

Analog Computer

1 Introduction

This project, titled 'Analog Computer', aims to explore and demonstrate the functionality of op-amp circuits in performing fundamental analog computations – addition, subtraction, and multiplication. The utilization of these analog operations holds immense potential in the field of analog signal processing. The project will dive into the design and implementation of analog adder, subtractor, and multiplier circuits, analysing their underlying principles and practical applications. By successfully executing this project, we will not only grasp the intricacies of analog electronics but also underscore their relevance in contemporary signal manipulation techniques

2 Requirements

- Required Operations:
 - Addition
 - Subtraction
 - Multiplication
- Analog Computing Principles: Utilize operational amplifier (op-amp) circuits for implementing the desired operations. Design dedicated circuits for each operation, considering appropriate signal conditioning and biasing.
- Frequency Range: The device should be able to perform computations on waveforms within the frequency range of 1 Hz to 10 kHz.
- Addition and Subtraction: Create separate analog adder and subtractor circuits. The circuits must handle both positive and negative input voltages and produce accurate results within the specified frequency range
- Multiplication: Design an analog multiplier circuit capable of accurately multiplying two input waveforms. The multiplier should have a controllable gain and be operational within the specified frequency range.

- **Input and Output:** Provide dual-channel input interfaces for each operation. The input interfaces should accept waveforms within the specified frequency range and ensure proper impedance matching. Output interfaces must deliver computed results with minimal distortion.
- **Control Interface:** Implement control mechanisms for adjusting gain, biasing, and operation mode (addition, subtraction, multiplication). Consider using potentiometers or digital control for user-friendly manipulation.
- **Accuracy and Precision:** Aim for high accuracy and precision in the computed results. Minimize signal distortion, noise, and non-linearities to achieve reliable analog computation.
- **Power Supply:** Design a stable and clean power supply system to ensure consistent operation of the op-amp circuits. Include appropriate filtering and regulation to minimize interference.

3 Additional Rules

- Any change of the above specifications is negotiable only before the mid review.
- All the circuits should be simulated using software before the implementation.
- It is allowed to use an external PCB manufacturer for producing the circuits, and no marks will be reduced or added.
- Using any other pre-built ICs (other than transistors and op-amps) are prohibited.
- Regardless of the method of PCB manufacture, the full set of output files required to mass produce the PCBs, to assemble the circuit and to package it is required.
- Follow provided “General guidelines”.