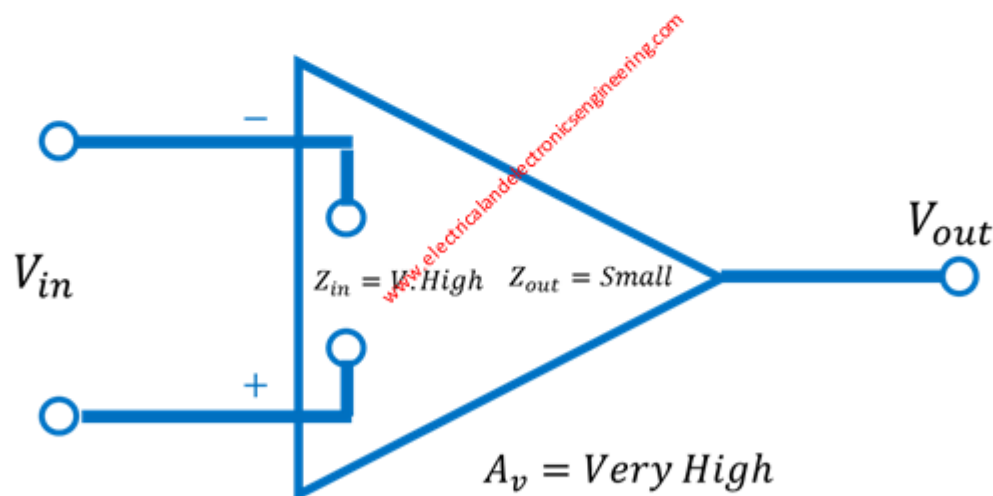
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The Practical Op-Amp

The characteristics of ideal op-amp discussed previously cannot be actually obtained.

However it is often desired to reach as close as possible to obtain the ideal device. The practical op-amp has following characteristics:

1. High Voltage Gain
2. High input impedance
3. High bandwidth
4. Small Output Impedance



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Open Loop Operational Amplifier

The open loop operational amplifier is the amplifier which operates without any external feedback components.

The open loop voltage gain of an operational amplifier is very high. This can lead towards instability when certain input is applied.

Due to this reason operational amplifiers are always employed with some sort of feedback circuit.



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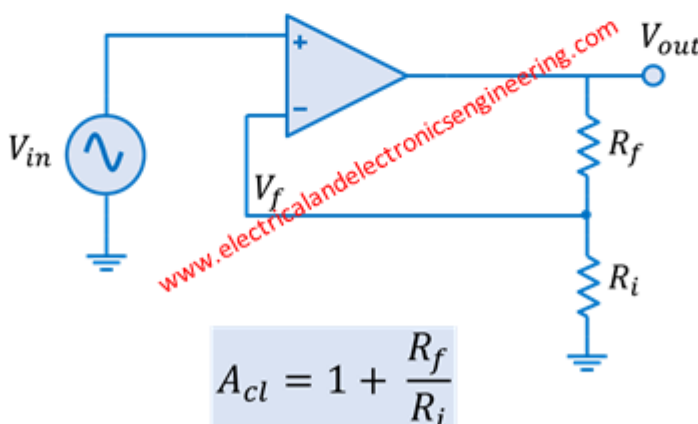
Op-Amp & The Feedback

Feedback is the process in which a portion of output is fed back to the input. There are two types of feedback in this case:

1. Negative feedback
2. Positive feedback

Of both the negative feedback is of practical importance. In Electrical and Electronics Engineering the negative feedback refers to the process in which the output is fed back to input at an angle that is opposite to input signal.

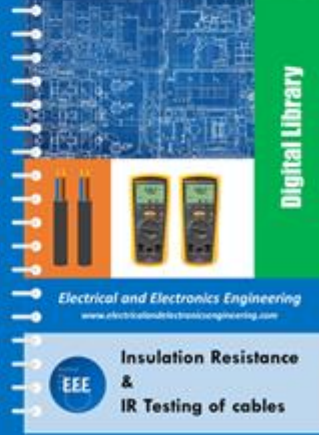
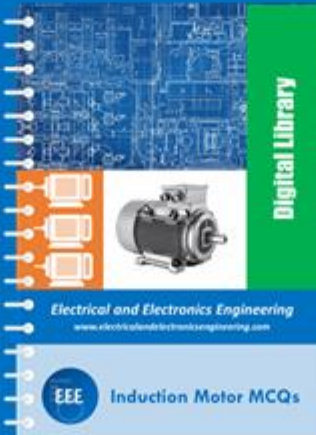
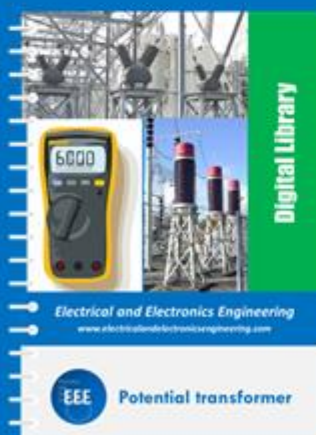
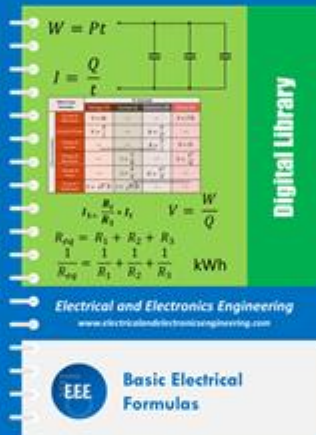
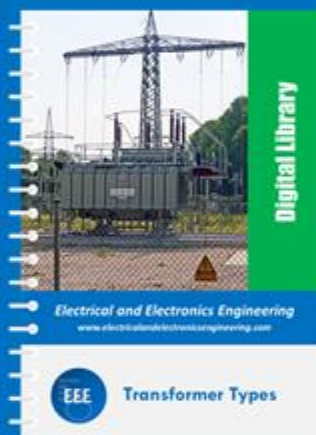
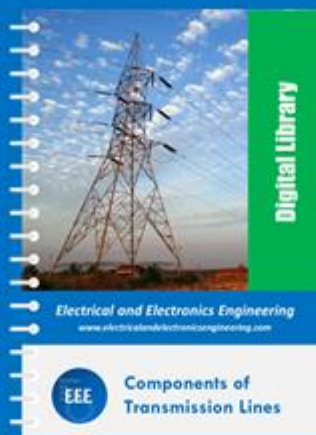
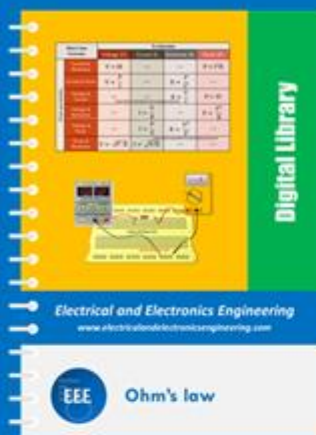
The figure below displays the negative feedback applied to an op-amp using a voltage divider circuit, and its voltage gain equation:



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