2017年1月7日

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Stereo tone controller

1. Introduction

The stereo tone controller should realize the function that the base and treble for a two-channel stereo system can be amplified.

We managed to use voltage regulator to generate a stable 5V-voltage , and use a voltage follower to make the 5V output not affected by the post circuit. The adjust of the treble of bass is realized mainly by potentiometer , the detail will be described below.

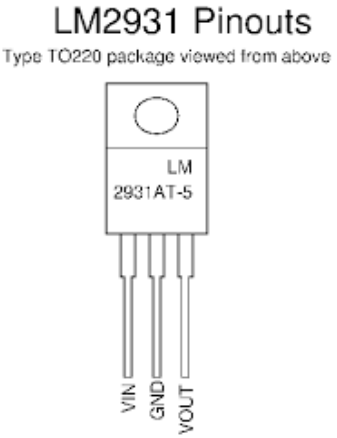
2. Components

resistors	some
capacitors	some
potentiometers	100kΩ*4 & 10kΩ*1
voltage regulator	LM2931AM-5*2
op amp	LMC6482AIN*2
battery	9V*1

3.Circuit Principle

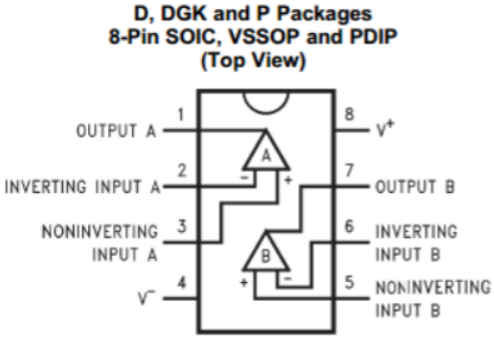
(a)regulator

We use battery as the source ,which is not very ideal .So we use a 3-terminal voltage regulator LM2931M-5 to get a 5V output .



(b)voltage follower

To make 5V output not affected by the post circuit , a voltage follower is needed.We use an op amp LMC6482AIN to construct the voltage follower.Here is the op amp we use.



(c)block DC

The 1μF capacitor at the input can block DC signal because what we need is only AC signal.

(d)bass control

When the input signal is low-frequency.The impedance of the 10nF capacitor is very large. The 100kΩ potentiometer in the bass control divides the voltage and transmit it to the inverting-input.

The treble control has nearly no effect on the inverting-input because the 1μF capacitor is nearly open.

(e)treble control

When the input signal is high-frequency , the 10nF capacitor in bass control is nearly shorted.

The 100kΩ potentiometer in the bass control divides no voltage ,while the 100kΩ potentiometer in the treble control divides voltage and transmit it to the inverting-input.

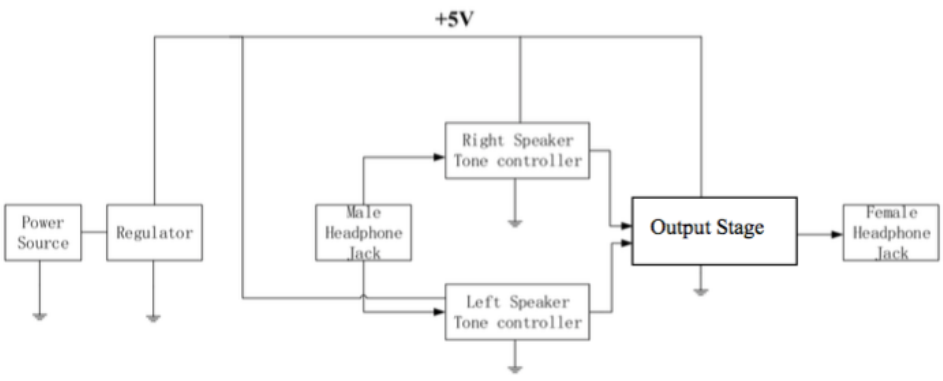
(f)output stage

We use a capacitor to filter the DC signal and a potentiometer to make the loudness can be changed.

