Department of Computer & Software Engineering

CE150L: Linear Circuit Analysis Lab

Lab Project

OP AMP TESTER

Submitted by:

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Requirements / Specifications: The Op Amp Tester project is designed to operate within the following technical specifications:

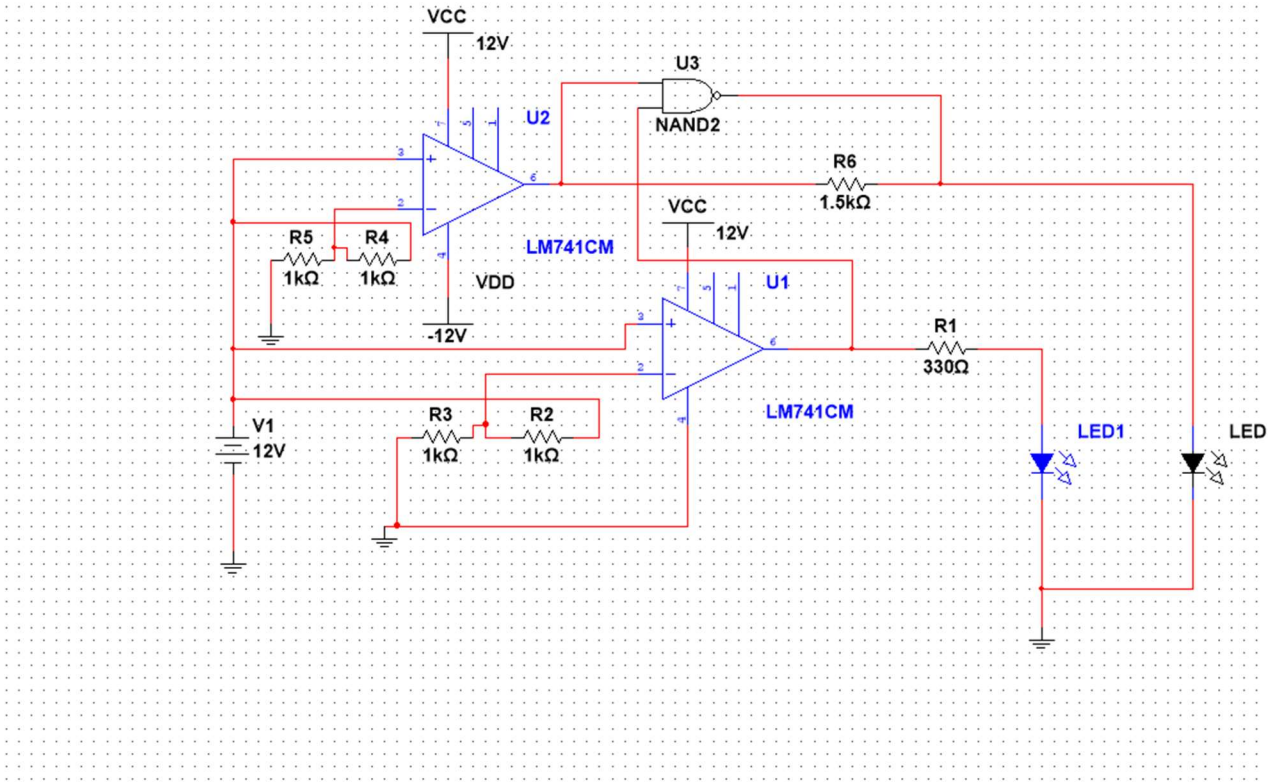
- Power Supply: +12V DC
- Frequency Range: 1 Hz - 1 MHz
- Operating Temperature: 0°C to 50°C
- Active Power Consumption: 100mA
- Reactive Power: N/A

Components Selection:

1. **Nand Gate:** Used for logic operations in the circuit.
2. **1K Resistor (×4):** Current limiting resistors in various parts of the circuit.
3. **1.5K Resistor:** Component for setting specific voltage levels.
4. **330 Resistor:** Part of the LED current limiting circuit.
5. **Green LED and Red LED:** Indicators for operational status.
6. **LM741 (×2):** Operational amplifiers used in the circuit.
7. **IC Socket:** Allows for easy replacement of operational amplifiers.
8. **Other Basic Components:** Wires, connectors, etc.

