AUDIO MIXER WITH NOISE FILTER

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A mixer is a device which takes various audio sources through its multiple input channels, adjusts levels and other attributes of the sound, then usually combines them to a lesser number of outputs. Audio mixers of various configurations are used in the music industry to mix various sounds and to add effects. As well as combining signals, mixers allow you to adjust levels, enhance sound with equalization and effects, create monitor feeds, record various mixes, etc Mixers are frequently described by the number of channels they have. For example, a "12-channel mixer" has 12 input channels, i.e. you can plug in 12 separate input sources. You might also see a specification such as "24x4x2" which means 24 input channels, 4 subgroup channels and two output channels. More channels means more flexibility, so more channels is generally better.

Introduction

In this project I had designed a four channel audio mixer with audio noise filter with LED visualizer. An audio mixer is a device which takes two or more audio signals, mixes them together and provides one or more output signals. At the heart of a mixing circuit is the basic summing circuit. If I add more input resistors to the input, each equal in value to the original input resistor, (Rin) I end up with another operational amplifier circuit called a Summing Amplifier , “ summing inverter ” or even a “ voltage adder ” circuit as shown below.

In this simple summing amplifier circuit, the output voltage, (Vout) now becomes proportional to the sum of the input voltages, V1, V2, V3, etc. Then I can modify the original equation for the inverting amplifier to take account of these new inputs thus: However, if all the input impedances, (RIN) are equal in value, I can simplify the above equation to give an output voltage of

Thie audio noise filter circuit is a bandpass filter for audio frequency bands. It filters unwanted signals that are lower or higher than the audio frequencies. The audio LED visualiser uses LM3915 IC to demonstrate the signal amplitude at the Output.

List of Component Used

1. IC741
2. NE5532
3. MJ-2523 audio jack 5
4. LB10 LED BAR
5. Resistors
6. Capacitors

Details of the Components

1. IC741

The 741 Op Amp IC is a monolithic integrated circuit, comprising a general purpose Operational Amplifier. The number 741 indicates that this operational amplifier IC has 7 functional pins, 4 pins capable of taking input and 1 output pin.IC 741 Op Amp can provide high voltage gain and can be operated over a wide range of voltages, which makes it the best choice for use in integrators, summing amplifiers and general feedback applications. It also features short circuit protection and internal frequency compensation circuits built in it. The following are the basic specifications of IC 741:

- **Power Supply**: Requires a Minimum voltage of 5V and can withstand upto 18V
- **Input Impedance:** About 2 megaohms
- **Output impedance**: About 75 ohms
- **Voltage Gain**: 200,000 for low frequencies
- **Maximum Output Current**: 20mA
- **Recommended Output Load**: Greater than 2 kiloohms
- **Input Offset**: Ranges between 2mV and 6mV
- **Slew Rate**: 0.5V/microsecond (It is the rate at which an Op-Amp can detect voltage changes)

The high input impedance and very small output impedance makes IC 741 a near ideal voltage amplifier.

2. NE5532

The 5532 is a dual high-performance low noise operational amplifier. It shows better noise performance, improved output drive capability and considerably higher small-signal and power bandwidths. This makes the device especially suitable for application in high-quality and professional audio equipment, instrumentation and control circuits, and telephone channel amplifiers. The op amp is internally compensated for gains equal to one.

Basic Specification

- **Small-Signal Bandwidth**: 10 MHz
- **Output Drive Capability**: 600 , 10 VRMS
- **Input Noise Voltage**: 5.0 nV Hz (Typical)
- **DC Voltage Gain**: 50000
- **AC Voltage Gain**: 2200 at 10 kHz
- **Power Bandwidth**: 140 kHz
- **Slew Rate**: 9.0 V/s
- **Supply Voltage Range**: 3.0 to 20 V
- Compensated for Unity Gain

