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A HIGH GAIN AND EFFICIENT MULTISTAGE BJT DIFFERENTIAL POWER AMPLIFIER

Rajesh Kumar¹, Dr. O. P. Singh²

¹Research Scholar, University Department of Physics, J P University, Chapra

²University Department of Physics, J P University, Chapra

Abstract: This paper presents a fully differential power amplifier (PA) with high efficiency and linearity. To improve the linearity, an optimum gate bias is applied for the cancellation of the nonlinear harmonics. The amplifier delivers a 6 dB of power gain. The signal noise distortion and total harmonic distortion of 55.68 dB and 0.144% has been shown. The compensation characteristics of the circuit has been studied using simulation and experimentally.

Keywords: Differential power amplifier, gain, signal noise distortion, total harmonic distortion n

I. Introduction

Audio amplifiers were first implemented in 1912 with vacuum tubes, when class A was the only configuration in use, class B was developed after some time. From that time until the present, designed topologies have been implemented and have been improved, even more when the transistor was created. Thus we have today topologies: Class A, B, C, AB, D and standardized versions E, G and H. However, most audio power amplifiers that exist currently in the market present AB topology, achieving real efficiency of approximately 60% and a low total harmonic distortion. This configuration allows the two transistors in the output stage work at the same time for a brief moment to avoid zero crossing distortion. Also, higher performance than Class A can be achieved and a minor distortion than class B. About the development of our circuit, to get an idea of the choice of components, we considered the parameters related to the power that should be in the load resistance, plus various simulations were made to confirm the correct choice. We have analyzed the overall architecture of the steps our circuit has, especially identifying the reason for each one. This step also helped in the choice of components. Attention was paid to the analysis of total harmonic distortions finishing circuit. This value, being smaller allows components in the circuit with more precise performance by reducing the harmonics caused by nonlinearity of components. In this exhibition we have studied Vulnerability of power quality problems due to proliferation of micro electronic circuitry in wide variety of equipment's. The electrical disturbances which occur because of many reasons has an adverse impact on the proper functioning of system, this affects various kind of sensitive loads. Power needs to be non-variant; this has led to research on this topic, which is in high demand in industries and for commercial applications. The differential amplifier is used extensively in modern monolithic electronic circuitry.

The differential power amplifier circuit has assumed considerable prominence development of circuit configurations which comprehends the strength of the technology, which removes the weakness and enhances the development of electronic circuitry. The 'Differential Amplifier' is associated closely with integrated circuit technology; this technology provided both incentives for use of the circuit configuration as well as the means to construct effective circuits of this type.

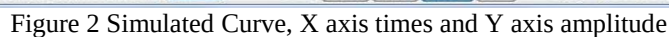
II. Circuit Design

A bipolar junction transistor has three terminals which are used for the connection purpose. This semiconductor device used to amplify or switch electronic signals. The differential amplifier being driven by a single npn BJT. This is a multistage amplifier; emphasis is on multistage rather than the single stage amplifier because of the fact that the multistage finds applicability and suitability in many applications. Two big advantages of multistage over single stage are that it has a higher gain, and has flexibility for higher input and output impedances.

The circuit shown in Fig 1, presents a basic differential BJT amplifier configuration; the insert indicates how the single physical emitter resistance can be apportioned symmetrically as two physically symmetrical half- circuits and the that corresponding resistors and transistors are precisely matched.



Circuit is simulated in Multisim Software to observe the performance and applicability of design. Input to the circuit is 138 mV, peak to peak value of 19.8 V and RMS value of 7 V, peak to peak current of 19.8 pA and RMS value of 7 pA, frequency was maintained at 1KHz. The simulated design gives a well-defined output voltage value of 63.2 mV, with peak to peak value of 41.1 V and RMS value of 14.5 V, V_{dc} is 464 mV peak to peak current of 41.1 pA and RMS value of 14.5 pA. This output was obtained at the same frequency of 1 KHz. simulated result is shown in Fig 2.



IV. Conclusion

A differential linear power amplifier having a power gain of 6dB from 0 to 8 KHz has been presented. Above 8 KHz frequency output is affected by limiting slew rate. THD is less than 0.2% because of negative feedback to the input differential amplifier. A multistage amplifier is more useful than a single stage amplifier in that it has a higher gain and has more flexibility for higher input and output impedances. A single npn BJT was used to drive this differential amplifier. The collector current entering the npn BJT will be the current source driving the differential amplifier. Clipping occurs when the amplifier tries to output a higher power than what the amplifier can achieve.

V. References

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