BEE332 Design Project

"0.5 W audio amplifier with Output Stage Optimization"

Overview:

This design project aims to utilize every single skill you have learned in BEE 332 this quarter. You will use your newly acquired knowledge to build a useful product that could potentially be subsequently refined and sold. This is the second step, after marketing, of a typical commercial production process: creating a working prototype.

Your job is to simulate an audio amplifier that can take the input from a CD player or portable music player and amplify the signal to drive a loudspeaker. Your design can utilize any passive electronic components, discrete BJT's or MOSFET's (array chips are okay too), and operational amplifier's (with some specific guidelines). Listed below are some project specifications as well as the equipment that is available to you:

Input signal specifications:
Signal voltage: 0.5 VAC
Signal source resistance 50 Ω
Equipment available for testing: Software: PSPICE, HSPICE etc.

Minimum Design Specifications of the amplifier:
Output power: 0.5W (minimum)
Load Impedance (speaker): 8Ω
Idling power: < 1W
Distortion: No distortion

Extra credit: Gain Bandwidth: 20Hz – 20 kHz (-3dB)

Design Description:

A skeleton description of what your design may look like is as follows:
Your amplifier will take a small signal input from a music player, and then presumably send it into a gain stage to meet the gain requirements for the design. As you have learned, we will need a specially designed output stage to drive a speaker resistance of 8 ohms.

Design Decision Justification:

There is no specific topology that you should follow, the method is open-ended and you are free to explore any resources. With this in mind, the decisions and tradeoffs you make in your design will be critical in determining the overall quality of your project, and thus will play a significant role in the final grade.

You must justify all blocks in your design. Why did you implement a given output stage? Which component did you use and why? It is encouraged to meet specifications while looking to optimize performance (output power or bandwidth. This is a great opportunity to design something that is truly yours, so use it that way.

Optimization:

There is much room for improvement to *exceed* the specifications. Please aim to meet the specifications first (it may not be as easy as you think!), and then look to optimize an aspect of your design.

Timeline:

You are highly encouraged to start early. I anticipate that this will take about three weeks of about 6-10 hours each to complete, including simulation and testing. In order to guide you through this process, I have setup milestones to help you maintain the momentum.

Project Report Requirements

Introduction

- Briefly explain the objective of the project

Architecture Design

- Design specifications
- Block Diagrams
- Discussion on the chosen architecture
- Trade offs

Circuit Design

- Schematics
- Design equations and calculations
- Simulation results

Results

Maximum Output Power

- What is the largest Vpk-pk on output that is not distorted/clipping and greater than or equal to .5W while achieving -3dB bandwidth of 20Hz-20KHz?

Idling power

- DC power used with no input

Grading:

Report: 100%

Functionality: 40%
Justification: 60%

Weekly Progress Recommendations

Week 1:

- Circuit Topology Determined
- Try to get all stages connected and simulated
- At LEAST 1 stage built, tested

Week 2-3:

- All stages built
- You should now be working to finalize optimizations

Week 3:

- Final project report turn in