Review Paper on Different types of Amplifier & its Applications

Ashish Kumar, Khuspreet Singh, Rajveer Singh
Poornima College of Engineering, Jaipur

***Abstract*- An amplifier is used to increase the power of a signal. This is done by using energy from a power supply and controlling the output to match the signal input's shape but with larger amplitude. Amplifiers can be used to improve the quality and resolution of TVs, DVRs, computer monitors, set-top boxes and video signals from security cameras. Operational amps are very widely used in electronic devices and can be found in several consumers, industrial and scientific applications and are widely used as building blocks for circuit design. Once you choose the amplifier category, you can narrow them down by various attributes: by gain, output power, nominal gain bandwidth.**

***Index Terms*- op-amps, instrumentation, isolation, charge amplifier and applications.**

I. INTRODUCTION

An amplifier is an electronic device that increases the power of a signal.It does this by taking energy from a power supply And controlling the output to match the input signal shape but with larger amplitude. In this sense, an amplifier modulates the output of the power supply to make the output signal Stronger than the input signal. An amplifier is effectively the opposite of an attenuator: while an amplifier provides gain, . The gain in analog amplifiers is specified in decibels (dB), whereas the gain bandwidth is in

Hertz.An attenuator provides loss The four basic types of electronic amplifiers are voltage amplifiers, current amplifiers, transconductance amplifiers,and transresistance amplifiers. A further distinction is whether the output is a linear or nonlinear representation of theinput.Amplifiers can also be categorized by their physical placement in the signal chain.

II. OPERATIONAL AMPLIFIERS (OP AMPS)

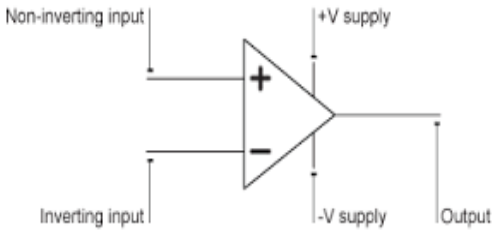
The operational name,is because this type of amplifier can be used in circuits that perform mathematical algorithmic functions, or operations on input signals to obtain specific types of output signals. Modern opamps are usually provided as,integrated circuitsrather than constructed from discrete components. A typical modern opamp has differential inputs (one "inverting", one "noninverting") and one output.An idealised opamp has the following characteristics:-Infinite input impedance,Zero output impedance, Infinite gain & Zero propagation delay.

Operation:-

The amplifier's differential inputs consist of a non-inverting input (+) with voltage V+ and an inverting input (–) with voltage V−; ideally the op-amp amplifies only the difference in voltage between the two, which is called the differential input voltage. The output voltage of the op-amp V' is given by the equation:

$$V' = A^* (V+ - V\_)$$

Where 'A' is the open-loop gain of the amplifier.



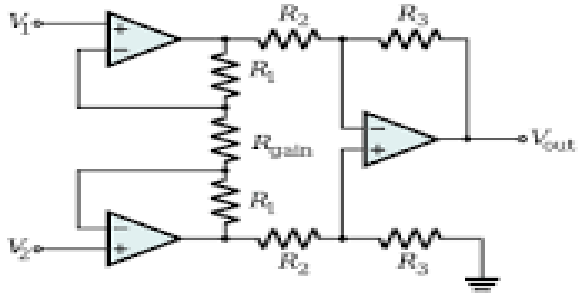
Applications:-

- Use in electronics system design.
- The op-amp is being used as a voltage comparator.
- Audio and video frequency.

- Preamplifiers and buffers differential amplifiers.
- Differentiators and integrators. .
- Precision rectifiers and filters.
- Precision peak detectors.
- Voltage and current regulators
- Analog calculators.
- Analog to digital converters.
- Digital to analog converters.
- Voltage clamping.
- Oscillators and waveform generators.

III. INSTRUMENTATION AMPLIFIER

An instrumentation amplifier is a type of differential amplifier that has been outfitted with,input buffer amplifiers, which eliminate the need for input impedance matching and thus make the amplifier particularly,suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, lowdrift,low noise, very highopen-loop gain, very highcommon-mode rejection ratio, and very high input impedances.Instrumentation amplifiers are used where great accuracy and stability of the circuit both short and long-term are required.



Advantages of instrumentation amplifier:

- The gain of the instrumentation amplifier can be varied by just varying resistors in input circuit without affecting the resistors in difference amplifier circuit.
- High CMMR.
- High input resistance.

Applications:-

- In Data acquisition from low output transducers such as strain gauges.
- Thermocouples, Wheatstone bridge measurements etc.
- In Medical, Navigation, Radar instrumentation etc.
- In Audio applications involving low amplitude audio signals in noisy.
- Environments to improve the signal to noise ratio.
- High speed.
- Signal conditioning for video data acquisition and imaging.
- High frequency signal amplification in cable RF systems.

