Lab 05

Collector Feedback Bias and Voltage Divider Bias BJT Biasing Configurations

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# Objective

To investigate the effect of current gain *β* variation on quiescent operating conditions of a Bipolar Junction Transistor in collector feedback bias and voltage divider bias configurations.

**Note:** Pre-lab (printed or hand-written) should be done on a separate paper (use A4 sheet) and will be submitted at the start of Lab within the first 5 minutes.

# Introduction

In previous lab, the stability of fixed-bias and emitter-bias BJT biasing configurations have been investigated. In this lab, you will investigate the dependency of BJT operating point on DC current gain *β* for two more circuits of BJT biasing; collector feedback bias (with and without emitter resistor) and voltage divider bias configuration.

# Pre-Lab Task

**Task 1:**

1. List down two differences between 2N3904 and 2N4401 in terms of power rating and beta value.

The 2N3904 and 2N4401 are both NPN bipolar junction transistors (BJTs) commonly used in electronic circuits. Here are two differences between them:

**Power Rating:**

**2N3904:** The 2N3904 has a lower power dissipation rating compared to the 2N4401. The typical power dissipation for a 2N3904 transistor is around 625 mW.

**2N4401:** The 2N4401, on the other hand, typically has a higher power dissipation rating, often around 600 to 800 mW. This indicates that the 2N4401 can handle slightly higher power levels without exceeding its maximum rating.

**Beta (Current Gain) Range:**

**2N3904:** The current gain, or beta (hfe), for a 2N3904 transistor typically falls in the range of 100 to 300. Beta is an important parameter that indicates the amplification capability of the transistor.

**2N4401:** The 2N4401, on average, has a higher beta range compared to the 2N3904. It usually falls in the range of 200 to 600. A higher beta allows for greater amplification of the input signal in certain circuits.

1. State advantages and disadvantages of the following transistor biasing configurations and which configuration is most used and why?
   1. Fixed Bias Configuration
   2. Common Emitter Bias configuration
   3. Collector Feedback Bias configuration
   4. Voltage Divider Bias configuration

* Transistor biasing helps with making sure that our operation is operated correctly and ensures the stability of a transistor in electronic circuits. **Fixed Bias Configuration:**

The Fixed Bias Configuration is simple but lacks stability and tolerance to temperature variations. The Common Emitter Bias Configuration provides good stability and voltage gain but requires a higher supply voltage. Collector Feedback Bias Configuration improves stability but is more complex and costly. The Voltage Divider Bias Configuration strikes a balance between simplicity and stability, making it widely used for its good compromise in providing stability over temperature variations and tolerance to transistor parameter changes. It is suitable for applications requiring a high degree of stability without the complexity of other configurations.