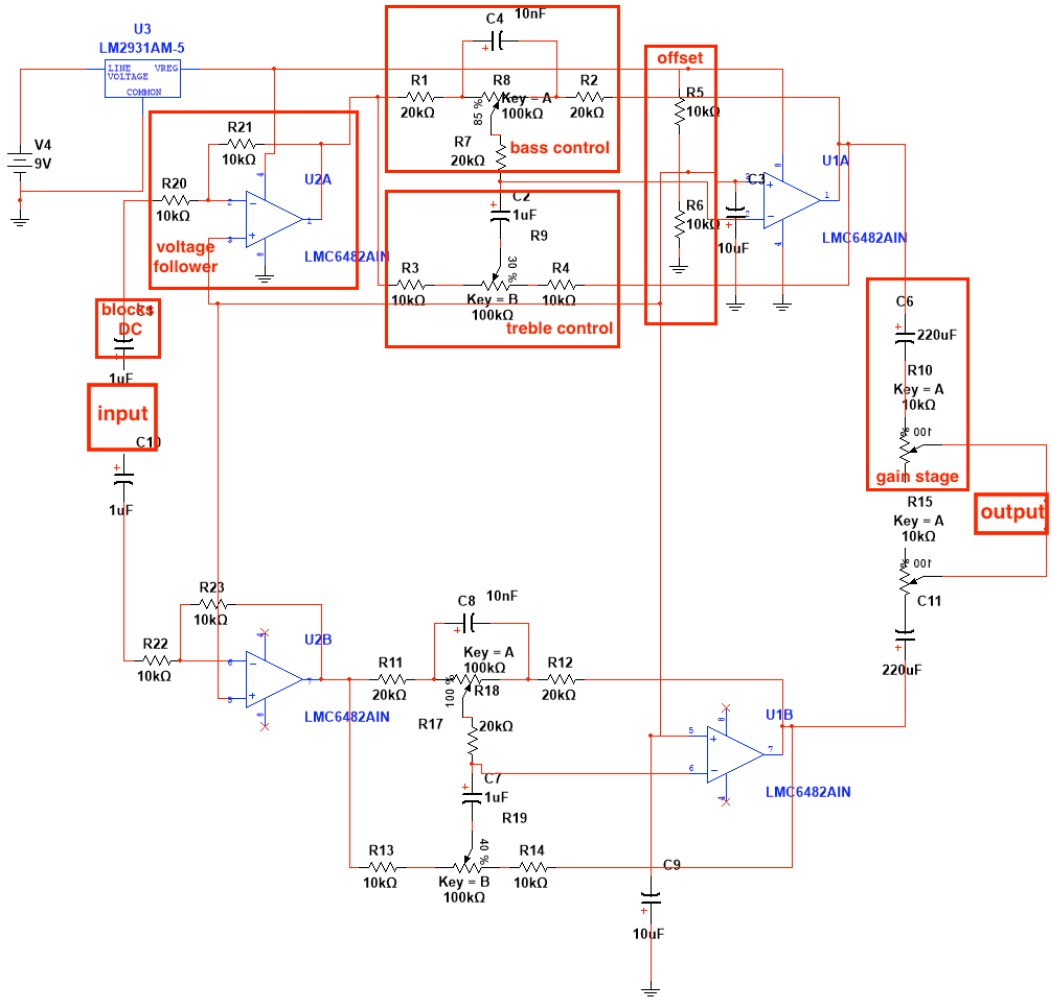
(g)offset

We use two 10kΩ resistors to get a 2.5V-voltage and connect it to the non-inverting of each op amp, so we can omit the -5V-voltage and replace it with 0V(ground).