Remarks:
The selection criteria for resistors are based on their roles in setting voltage levels and current limiting for LEDs. LM741 operational amplifiers were chosen for their versatility and wide usage in various amplifier applications.

Circuit Design & Working:

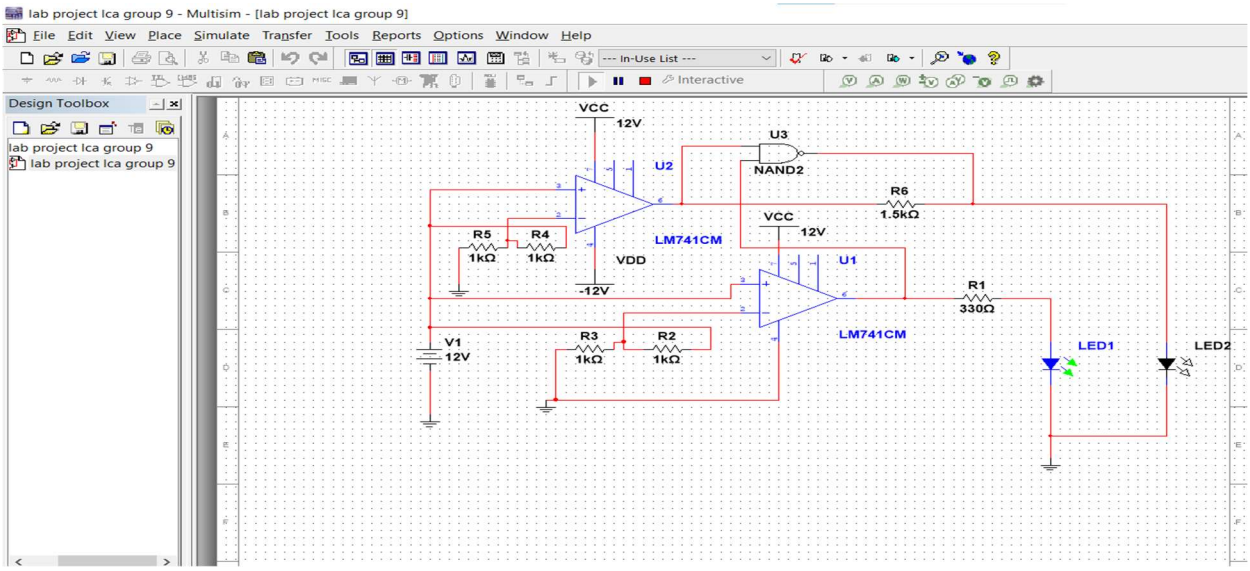


The Op Amp Tester circuit utilizes LM741 operational amplifiers, NAND gates, and various resistors to create a versatile testing tool. The circuit amplifies and processes input signals, providing visual feedback through LEDs.

