1. Research Objective

Accurate and Fast measurement of Operational Amplifier

For reliable and low-cost IoT systems

Approach

NULL Method
Minus input voltage of amplifier → Zero potential with servo loop

2. Background

Operational Amplifier

Differential inputs → Single-ended output

Extremely high gain

Key device in IoT systems

Goal

Apply NULL method to mass production testing

3. NULL Method Prototype

Measured Operational Amplifier

Operational Amplifier: Vendor provided

SPICE model

Auxiliary Operational Amplifier

Experimental Circuit using NULL Method

4. SPICE Simulation Verification

< Frequency Characteristics >

Input sine wave (1mVpp, 1kHz)

Change C₁ and C₂

Optimal value: C₁=1nF, C₂=0.1μF

30 times faster

5. Conclusion

- Optimization of phase compensation constants
  \[ C₁ = 1nF, C₂ = 0.1μF \]
  NULL Circuit → Fast and Stable

- Switching C₁ and C₂ depending on the measurement item
  Settling time reduction → \( \approx 1/10 \)

References