University of Maryland Baltimore County
Department of Computer Science and Electrical Engineering

CMPE 314 Lab 6
Emitter-Follower Amplifier Circuit

I. Objective

Construct and study emitter-follower circuit.

II. Introduction

A common-collector (also known as an emitter follower or voltage follower) amplifier is one of three basic single-stage bipolar junction transistor (BJT) amplifier topologies, typically used as a voltage buffer. In this circuit the base terminal of the transistor serves as the input, the emitter the output, and the collector is common to both (for example, it may be tied to ground reference or a power supply rail), hence its name. The analogous field-effect transistor circuit is the common-drain amplifier.

III. Equipment and Parts

DC power supply, oscilloscope, function generator, breadboard, NPN transistor, resistors, capacitor, digital multimeter, wires and cables.

IV. Experiments and Procedures

Part (A) Study the voltage gain

(1) Construct the amplifier circuit shown in Figure 1. Set V_{CC}=6 V, C_1=1 μF. Use the resistors provided for R_1, R_2, and R_E. Do not apply the AC voltage v_s. Add R_L and C_2 as the load of emitter.
(2) Measure V_{R1}, V_{R2}, V_E to calculate V_{CEQ}, I_{BQ}, I_{CQ}.
(3) Connect the sinusoidal voltage source v_s with amplitude ±100 mV and at frequency 10 kHz to the circuit as shown. Record down both the input v_{in} (v_{in} means input voltage at the base) and output v_o waveforms (v_o is the voltage across the load R_L) using the 2-channel oscilloscope.

Comment on the phase relationship. Find the small signal voltage gain and compare to the theoretical value.

(4) Increase the input sinusoidal voltage, and record down any signal distortion. Comment on whether it is due to cutoff clipping or saturation clipping.

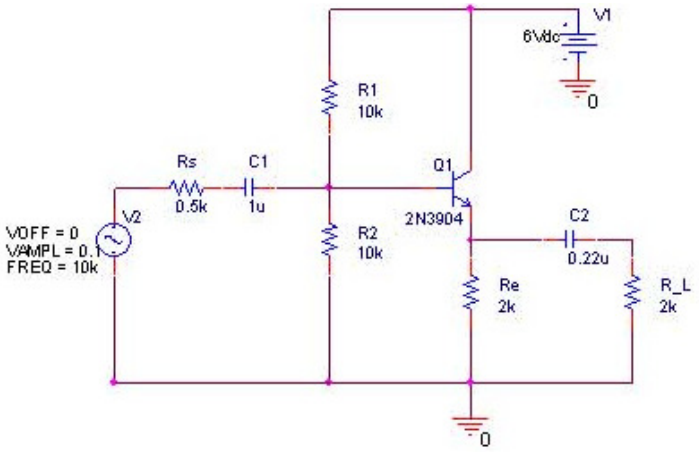

Figure 1: Emitter follower circuit with NPN transistor

Part (B) Output Resistance

With a voltage gain essentially of 1, the emitter-follower may not seem to be very useful. However, its input and output resistance characteristics make this circuit extremely valuable in many applications.

(1) Take out load R_L. Set v_s amplitude 100 mV. Record the output peak to peak voltage with open load.

(2) Use a potentiometer as load. Vary the potentiometer until the output peak to peak voltage is a half of the voltage measured in (1). Disconnect the potentiometer off the circuit and measure its resistance. This value is the output resistance of the circuit. Compare the output resistance of emitter-follower to a common emitter circuit in Lab 6.

(3) Vary the potentiometer and measure at least three different resistances, in order that the output waveform shows three different peak to peak values. Record down the corresponding output waveforms. Comment on how the small signal gain is influenced by the value of the load resistance and output resistance of the amplifier circuit.

(4) Calculate the DC Q-parameters (V_{CEQ}, I_{BQ}, I_{CQ}, etc.) and AC parameters (R_{in}, R_{out}, A_v, etc.) for the circuit. Compare them with the measured values.