Audio Amplifier Lab

Introduction

In this lab, we will attempt to build a simple audio amplifier using a pair of npn transistors. We will learn about properly biasing microphones, use capacitors to block out DC voltages, learn how to properly bias transistors and use transformers to couple the amplifier's output to a low impedance speaker.

Overview and Procedure

Microphone Biasing

Typical microphones used in phone headsets can be modeled as a variable resistor. The resistance of the microphone changes according to the loudness of the audio waves interacting with it. In order to convert this change in resistance to an electric signal, one can connect the microphone in series with another resistor which in turn is connected to a power source as shown in the schematic below.

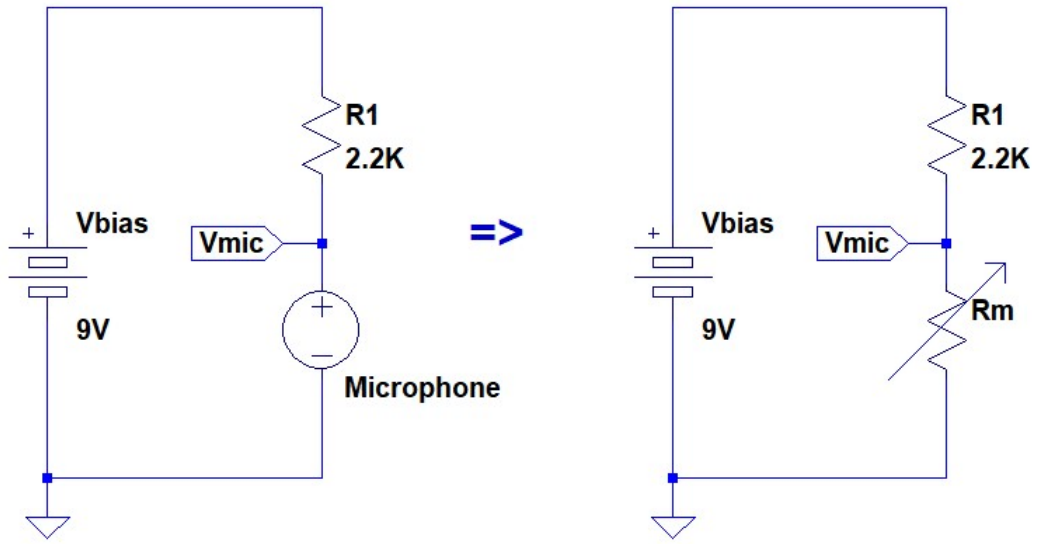

Figure 1 - Microphone Biasing

As seen above, the voltage source connected to the microphone is called the bias voltage, and the resistor connected to the microphone is called the bias resistor.

Recall that the voltage at the top of the microphone (Labeled "V_{mic}") can be found using the "voltage divider" formula as shown below.

$$V_{mic} = V_{bias}\frac{R_m}{R_1 + R_m}$$

Created by Babak Aryan,

Therefore, as the resistance R_m changes in response to sound waves, V_{mic} changes accordingly.

Decoupling Capacitor

The signal produced by a microphone biased as shown above in Figure 1 will contain a DC bias. When the sound waves activate the microphone, the resulting signal fluctuates about the DC bias. We will use a capacitor to remove this DC bias before connecting the microphone stage to the next stage of our amplifier. Recall that capacitors act as an open circuit to DC currents; therefore, connecting a capacitor to the microphone output, as shown below, will stop the DC current while allowing the varying AC current (due to voice activities) to pass through.

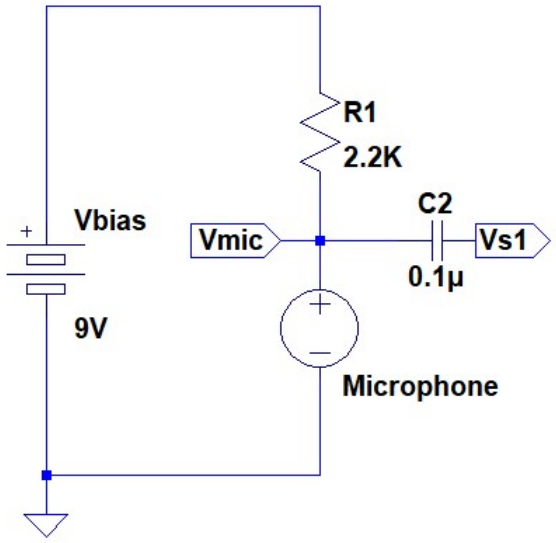

Figure 2 - Stage 1 with Decoupling Capacitor

Stage 1 Construction

Construct the circuit shown in Figure 2 above. Use a power supply set to 5V output as the power source. Using an oscilloscope, monitor the following voltages:

1. Probe the signal at "V_{mic}".
    a. How does it change in response to your voice?
    b. What is the value of DC bias? V_{mic} = _____ V
    (Note: Measure the voltage at V_{mic} when there are no audio waves exciting the microphone.)
2. Probe the signal at "V_{s1}".
    a. How does the signal change in response to your voice?
    b. What is the value of DC bias at this point? V_{s1} = _____ V

Complete Circuit