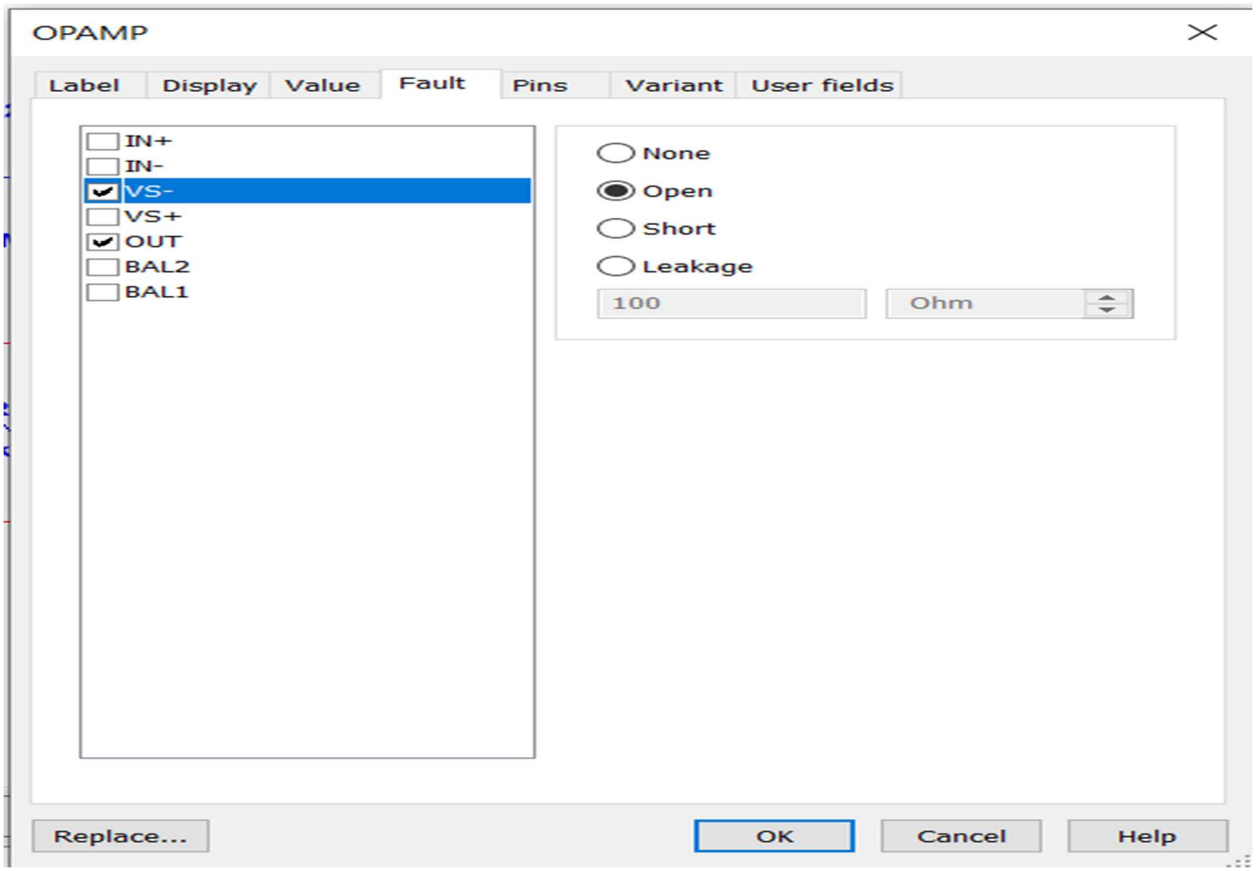
Working:
The input signal is processed through the operational amplifiers and NAND gates, and the resulting output is indicated by the LEDs. The specific functions of each component contribute to the overall testing capability of the circuit.

