LAB - 3

date : 4 February, 2020

Lab Title: Scaled Adder

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Objective: To build a scaled adder using inverting op-amp configuration in which input one should be amplified by 10 and two should be amplified by 5. use R1 10k ohm and calculate other values.

Apparatus Required:

Name of Components	Specifications	Quantity
(LM348N) op-amp IC	Lm348N	1
Resistor	10k, 100k, 20k	1
	1k, 1.8k, 3.9k	1
	1.8k, 3.9k, 6.8k, 2.2k	1
Switch	3 Pin	1
Regulated power Supply	Agilent E3620A 0-1A 0-25V	1
function generator	RIGOL DG1022A 2 channel 25MHz	1
Oscilloscope	RIGOL DSI102E 2 channel 100 MHz	1
potentiometer	10k	1

Part - 1 Scaled adder

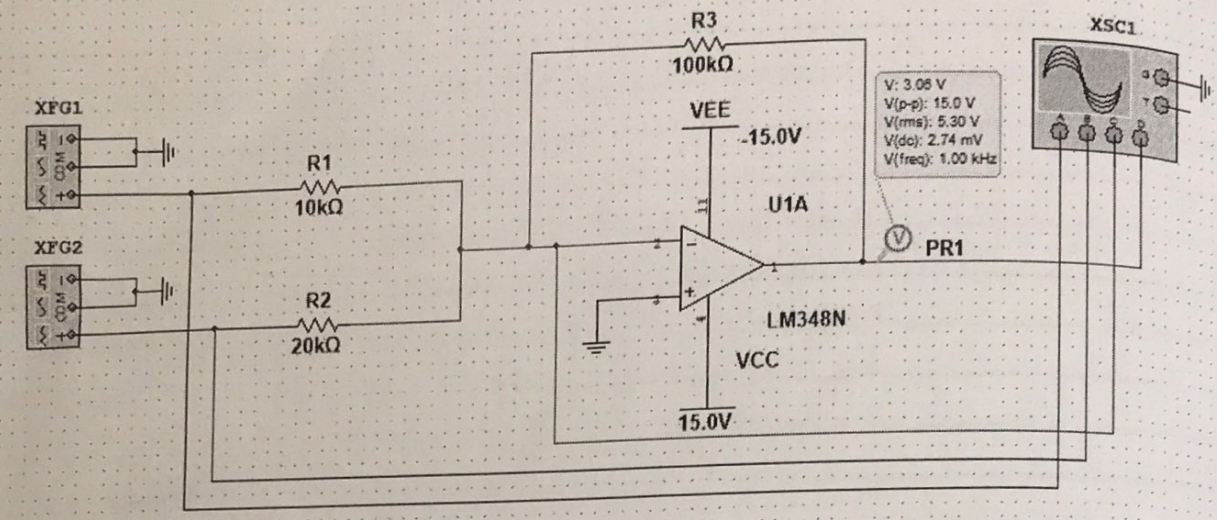


Figure 3.1 circuit diagram

Measurement & Observation

Sr. no	Theoretical							Practical			
	V1 In Vpp	V2 In Vpp	Gain of Channel1	Gain of Channel2	Vout In v	F1 In khz	F2 In khz	V1 In Vpp	V2 In Vpp	Vout In V	Fo In khz
1	1	1	10	5	15	10	10	1	1	15	10
2	1	1	10	5	15	10	1	1	1	15	1
3	1	0.8	10	5	14	10	10	1	800	13.9	10
4	0.8	0.8	10	5	12	10	10	800	800	12.0	10
5	0.5	0.5	10	5	7.5	10	10	0.5	0.5	7.52	10
6	0.5	0.2	10	5	6	10	10	0.5	0.2	6.00	10
7	0.2	0.5	10	5	4.5	10	10	0.2	0.5	4.48	10
8	0.2	0.2	10	5	2.4	10	10	0.2	0.2	2.88	10
9	0.1	0.1	10	5	1.5	10	10	0.1	0.1	1.40	10
10	0.1	0.1	10	5	1.5	1	10	0.1	0.1	1.47	1

