Elec Eng 2EI5
Design Project #3

Problem Statement

Design, simulate, and build an amplifier that can take an input of ±0.5V from a source with an internal resistance of 100Ω and deliver it to a 100Ω load with good linearity and less than 10% attenuation.

Test Requirements

1. You are limited to the dc supplies available from your Digilent module.
2. You are limited to a single transistor (MOSFET or BJT).
3. You are limited to the components in your lab kit.
4. You may not use op-amps for this project.
5. In testing your circuit you should feed the input into the circuit from your Digilent function generator through a 100Ω resistor that you connect in series with the function generator. You should demonstrate different waveforms from the function generator. You should demonstrate different amplitudes up to ±0.5V. You should demonstrate a range of frequencies.
6. You should be able to answer questions about:
    a. Choice of circuit
    b. Choice of transistor
    c. How the circuit works
    d. Design tradeoffs, if any, and choice of component values

Report Requirements

Your submitted report should not exceed four pages. You are allowed:

1. A maximum of 2 pages showing your hand analysis and discussing design considerations;
2. A maximum of 1 page showing figures (circuit diagram, simulation results, etc.); and
3. A maximum of 1 page describing your simulations, reporting results measured in the lab, and comparing theory with experiment.

At a minimum, your report must include:

1. A picture of your physical circuit;
2. A schematic of your circuit;
3. Screen captures of your measurements;
4. The PSpice netlist for your circuit; and
5. Screen captures of your PSpice simulations.

You are expected to explain in your report:

1. Hand design
    a. Why did you choose a specific circuit topology?
    b. Why did you choose a specific device (MOSFET or BJT)?
    c. How did you estimate needed component values for your circuit?

    d. How did you calculate or choose component values to meet the specifications?
    e. How did you address all of the specifications that are given here?
2. Simulations
    a. What simulations did you choose to perform?
    b. What Spice models did you have to use and how did you obtain parameters for those models?
    c. How do the results of simulation compare with hand design?
3. Measurement
    a. What measurements did you perform on your circuit?
    b. Did the circuit meet specifications? Justify your answer using the specific measurements you took.
    c. Explain any discrepancies between your hand calculations, Spice simulations, and measurements.
    d. If the circuit you built did not meet specifications, can you address why that happened? Having done the project and demonstrated a circuit, have you come to understand what circuit(s) could meet the specifications?

Marking

Rubrics for marking will be published on Avenue. Please check them for more guidance.

Workload & Time Management

In order to successfully complete this project you will need to learn about:

1. Different amplifier topologies and what each topology is useful for;
2. How to experimentally characterize an amplifier circuit to completely describe its behavior; and
3. How to simulate amplifier circuits to be able to understand the effect of different design choices (including component values).

The first two items are the subject of Module 6 in the course and are covered in the textbook in Chapter 7. The last item is covered in the Lab Manual available on Avenue.