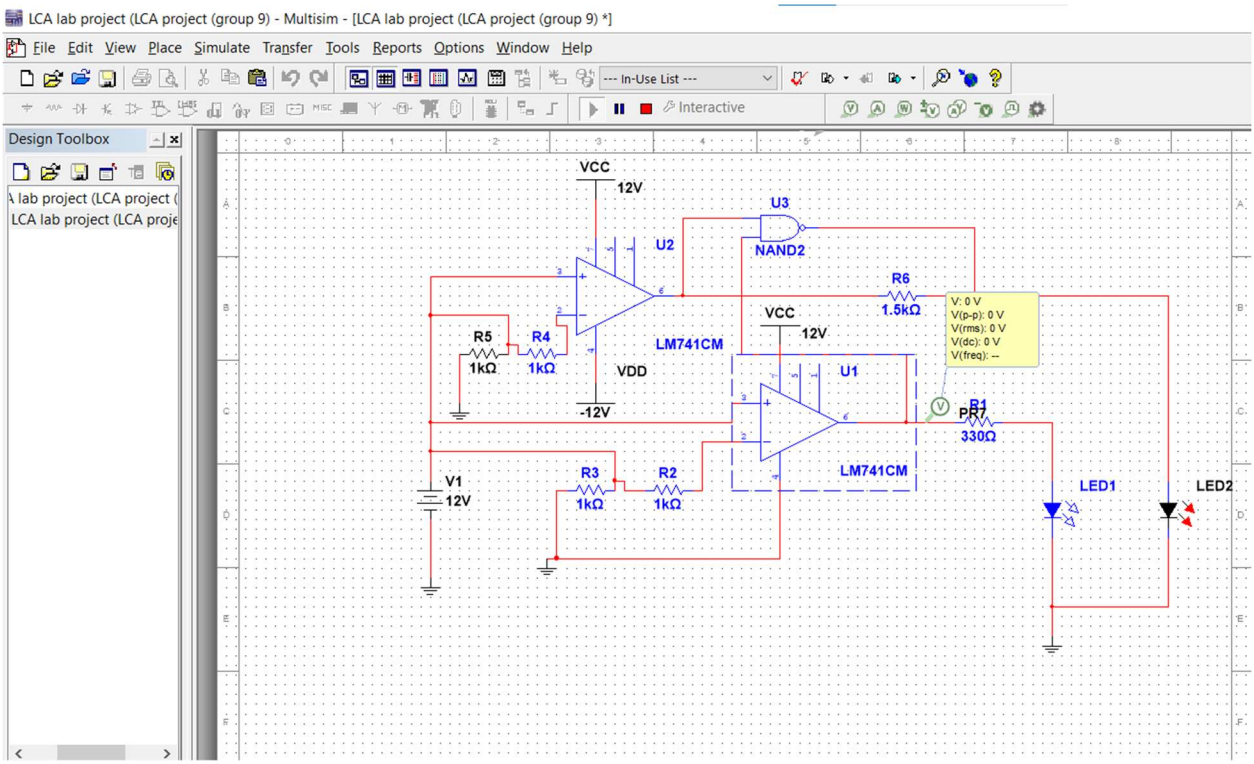
Simulation Results:

BEFORE FAULT:



AFTER FAULT:





Screenshots of simulations conducted for various input scenarios demonstrate the expected behavior of the Op Amp Tester circuit. These results validate the functionality of the designed circuit.

