Audio Noise Cancellation using Op-amp

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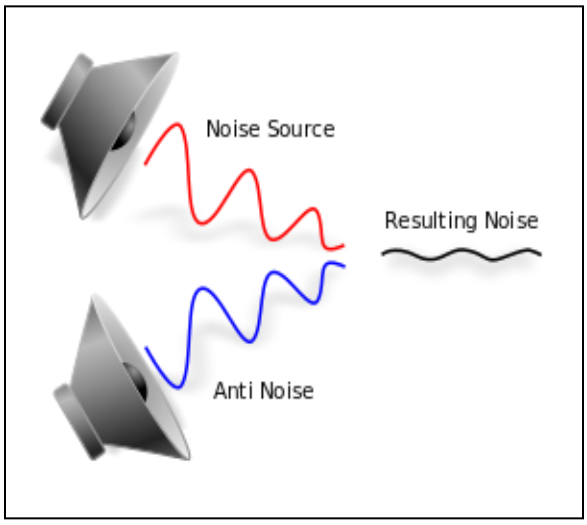
Abstract **- This paper gives a brief about how operational amplifiers can be used in a noise cancellation device. This will be a cost-effective method to design and produce noise cancellation devices for non-precise applications.**

Index Terms **- Op-Amp, Analog Electronics, Audio Electronics, Electronics.**

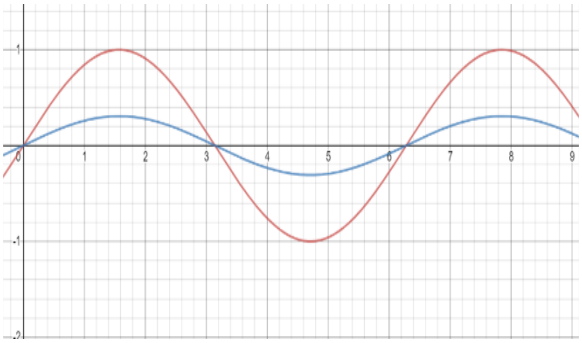
I.INTRODUCTION

We all know that main Idea behind noise cancellation is that when two signals having a phase shift of 1800 is super imposed, the two signals cancel out each other. This basic concept is used to generate an inverted signal to cancel out the outside noise.



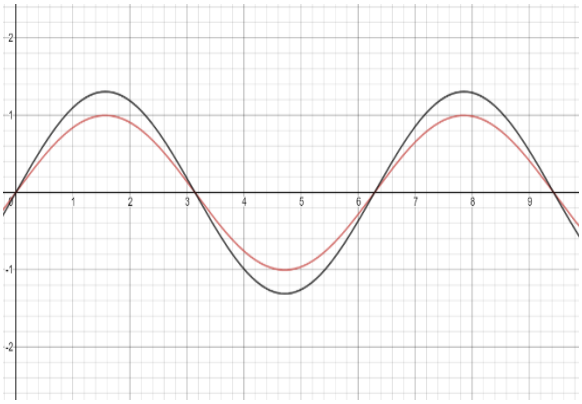
II. WORKING

We will need 2 Op-amps. 1st Will add as unity gain differential amplifier While 2nd Will act as summing amplifier and a microphone.
Microphone will collect the feedback signal and apply it to unity gain differential amplifier.
From the unity gain differential amplifier We will isolate noise signal with 180-degree phase shift and with summing amplifier we add this error signal to the audio signal to cancel it out.
Thus, removing some extra noise.



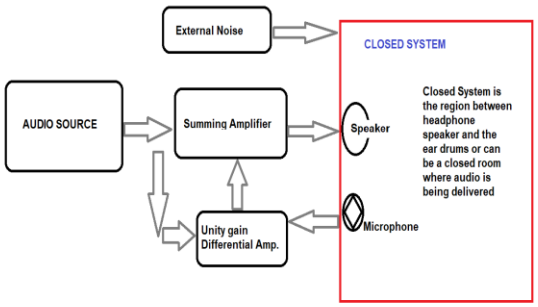
Red -Audio signal
Blue-Noise
Black-Noise + Audio signal

Now this gets super imposed to give us the following results:



III. ALGORITHMN

- Power ON
- Check for noise using Unity gain Differential Amplifier.
- Apply error signal and audio signal to summing amplifier.
- Repeat the above steps till power off.
- Power OFF



BLOCK DIAGRAM OF THE SYSTEM

IV. EQUATIONS

Gain of a unity gain differential inverting configuration op amp is given as

Vout=(-R3)/R1(V_2-V_1) [2]

R3 is Feedback resistor while R1 is Input resistance. For unity gain we take R3=R1.

V1=Audio Signal & V2=Feedback signal

V out is the error Signal.

Now if we isolate the noise signal and apply it to the op-amp then we will get the noise signal with a 180-degree phase. This signal if applied to the speaker along with target signal then We will be able to cut out noise signal by some percentage.

This is done so that we can easily use inverting summing amplifier instead non-inverting summing amplifier as in case of non-inverting summing amplifier gain is

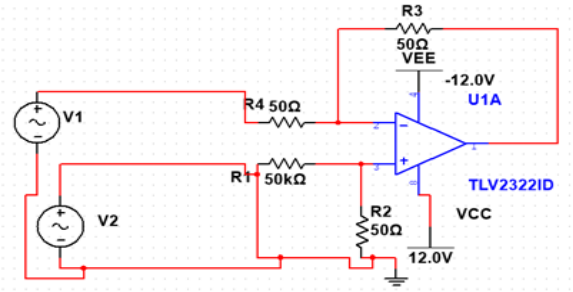
$$A = 1 + \frac{Rf}{Rin}$$

So Rin has to be infinite or Rf=0, Instead it is simpler to use inverting configuration with gain: -

$$A = \frac{-Rf}{Rin} \text{(Rin=R1=R2)}$$

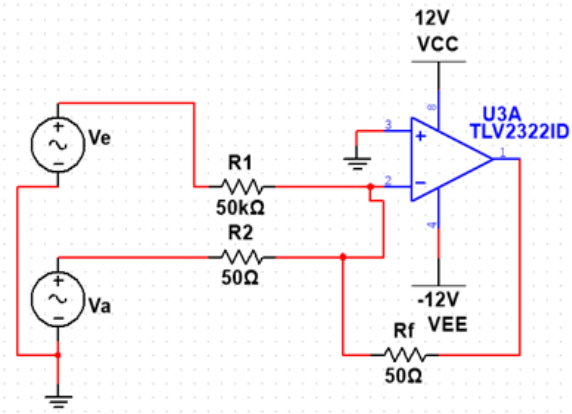
V. CIRCUIT DIAGRAM

Differential Amplifier



V1=Audio Signal

V2=Feedback signal



Ve will be the error voltage from differential amplifier.

Va is the audio signal.

VI. CONCLUSION

We can conclude that by using 2 op-amps we can create a noise cancellation system, but this system needs 12V supply and might have some delay.

VII. ACKNOWLEDGMENT

I would like to thank developers of Multisim and Desmos graphing calculator for developing tools which helped me write this paper.

REFERENCES

[1] https://commons.wikimedia.org/wiki/File:Active_Noise_Reduction.png

[2] https://www.electronics-tutorials.ws/opamp/opamp _5.html