IV. ISOLATION AMPLIFIER

Isolation amplifiers are a form of differential amplifier that allows measurement of small signals in the presence of a high common mode voltage by providing electrical isolation and an electrical safety barrier. They protect data acquisition components from common mode voltages, which are potential differences between instrument ground and signal ground. Isolation amplifiers are used in medical instruments to ensure isolation of a patient from power supply leakage current. These amplifiers are also used for amplifying low-level signals in multi-channel applications. They can also eliminate measurement errors caused by ground loops. Amplifiers with internal transformers eliminate external isolated power supply. They are usually used as analogue interfaces between systems with separated grounds

Operating principles:-

Isolation amplifiers are commercially available as hybrid integrated circuits made by several manufacturers. There are three methods of providing isolation.

A transformer-isolated amplifier relies on transformer coupling of a high-frequency carrier signal between input and output. Some models also include a transformer-isolated power supply that may also be used to power external signal processing devices on the isolated side of the system. The bandwidth available depends on the model and may range from 2 to 20 kHz. The isolation amplifier contains a voltage-to-frequency converter connected

through a transformer to a frequency-to-voltage converter. The isolation between input and output is provided by the insulation on the transformer windings.

An optically-isolated amplifier modulates current through an LED op to coupler. The linearity is improved by using a second op to coupler within a feedback loop. Some devices provide up to 60 kHz bandwidth. Isolation is provided by the layer of

Carrier signal. Some models on this principle can stand off 3.5 kilovolts and provide up to 70 kHz bandwidth. transparent glass or plastic between the LED and detector.

A third strategy is to use small capacitors to couple a modulated high-frequency carrier; the capacitors can stand off large DC or power frequency AC voltages but provide coupling for the much higher frequency

Application:-

- Stacked voltage cell measurement.

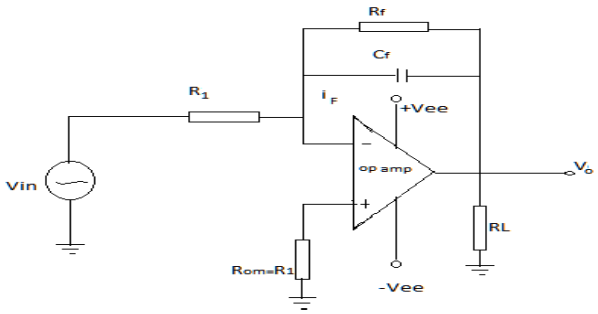
Stacked voltage cell measurements illustrate the need for an isolation amplifier. Stacked voltage cell measurements are common with the growing popularity of solar cells and fuel cells. In this application the technician wants to profile the performance of individual series-connected voltages cells, but the need for an isolated amplifier is often overlooked. Each voltage cell is removed from ground by an amount equal to the sum of the voltage cells below it. Unless the amplifiers used to measure individual cell voltages are allowed to float at a level equal to the common mode voltage measurements are not likely to be accurate for any but the first cell in the string where the common mode voltage is zero. A non-isolated differential amplifier can be used but it will have a rated maximum common mode voltage that cannot be exceeded while maintaining accuracy.

V. CHARGE AMPLIFIER

A charge amplifier is a current integrator which produces a voltage output proportional to the integrated value of the reference capacitor, and produces an output voltage inversely proportional to the value of the reference capacitor but proportional to the total input charge flowing during the specified time period, hence the circuit acts as a charge to voltage converter. The gain of the circuit depends on the value of the feedback capacitor.

Design:-

Charge amplifiers are usually constructed using an operational amplifier or other high gain semiconductor circuit with a negative feedback capacitor. The input current is offset by a negative feedback current flowing in the capacitor, which is generated by an increase in output voltage of the amplifier. The output voltage is therefore dependent on the value of input current it has to offset and the inverse of the value of the feedback capacitor. The greater the capacitor value, the less output voltage has to be generated to produce a particular feedback current flow. The input impedance of the circuit is almost zero because of the Miller effect. Hence all the stray capacitances (the cable capacitance, the amplifier input capacitance etc.) are virtually grounded and they have no influence on the output signal.



Applications:-

- Accelerometer signal conditioning.
- Guitar pickup amplifiers.
- Vibration transducers.
- Proportional counter - measurement of ionizing radiation.
- Scintillation counter- measurement of ionizing radiation.
- Piezoelectric sensors and photodiodes in which the charge output from the transducer is converted into a voltage.
- Charge amplifiers are used extensively in instruments measuring ionizing radiation
- Charge amplifiers are also used in the readout circuitry of CCD imagers and flat panel X-ray detector arrays. The objective is to measure the very small charge stored within an in pixel

VI. CONCLUSION

Amplifiers are described according to their input and output properties.They exhibit the property of gain or,multiplication factor that relates the magnitude of the output signal to the input signal.They have many applications to amplifying voltage, current, power and frequency.

VII. FUTURE SCOPE

In renewable energy sources to improve their efficiency like in solar system opamp used in inverter. Stacked voltage cell measurements are common with the growing popularity of solar cells and fuel cells and Isolation amplifiers provide electrical safety.

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