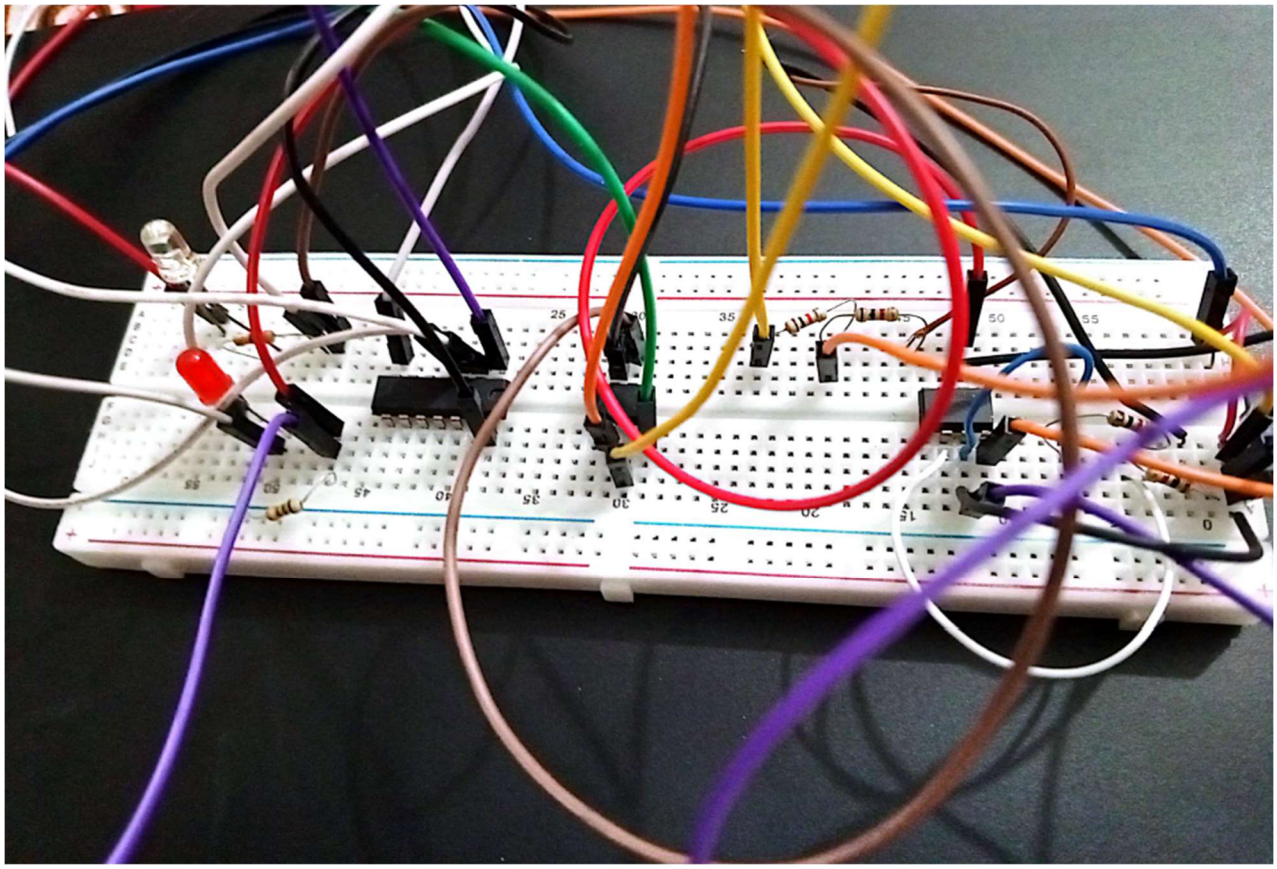
Hardware Implementation:

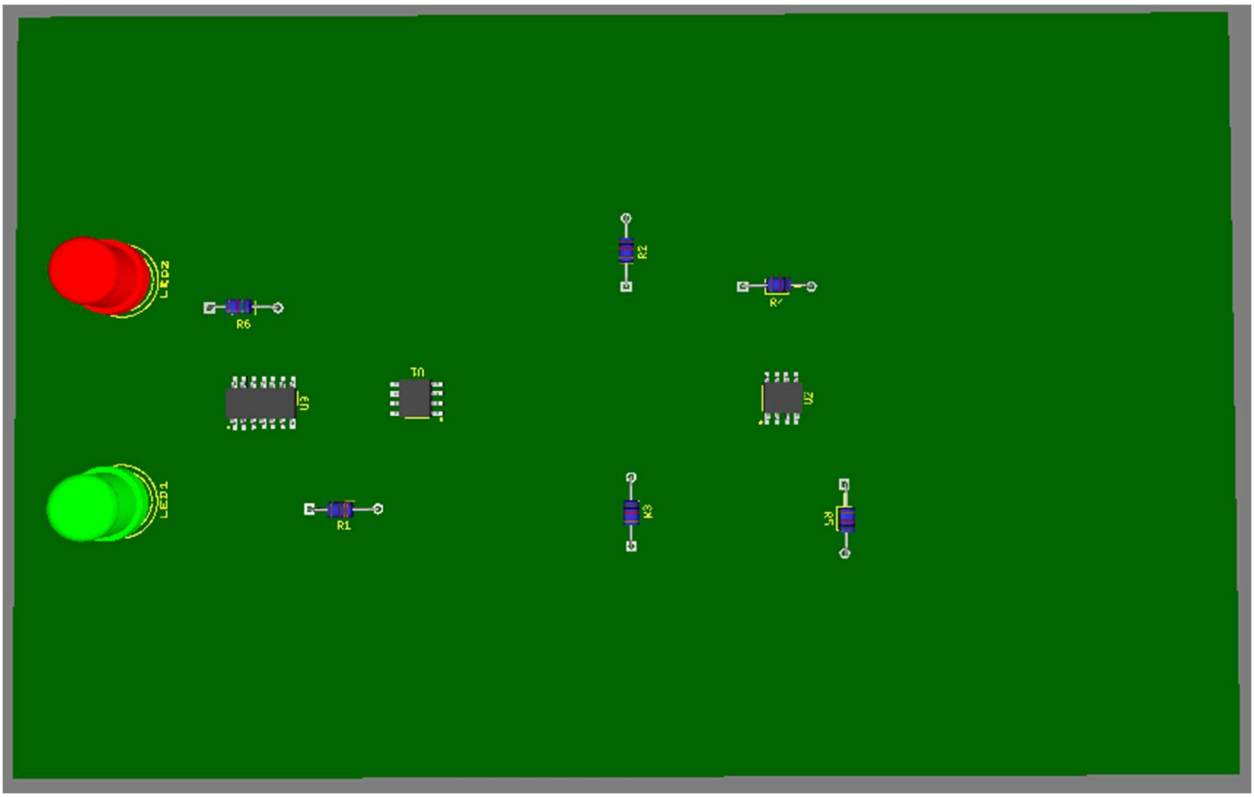
The Op Amp Tester's hardware implementation involves translating the designed schematic into a physical circuit on a veroboard or PCB. Below are the key aspects of the hardware implementation.

