TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

PURWANCHAL CAMPUS

Dharan-8

A Lab Report On: Instrumentation and Differential Amplifier

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TITLE: INSTRUMENTATION AND DIFFERENTIAL AMPLIFIER

APPARATUS REQUIRED

1. Instrumentation and Differential Amplifier Kit
2. Connecting Wire

THEORY

Instrumentation Amplifier is type of differential amplifier that has been outfitted with input buffer amplifiers which eliminates the need for input impedance machine and thus making the amplifier suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, low drift, low noise, very high open-loop gain, very high input impedance. Instrumentation amplifiers are used where great accuracy and stability of the circuit both short and long term is required.

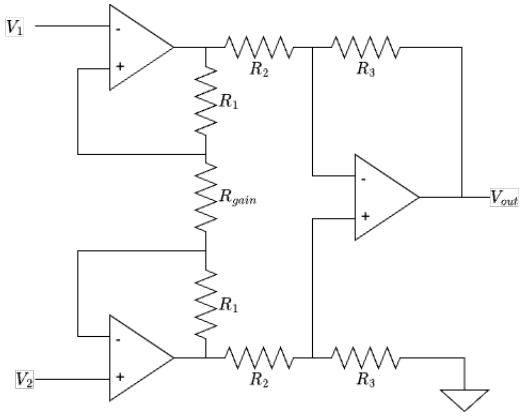

Fig: Instrumentation Amplifier Schematic

$$A_v = \frac{V_{out}}{V_2 - V_1} = \left(1 + \frac{2R_1}{R_{gain}}\right)\frac{R_3}{R_2}$$

To convert the change in resistance of the strain gauge into a voltage output, we use wheatstone bridge circuit. The three resistance in the circuit have same resistance as the nominal (unstrained) value of the strain gauge. So, its output is approximately proportional to the change in resistance **Δ**R

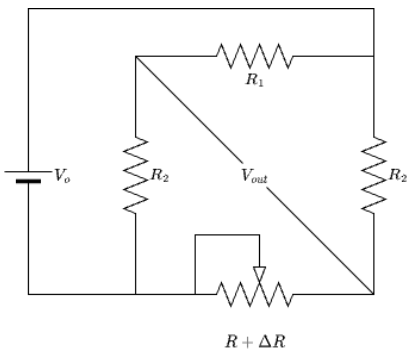

Fig: Wheatstone Bridge

Bridge Balance Condition,

$$\frac{R_1}{R_2} = \frac{R_3}{R + \delta R}$$

PROCEDURE

1. The kit was powered on and all the connecting wires were connected as in the diagram to complete the circuit.
2. The gain of the Op-Amp was calculated by giving a small amount of input voltage and checking at the output.
3. Different Voltages at the input V_1 and V_2 were varied and data was taken to calculate V_{out} and Voltage Gain (A_v).
4. Similarly in Wheatstone Bridge Circuit the voltage across R_1 was varied and output readings were taken.

OBSERVATION

SN	V_1	V_2	V_{out}	$A_v = \frac{V_{out}}{V_1 - V_2}$	Remarks
1	0	0	-3.22	-3.22	
2	1	1	-1.0	∞	
3	2	1	-4.24	-4.24	
4	3	1	-7.53	-3.765	
5	4	1	-10.76	3.59	
6	5	1	-13.16	-3.29	

For Wheatstone Bridge

SN	V_{R1}	V_{out}
1	1	-2.77
2	2	-2.41
3	4	-1.91
4	6	-1.51
5	8	-1.21
6	8.9	-1.10

PRECAUTIONS

1. All the wires should be connected properly.
2. Wrong connection can lead to bad value & towards the failure of the experiment
3. On setting the voltage V_1 & V_z we must carefully connect to the instrumental amplifier according to the circuit diagram & the rotation buttons should be rotated with care.
4. All the voltages can be cross checked by external multimeter

DISCUSSION AND CONCLUSION

In summary by using instrumental amplifier, we can have high amount of gain for very low lever signals, often in the presence of high noise levels.

On conclusion, we have successfully used instrumental amplifier & instrumentation amplifier with transducer (Wheatstone) bridge and find out different voltage gain (ΔV) and V_{out} according to the change in V_{R1} in KΩ.