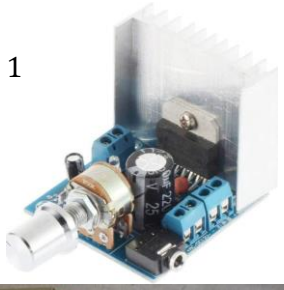
Amplifiers Lab Spring 2023

Describe all results in as much detail as possible in the lab report, there is no max on the number of pages.

1. Familiarize yourself with the components: this includes the two channel 15W amplifier board (using the TDA7297), the two channel 50W amplifier board (from Dayton Audio Dspb-250), the two channel 8W amplifier board (from Tube Depot K-12G/M based on the 11MS8 twin triode/pentode) as well as the 200W 10Ω loads.

1



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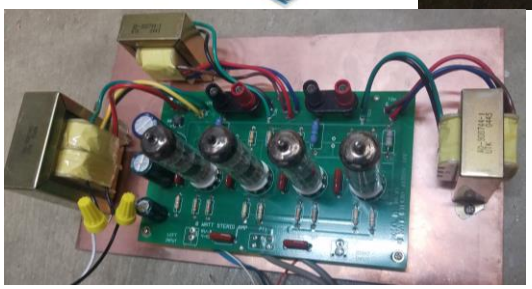

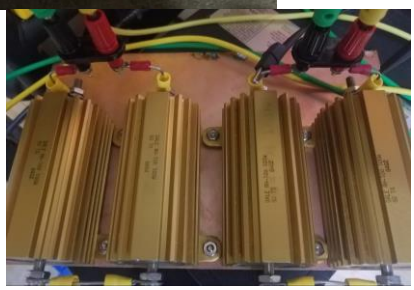

a. Identify each of the amplifier/components in your lab report. Please take pictures and upload them to your report.
b. In THIS lab, please initially start with the solid state-based amplifiers before starting with the vacuum-based tube amplifiers.
c. Solid state-based amplifier 1:
    i. Connect the input to the function generator, make sure to turn down the knob (counterclockwise) on the amplifier. Set the function generator to a 1kHz sine wave with 10mVpp amplitude and 0mV offset.
    ii. Connect both output channels to the 200W 10Ω loads using the banana cables.
    iii. Connect a 12VDC power supply to the amplifier.
    iv. Measure the voltage gain with the knob at ¼ of a turn clockwise. What gain do you get at 1kHz?
    v. Repeat the measurement from 100Hz to 20kHz. Capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.
    vi. Reset the function generator to 1kHz with the same amplitude and turn the knob up to see if you can get the amplifier to reach saturation. Repeat the measurement from 100Hz to 20kHz and

capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.

d. Solid state-based amplifier 2:

i. Connect the input to the function generator, make sure to turn down the knob (counterclockwise) on the amplifier. Set the function generator to a 1kHz sine wave with 10mVpp amplitude and 0mV offset.
ii. Connect both output channels to the 200W 10Ω loads using the banana cables.
iii. Connect a 12-24VDC power supply to the amplifier.
iv. Measure the voltage gain with the knob at ¼ of a turn clockwise. What gain do you get at 1kHz?
v. Repeat the measurement from 100Hz to 20kHz. Capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.
vi. Reset the function generator to 1kHz with the same amplitude and turn the knob up to see if you can get the amplifier to reach saturation. Repeat the measurement from 100Hz to 20kHz and capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.

e. Vacuum-based tube amplifier: (BECAREFUL THE TUBES ARE HOT AND THERE IS HIGH VOLTAGE PRESENT)

i. Connect the input to the function generator, make sure to turn down the knob (counterclockwise) on the amplifier. Set the function generator to a 1kHz sine wave with 10mVpp amplitude and 0mV offset.
ii. Connect both output channels to the 200W 10Ω loads using the banana cables.
iii. Connect the line cord to the amplifier. Check with lab supervisor before plugging in the unit and turning it on.
iv. Turn amplifier and wait for the tubes to warm up and everything to stabilize.
v. Measure the voltage gain with the knob at ¼ of a turn clockwise. What gain do you get at 1kHz?
vi. Repeat the measurement from 100Hz to 20kHz. Capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.
vii. Reset the function generator to 1kHz with the same amplitude and turn the knob up to see if you can get the amplifier to reach saturation. Repeat the measurement from 100Hz to 20kHz and capture the curves onto a flash drive for post processing. Plot the gain curve for the knob setting in dB vs frequency.

Post Processing

f. Now calculate the Total Harmonic Distortion of the amplifiers using scripts in MATLAB/Python or your code of choice. Do this calculation for a few select frequencies such as 100Hz, 500Hz, 1kHz, 2kHz.

$$THD = \frac{\sqrt{V_2^2 + V_3^2 + V_4^2 + \cdots}}{V_1}$$

g. What are the differences with the amplifiers based on specifications measured above and datasheets found online and what is attached below? What amplifier classes are they (A, B, AB, C, D)?
h. Which is the ideal amplifier in terms of THD, gain, power consumption?
i. Can you measure any switching noise from any of the amplifiers? Such as if it were a class B or class D amplifier?

Schematic of the K-12G/M Vacuum Tube Amplifier for reference