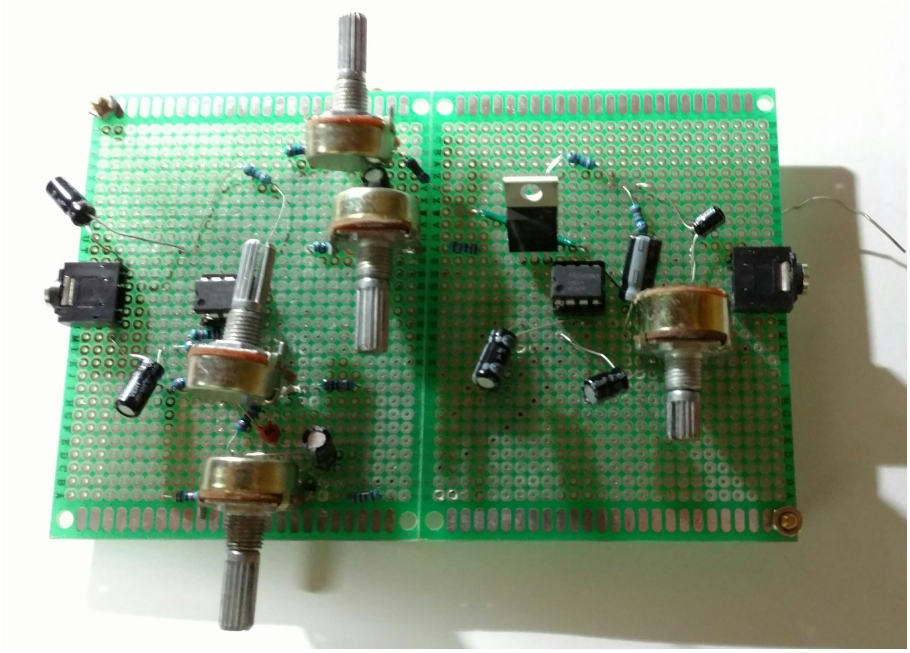
4.Block Schematic



5.Schematic Diagram



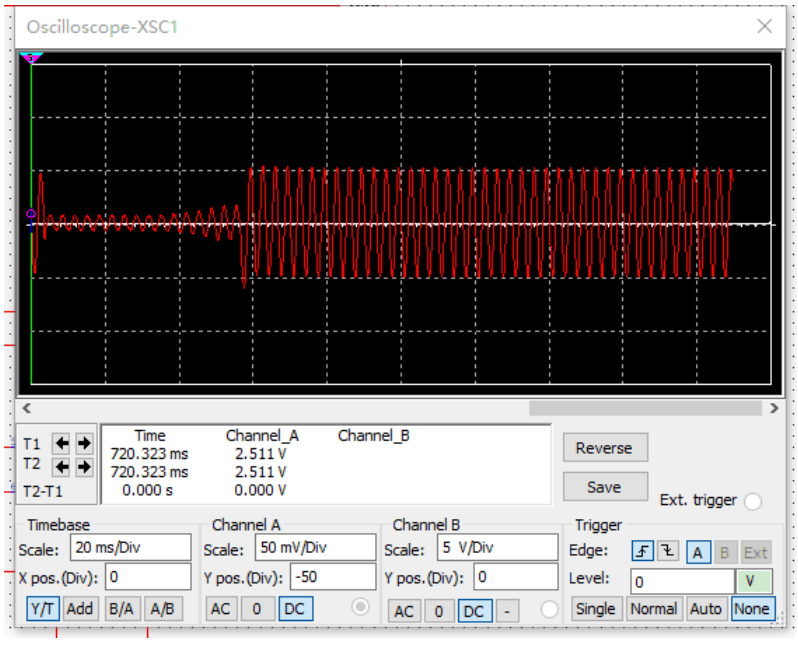
6.Actual Picture



7.Result Analysis

Since the sound signal is not visualizable ， the result of the simulation is attached here.

When the input signal is low-frequency ,adjusting the treble control has nearly no effect on the signal,but adjusting the bass control will change its amplitude .