1. **Veroboard/PCB Layout:**
    - The components, including LM741 operational amplifiers, NAND gates, resistors, LEDs, and other supporting elements, are strategically placed on the veroboard or PCB.
    - Ensure proper spacing and connections to prevent interference and facilitate ease of assembly.
2. **IC Socket Placement:**
    - IC sockets are used to accommodate LM741 operational amplifiers, allowing for easy replacement in case of component failure or upgrades.
    - Properly align the IC sockets on the board to ensure correct insertion and removal of operational amplifiers.

3. **Wiring Connections:**
    - Connect the components using the specified wiring configuration from the schematic.
    - Pay attention to the orientation of polarized components, such as LEDs and electrolytic capacitors, to avoid incorrect connections.
4. **LED Indicators:**
    - Position the green and red LEDs in a way that makes their status visible to the user.
    - Connect current-limiting resistors of the 330-ohm resistor in series with the LEDs to ensure proper current flow.
5. **Power Supply Connection:**
    - Connect the power supply to the designated points on the circuit.
    - Verify that the voltage levels meet the specified requirements +12V DC.
6. **Testing the Hardware:**
    - Before powering on the circuit, visually inspect the connections to ensure accuracy.
    - Apply power and observe the behavior of the green and red LEDs during testing.

The hardware implementation images showcase the tangible realization of the Op Amp Tester circuit. These visuals provide insight into the physical arrangement of components and the overall layout of the testing tool. The careful execution of the hardware design ensures reliable and efficient performance during operational amplifier testing.





Results:

The Op Amp Tester is designed to provide a clear indication of the operational status of the tested operational amplifier. The results are visually conveyed through two LEDs: a green LED for normal, non-faulty operation and a red LED for faulty conditions.

1. **Normal Operation (Not Faulty):**
    - When a functional operational amplifier is tested, the Op Amp Tester circuit amplifies the input signal appropriately.
    - The output is within the expected range, and the green LED lights up.
    - This indicates that the tested operational amplifier is in good working condition.
2. **Faulty Operation:**
    - In the case of a faulty operational amplifier, the Op Amp Tester detects irregularities in the input signal or amplification process.
    - The output deviates from the expected range, signaling a fault.
    - In response to a faulty condition, the red LED lights up, providing a clear visual indication of the detected fault.

By observing the LED indicators, users can quickly assess the health of the tested operational amplifier without the need for complex measurement equipment. This simple and effective feedback mechanism enhances the usability of the Op Amp Tester, allowing for rapid identification of faulty components during testing.