Table 3.1 Measurement and observation table for scaled adder

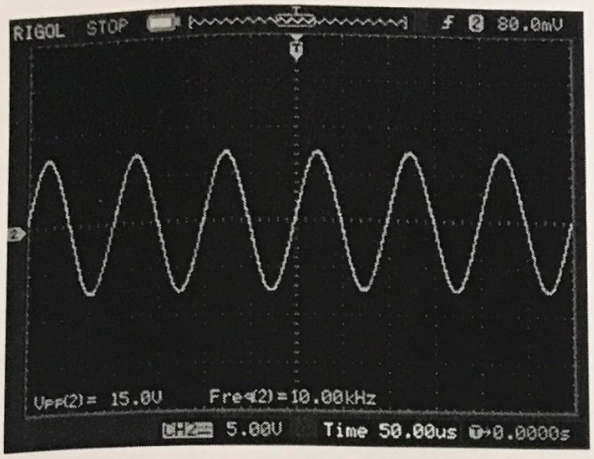


Figure 3.1.1 scaled adder case 1

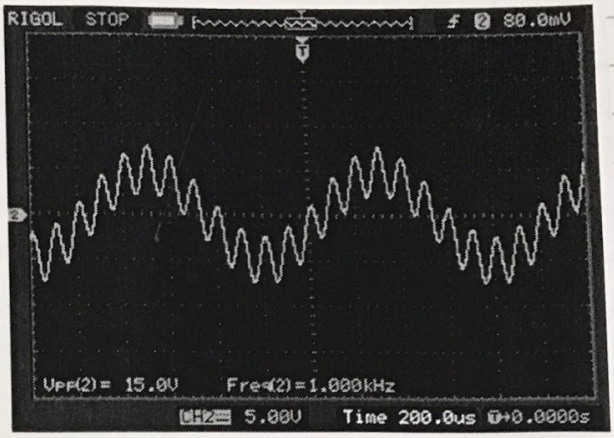


Figure 3.1.2 scaled adder case 2

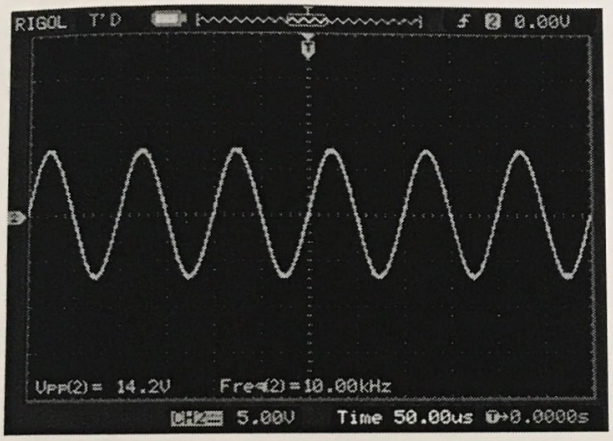


Figure 3.1.2 scaled adder case 2

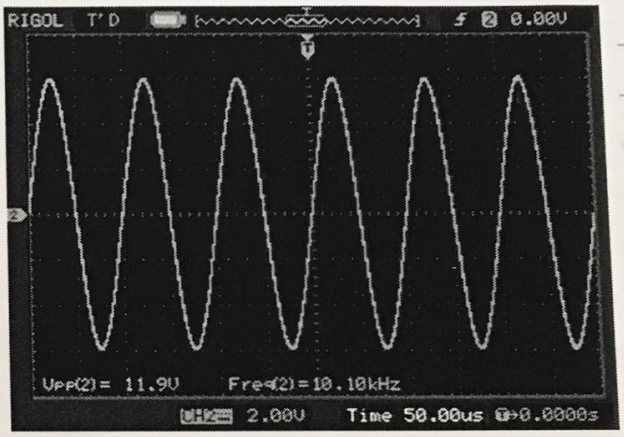


Figure 3.1.4 scaled adder case 4

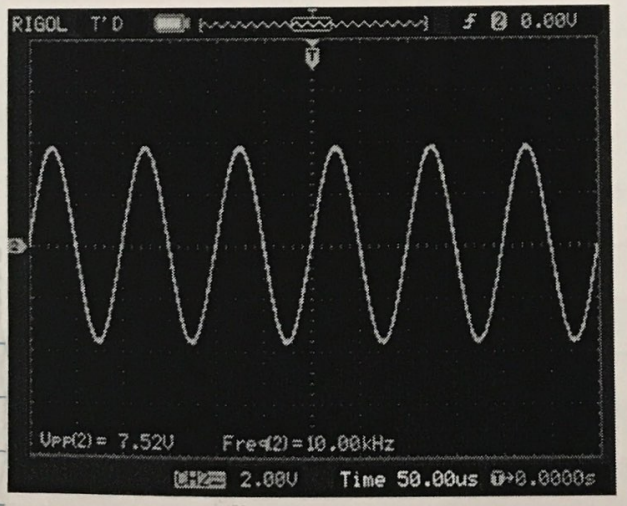


Figure 3.1.5 scaled adder case 5

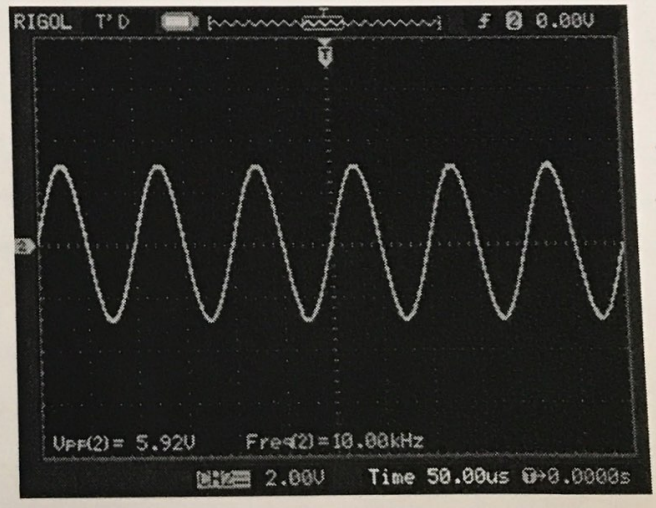


Figure 3.1.6 scaled adder case 6

