

# Implementation of Instrumentation Amplifier for ECG System Application

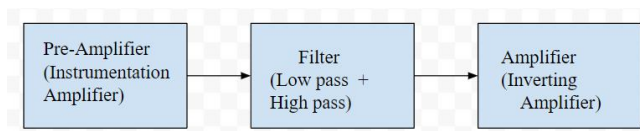
MANSI SHUKLA, International Institute of Information Technology, NAYA RAIPUR

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**Abstract**—An instrumentation amplifier is a type of integrated circuit (IC) that is primarily used for signal amplification. The signal energy at the input to the instrumentation amplifiers will be extremely low. As a result, the instrumentation amplifier needs to be precise and have a high gain with a single control, the gain should be easily adjustable. Because common mode signals like as noise are commonly present in transducer output when transmitted over long lines, the instrumentation amplifier should have a high CMRR. It must also have a high slew rate in order to accommodate rapid event rise times and offer the most not distorted output voltage swing possible. To avoid loading, it must have both a high input and a low output impedance.

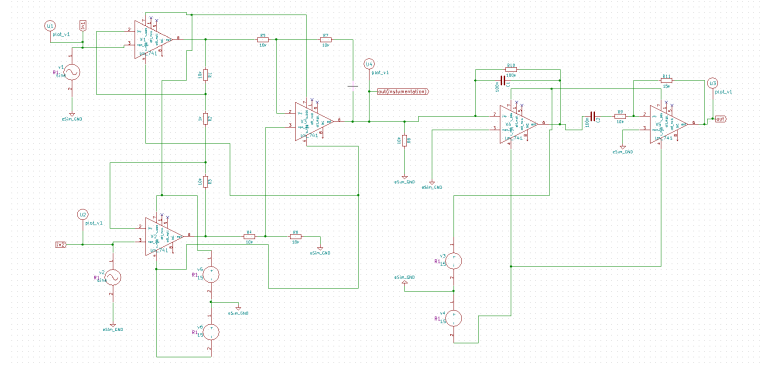
## I. INTRODUCTION

An Electrocardiogram or ECG is an instrument that is used to monitor the electrical activity of a heartbeat. It takes measurements and examines the flow of electricity from each heartbeat. ECG measurements are taken by attaching leads to the skin of the patient because of the physical constraints of monitoring the heart through the surface of the skin, detectable signal is incredibly small and electrical noise can be relatively large this means the real world ECG instruments use amplifiers and filters to condition the signal amplifiers, Amplifiers converts energy from a power source to increase the amplitude of an input signal. A common way to rate this magnification is the ratio of voltage measured at the output port to voltage measured at the input port this ratio is typically refer to as gain. There are many type of amplifiers like inverting amplifier, non-inverting amplifier, differential amplifier, instrumentation amplifier etc. Here we are using Instrumentation amplifier, it combines properties like DC offset, very high input impedance and high common mode rejection which is the rejection of unwanted input signal common to both input leads. Often with instrumentation amplifiers they are constructed so that all the resistors have the same value except for  $R_{gain}$ , then  $R_{gain}$  is adjusted to change the properties of the amplifiers. Instrumentation amplifiers have the benefit that they don't draw current from sources being measured.

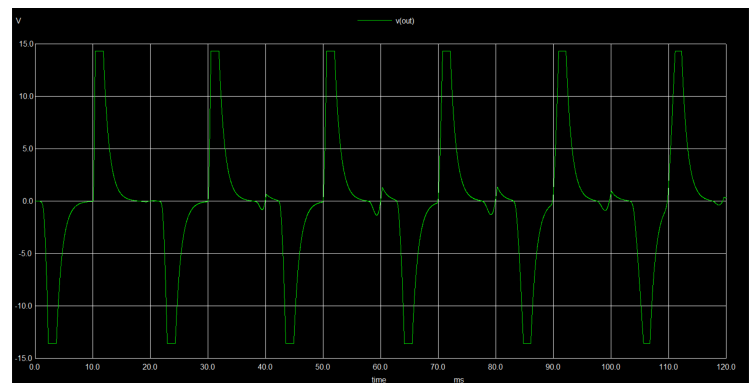


Fig(a): Block Diagram representation of Reference Circuit

## Implemented Circuit



## Output Waveform:



## References:

[1] Xiu, Limei, and Zheyang Li. "Low-power instrumentation amplifier IC design for ECG system applications." *Procedia Engineering* 29 (2012): 1533-1538.

[2] <https://www.youtube.com/watch?v=kiG7CyyRlcl&t=77s>