

ELEX 3120/3321: Electric Circuits 2

LAB 3 – Amplifiers

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# Introduction

In this lab, we explore the design and performance of three amplifier circuits: a non-inverting amplifier with a gain of 5 V/V, an inverting amplifier with a gain of -5 V/V, and a non-inverting adder. Using TL-084 op-amps and ±10V power supplies, we measure outputs across various input voltages and compare these results with theoretical predictions to understand amplifier behavior.

# Non-Inverting Amplifier

## Design of Amplifier



Figure 1 - Schematic of Non-Inverting Amplifier

## Predicted and Measured Circuit Values

|  |  |  |
| --- | --- | --- |
|  | Predicted | Measured |
| Ri [kΩ] | 1 | 0.98 |
| Rf [kΩ] | 4 | 3.93 |
| Vin [V] | Vout [V] | Vout [V] |
| -0.5 | -2.5 | -2.52 |
| 0.5 | 2.5 | 2.50 |
| 0.75 | 3.75 | 3.75 |
| 2 | 10 | 8.94 |

Table 1 - Predicted and Measured Circuit Value of Non-Inverting Amplifier

# Inverting Amplifier

## Design of Amplifier



Figure 2 - Schematic of Inverting Amplifier

## Predicted and Measured Circuit Values

|  |  |  |
| --- | --- | --- |
|  | Predicted | Measured |
| Ri [kΩ] | 1 | 0.98 |
| Rf [kΩ] | 5 | 5.31 |
| Vin [V] | Vout [V] | Vout [V] |
| -0.5 | 2.5 | 2.48 |
| 0.5 | -2.5 | -2.53 |
| 0.75 | -3.75 | -3.75 |
| 2 | -10 | -8.95 |

Table 2 - Predicted and Measured Values of Inverting Amplifier

# Non-Inverting Adder

## Design of Adder



Figure 3 - Schematic of Non-Inverting Adder

## Predicted and Measured Circuit Values

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Predicted | Measured |
| Vin1[V] | Vin2 [V] | Vout [V] | Vout [V] |
| 0.5 V DC | 0.3 V DC | 0.8 | 0.91 |
| -1.5 V DC | 1.0 V DC | -0.5 | -0.64 |
| Sine 1kHz, 1V AMP, 0 V offset | 1.0 V DC | Graph | Graph |

Table 3 - Predicted and Measured Circuit Values of Non-Inverting Adder

A diagram of a wave

Description automatically generated

Figure 4 - LTSpice Simulation of Test 3

A screen shot of a graph

Description automatically generated

Figure 5 - Oscilloscope Measurement for Test 3

# Conclusions

In summary, this lab successfully demonstrated the functionality of non-inverting and inverting amplifiers and a non-inverting adder. The measured results closely matched the predicted outputs, confirming the expected gains and validating the design equations used. Minor discrepancies between simulated and actual values highlighted the importance of accurate resistor tuning and careful circuit layout. This hands-on experience provided valuable insights into the behavior of amplifiers, reinforcing theoretical concepts with practical applications in circuit design.