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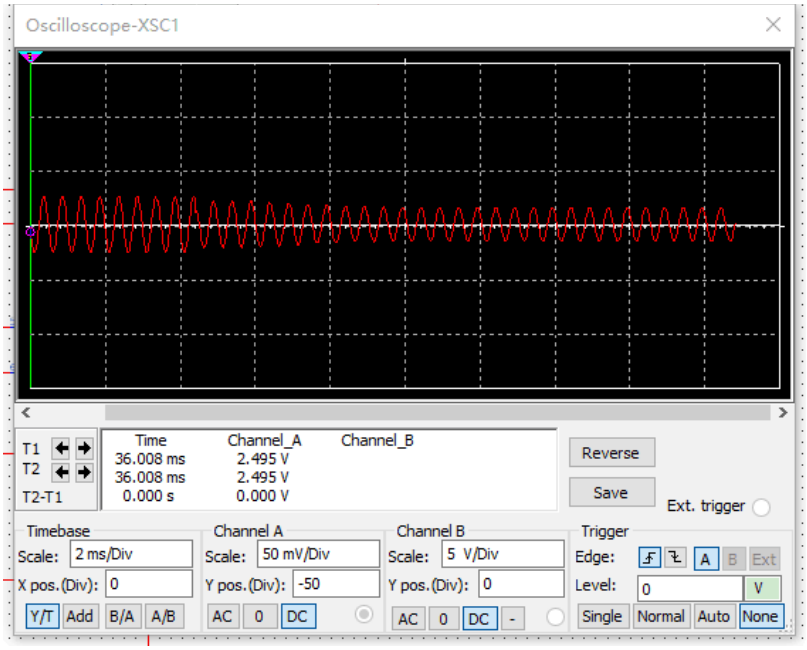
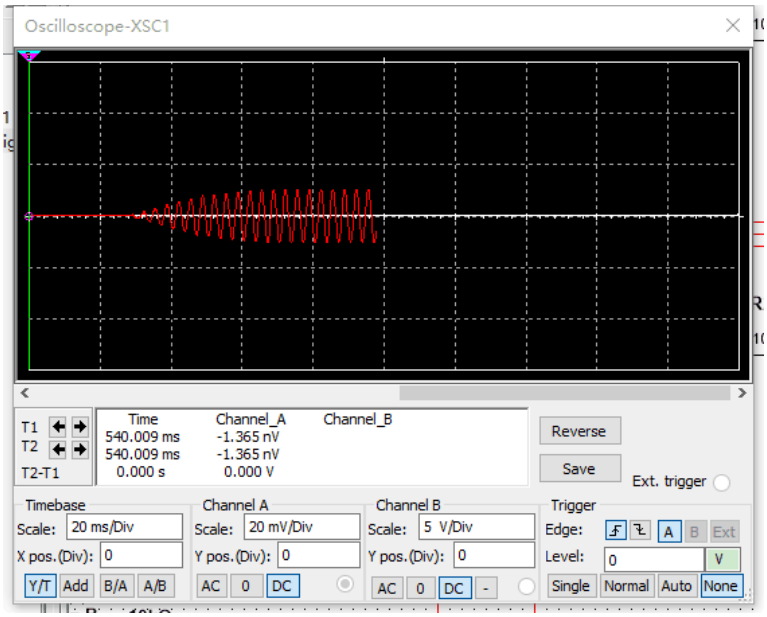
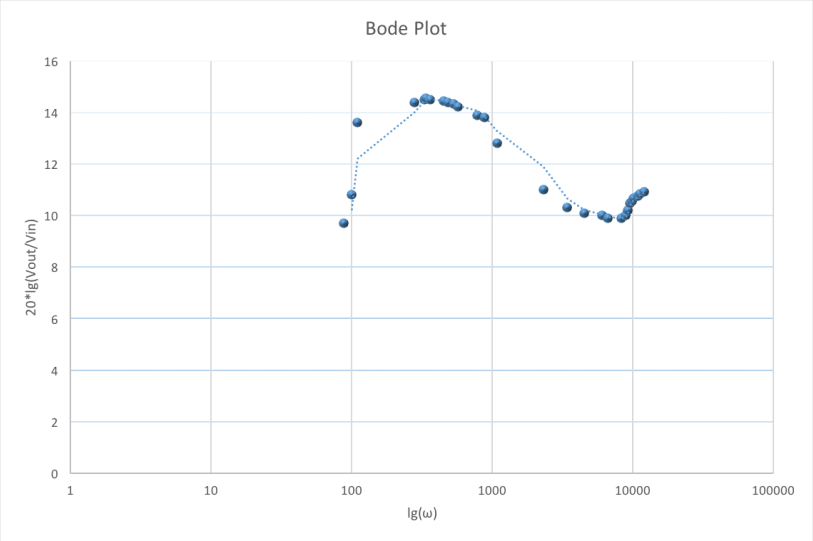


By adjusting the potentiometer in output stage ,we can see the amplitude of the output wave's change ,which means the volume can be adjusted.



8.Bode Plot



9.Discussion

(by 郑钧仁)

①What I do : I did the designing job mostly , both on Multisim and the circuit board.

Making the circuit clean and neat is really a nerve-racking thing.While the welding job was mostly done by my partner (Thanks for him!) . There is no doubt that experience is necessary to be an excellent EEer .and the experience I got during this project is far more than any experiment before , we all enjoy debugging by using the oscilloscope,block by block.

②How to make the circuit more clean and neat : drawing a schematic on paper before welding is a good habit , for example ,there is a lot of components which should be connected to the ground , so I think a common ground line is needed in the middle of the

board . Male headphone jack ,female headphone jack ,op amp should be as near to the ground as they can . The potentiometers should be placed in staggered form so that we can screw them conveniently.

③the necessity of a power amplifier : in the guide material , a power amplifier is suggested to be added so that the output signal can be heard more explicitly . But after the previous design , we found the output signal is larger enough so the power amplifier is omitted .

(by 何思鹏)

Undoubtedly, this is a fabulous experiment for me, a music lover. I have never considered that I can get to understand the theory behind the stereo in the electric circuit's experiment. This small experiment reminds me of the stereo I used in my childhood, what a lovely memory. During this experiment, mostly I do the solder job than other parts while my partner majoring in designing the circuit. From the beginning, I help to build the circuits in the Multisim. And then do the debugging job together with my partner. After everything is dealt, we start soldering. Unfortunately, this is both ours first time touching the welding, though I see a lot during my childhood observing my father fix some stuff. It's a extremely interesting experience tSince with it. I learned a lot of skills of soldering the components as well as taking them apart. Although it's not that easy to accomplish this project, but after ours effort(appreciate my partner attend the laboratory continuously for a week!), the moment when we listening to the music flowing through the earphone is so fantastic! And of course its volume can be adjusted by ours control.From the whole task, I learn more clear about how the electric components working and know their specific function. It's a very useful part of this course to let us know the electric circuit by ourselves. I really appreciate it.