X250994

UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

Department of Electrical Engineering

Experiment No.____Input/Output Impedance of a Transistor Amplifier

INTRODUCTION

The objective of this experiment is to determine for a common-emitter transistor amplifier the following: (1) the input impedance and voltage gain as a function of the collector resistance, RC; (2) the input impedance and voltage gain as a function of the emitter resistance, RE; and (3) the output impedance as a function of the source impedance, RG.

PRELIMINARY

P-1. Obtain a small-signal transistor from your instructor. Determine the following specifications for your transistor from the manufacturer's data book (and/or from your instructor).

Transistor ____________________ NPN or PNP (circle one)

Manufacturer ____

VCEmax = _____volts   VCBmax = _________volts

VEBmax = _____volts   ICcont = _________milliamperes

Pmax = _____milliwatts   ICpeak = _________milliamperes

hie = _____ohms   hre = _________volts/volts

hfe = _____mA/mA   hoe = _________mhos

Other information (such as pin-out, etc.)

P-2. Using a small-signal model, derive an expression for the input impedance (vi/ib) of the common-emitter amplifier of Figure l as a function of the transistor and circuit parameters (assume the impedance of the coupling capacitor is zero).

P-3. Using a small-signal model, derive an expression for the output impedance (vo/io) for the common-emitter amplifier of Figure 2 as a function of the transistor and circuit parameters (assume the impedance of the coupling capacitor is zero).

(INSTRUCTOR'S SIGNATURE___________________________DATE___________)

PROCEDURE

F-1. Bias the circuit of Figure l using the following components:

RB = 1 megohm potentiometer
RC = 1500 ohms
RE = 1500 ohms
VCC = 0.5 VCEmax
C1 = 1 uF

Decrease RB until VCE-Q = VCC/3. Note the value of RB and replace the potentiometer with a fixed resistor of approximately the same value.

F-2. Set the frequency of the signal generator, eg, to 5000 Hertz and adjust its magnitude and the magnitude of RG so that vi = eg/2 and the output signal, vo, of the transistor is not clipping.

F-3. Measure eg, vi, and eo as RC is varied from 500 to 2500 ohms in 500 ohm steps, EACH TIME adjusting RG so that vi = eg/2 and checking the output signal, vo, for clipping.

F-4. Repeat F-3 setting RC back to 1500 ohms and varying RE from 500 to 2500 ohms in 500 ohm steps, EACH TIME adjusting RG so that vi = eg/2 and checking the output signal, vo, for clipping.

F-5. Set up the circuit of Figure 2 with the following circuit changes:

RL + RC = 1500 ohms (RL is the resistance of the inductor)
C2 = 1 uF
L = 10 Henrys
RE set back to 1500 ohms

F-6. Set up the signal generator voltage, es, at some value less than VCE-Q/3 and adjust RS so that vo = es/2. Measure es and vo as RG is varied from 1/3 of its initial value (F-2) to 5/3 of its initial value. Do this in five steps, EACH time adjusting RS so that vo = es/2.

REPORT

R-1. Plot on the same graph the input impedance of the transistor as a function of RC and RE normalized at 1500 Ohms.

R-2. Plot the on the same graph the voltage gain, Av, as a function of RC and RE normalized at 1500 Ohms.

R-3. Plot the output impedance of the transistor as a function of RG, normalized at the initial value of RG.

R-4. Calculate the input and output impedance of the transistor using the derivations from the preliminary report and the circuit parameters from the procedure. Compare the calculated values with the measured values.

R-5. Discuss the results.