3. MJ-2523 audio jack 5

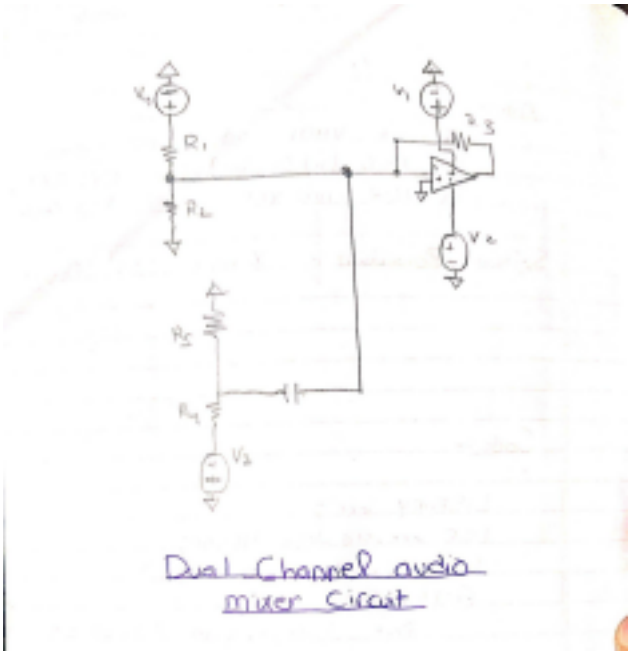
The following are the basic specifications are:-

- **Number of Conductors:**2
- **Voltage Rating:** 2V
- **Current Rating:** 1A

- **Shielding:** No
- **Number of Port:** 1

Circuits And Design

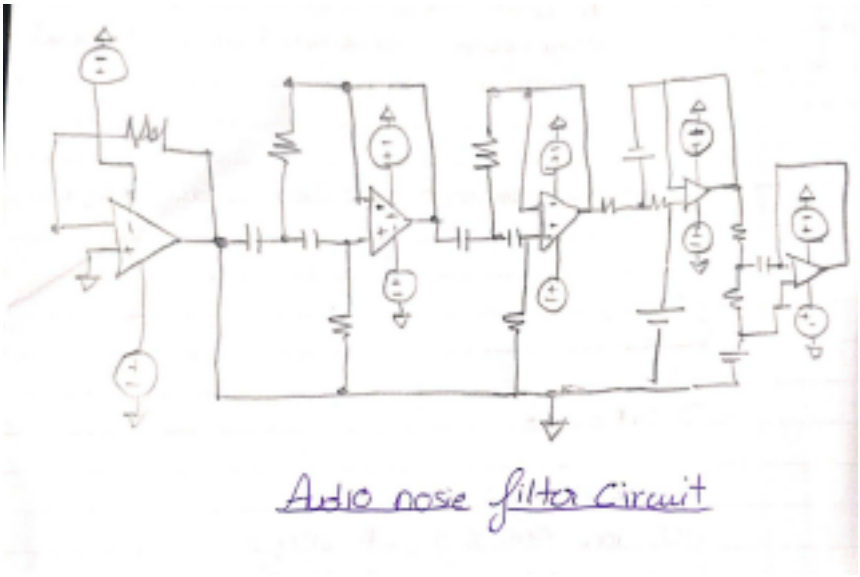
1. The Audio Mixer Circuit



The above image depicts a dual channel audio mixer I made to make the depiction of parts much clearer as more channels add up more complexity. This
audio mixer which was finally made has four channels meaning the final circuit

