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| Lab 5: Audio Power Amplifiers with Feedback Linearization |

Student Name: Click or tap here to enter text.

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Preparation

1. Run a 50-ms transient simulation for the Class-A output stage in Figure 2(a) with a 1-kHz, 1-Vpp input signal. Set the maximum time step of the transient simulation to 1 μs.
2. Display both the input voltage and output voltage waveforms.



1. Plot the output spectrum using the FFT function of the simulator.



1. Measure and record the power consumption of the amplifier for input signal amplitudes of 10 mVpp and 1 Vpp.

Final answer: Click or tap here to enter text.

1. Repeat step 1 for the Class-B output stage in Figure 2(b). Use the R1, R2, R3, and R4 values determined in Lab 3 so that both the p-MOSFET and n-MOSFET are biased at threshold (with little or no current flowing through them).
2. Display both the input voltage and output voltage waveforms.



1. Plot the output spectrum using the FFT function of the simulator.



1. Measure and record the power consumption of the amplifier for input signal amplitudes of 10 mVpp and 1 Vpp.

Final answer: Click or tap here to enter text.

1. Determine the gain of the amplifier in Figure 1. Observe and document the effect of varying the 1-kΩ feedback resistor value on the speaker’s output volume.

Final answer: Click or tap here to enter text.

1. The schematics in Figures 2(a) and 2(b) use two power supplies, +5V and -5V. This arrangement centers the output at 0V, allowing for DC coupling of the output stage directly to the speaker. Discuss the significance of this configuration. In cases where only a single supply is available, the speaker must be AC coupled through a series capacitor (Cs) because the output is no longer centered at 0V.

Determine the required value of Cs to ensure a cut-off frequency of 50 Hz or less using the formula:

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where RL represents the load resistance. Find the required Cs.

Final answer: Click or tap here to enter text.

Lab

1. Set the current limit to 400 mA.
2. Implement the Class-A output stage with an 8Ω load resistor. Ensure that the circuit is fully assembled before connecting the power supplies to avoid overheating or burning components.
3. Apply a 1 kHz, 1-Vpp sinusoidal input signal and observe the output waveform.



1. Determine the power consumption when the input voltage is 10 mVpp and 1 Vpp.

Final answer: Click or tap here to enter text.

1. Rreplace the 8Ω load resistor with a speaker. Connect the Class-A output stage and a signal at the input. Observe and document the sound quality.
2. Repeat steps 1 and 2 using the Class-B PA instead of the Class-A amplifier.
3. Apply a 1 kHz, 1-Vpp sinusoidal input signal and observe the output waveform.



1. Determine the power consumption when the input voltage is 10 mVpp and 1 Vpp.

Final answer: Click or tap here to enter text.

1. Build the linearized power amplifier with feedback from Figure 1, using the Class-B output stage and setting the voltage gain to 4 by adjusting the 1-kΩ resistor. Replace the 8Ω load resistor with a speaker. Connect the Class-A output stage and apply a sound waveform at the input. Observe and document the sound quality.