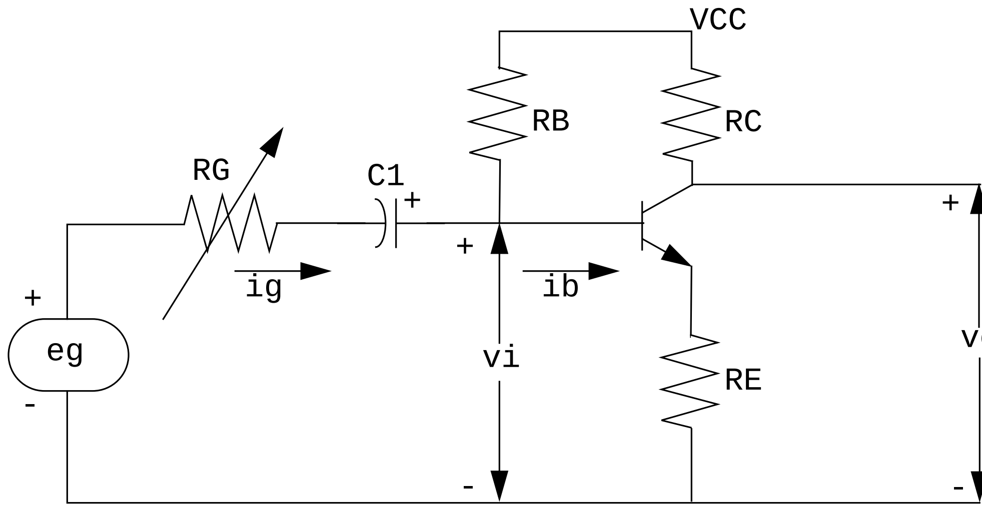

Figure 1.

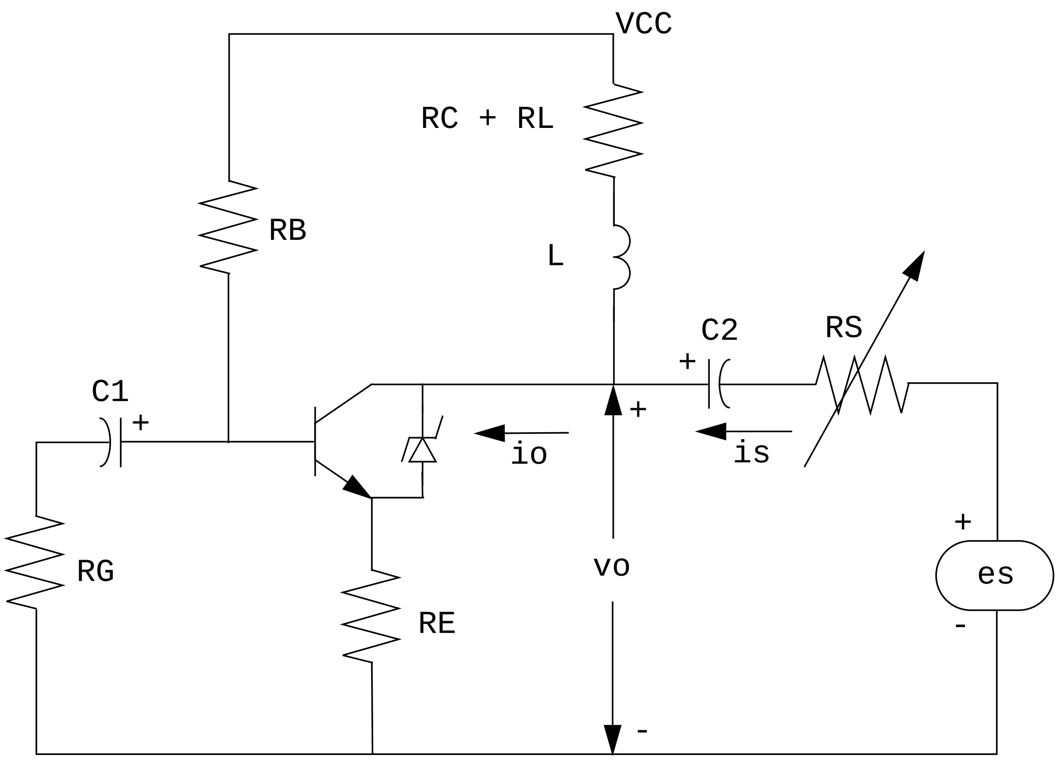

Figure 2.