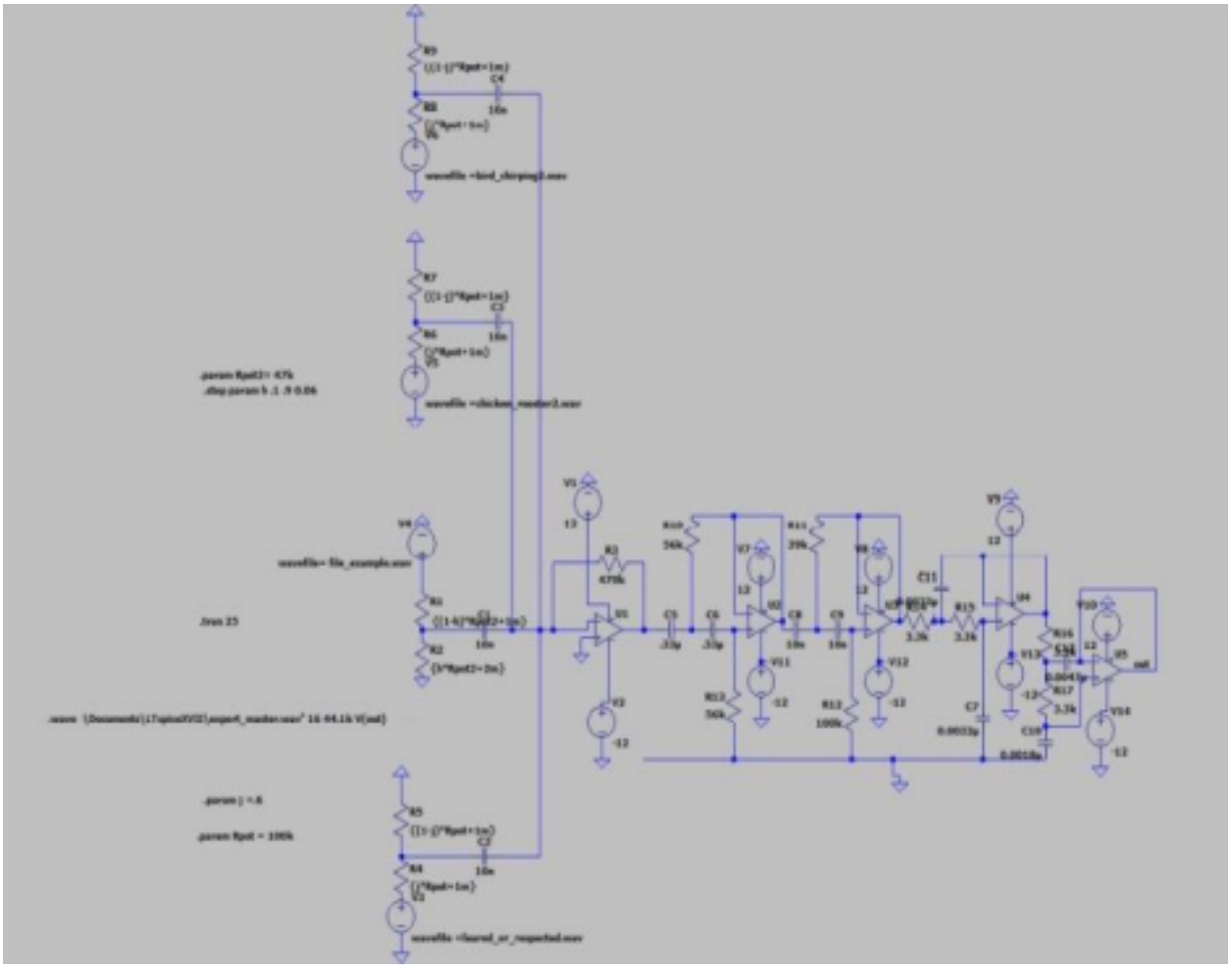
takes four inputs and gives single output.The capacitor is used to block any DC signal that may be coming from one of the sources. This is not necessary, but if all of the sources have a DC bias of 1 volt it may quickly be approaching the positive rail, causing significant distortion. Because of this it is very strongly recommended to include the capacitor.

2. The Audio Filter Circuit



This audio noise filter circuit is a bandpass filter for audio frequency bands. It filters unwanted signals that are lower or higher than the audio frequencies. It has 2 filters: a low pass filter and a high pass filter in a cascade configuration. Both filters are second-order filters with a 24 dB/octave filter capability. The 3 dB cut-off freq. are 11.8 Hz and 10.7 kHz.

Final Simulation: -



LTspice can produce a sound output in .WAV format. In our simulation, the output sound is stored as export_master.wav. Sample at the rate of 16 bits. 44.1K is the number of samples per simulated second

Future Of Project & Conclusion

In these projects, I used IC741 which was part of the syllabus. I got the learn how to use its for practical uses, which was the whole point of Mid-Term Evaluation. the Operational Amplifiers and Filters are one of the major topics of the subject in which I gained some extra understanding as the device audio mixer consists of op-amps and filters. The simulation I performed worked perfectly and gave us the output I desire. here is still a lot that can be done with the project to compete with a studio-level audio mixer and can also

be made into something better. Majority of the studio level audio mixers also have Equalizers controlling different frequencies or the tone of the signal , controlling the higher frequency often called as treble, Treble refers to tones whose frequency or range is at the higher end of human hearing. Bass (also called bottom end) describes tones of low (also called "deep") frequency, pitch and range from 16 to 256 Hz (C 0 to middle C 4) and bass instruments that produce tones in the low-pitched range C 2 -C 4 . In a studio-level audio mixer the various buses to output the signal also lead it to a processor.

References:-

https://www.allaboutcircuits.com/technical-articles/ltspice-simulation-using-wav-files/

MJ-2523-SMT-TR Datasheet - Jacks | Audio Connectors | CUI Devices IC741 Datasheet PDF - Operational Amplifier (datasheetcafe.com)

NE5532 - Internally Compensated Dual Low Noise Operational Amplifier (mouser.com)

https://www.allaboutcircuits.com/textbook/alternating-current/chpt-8/band-pass-filters/