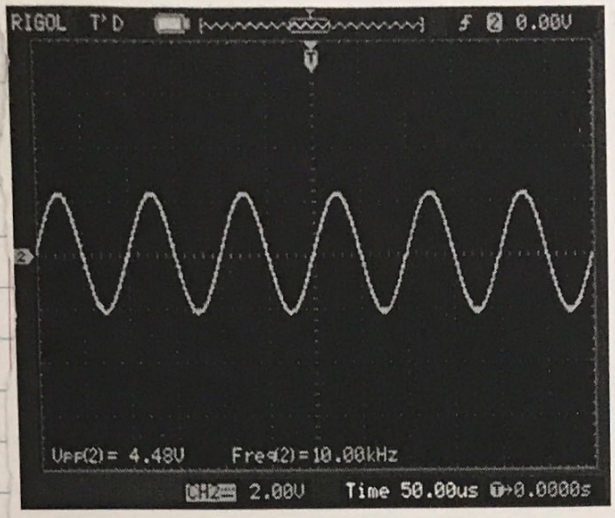


Figure 3.1.7 scaled adder case 7

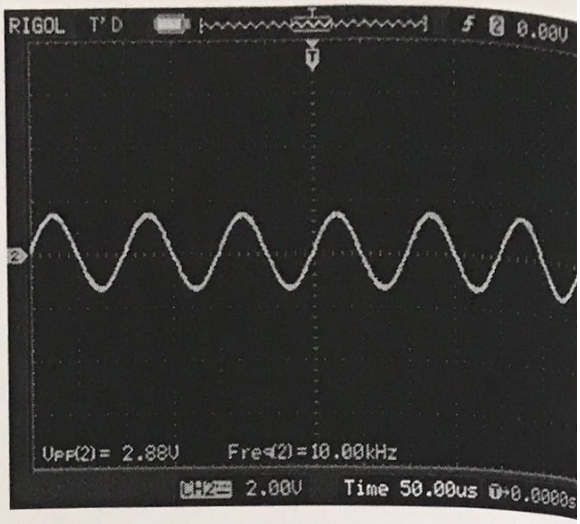


Figure 3.1.8 scaled adder case 8

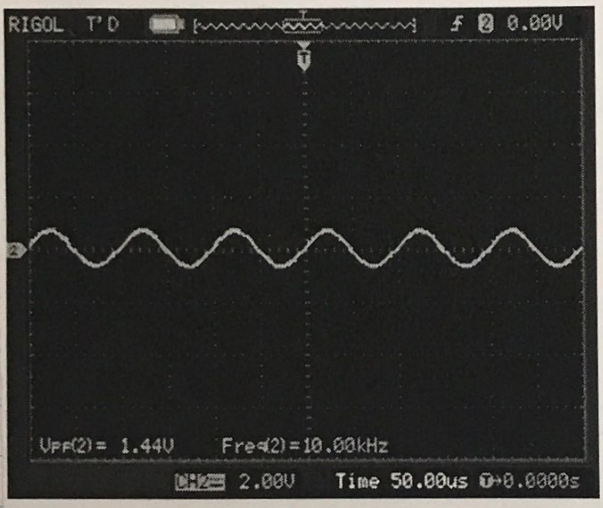


Figure 3.1.9 scaled adder case 9

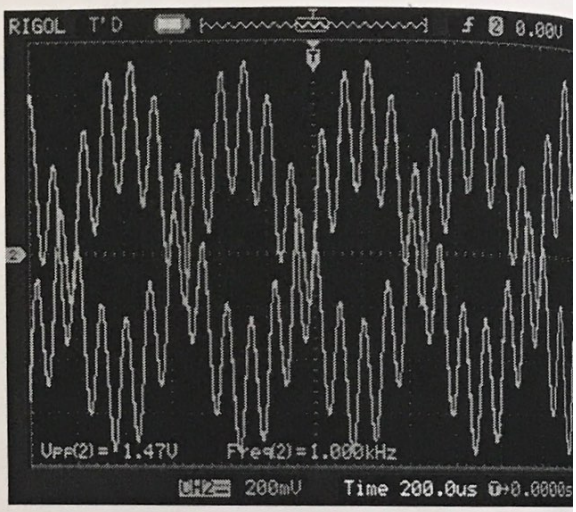
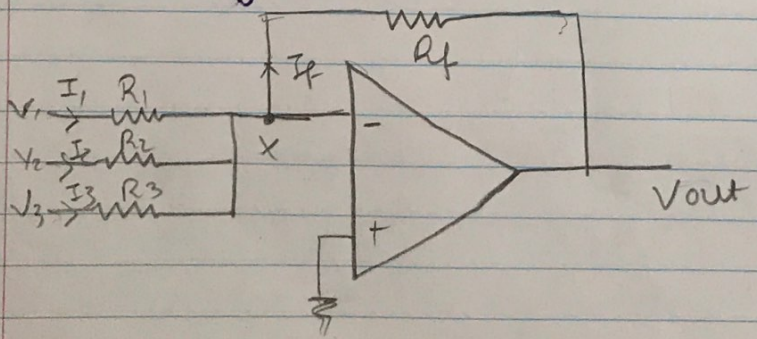


Figure 3.1.10 scaled adder case 10

Discussion And Analysis :-

Gain formula



Applying KCL at node X

$$I_1 + I_2 + I_3 = I_f$$

$$\frac{V_1 - 0}{R_1} + \frac{V_2 - 0}{R_2} + \frac{V_3}{R_3} = \frac{0 - V_{out}}{R_f}$$

Simplifying equation.

$$\frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3} = -\frac{V_{out}}{R_f}$$

$$\boxed{V_{out} = -\left[\frac{R_f}{R_1} V_1 + \frac{R_f}{R_2} V_2 + \frac{R_f}{R_3} V_3\right]}$$

$$V_{out} = -\frac{R_f}{R_1} V_{in}$$

If $R_1 = R_2 = R_3 = R$

$$V_{out} = -\frac{R_f}{R}[V_1 + V_2 + V_3]$$

if $R_f = R$

$$V_{out} = -[V_1 + V_2 + V_3]$$

If $R_1 \neq R_2 \neq R_3$

$$\frac{R_f}{R_1} \neq \frac{R_f}{R_2} \neq \frac{R_f}{R_3}$$

$$V_{out} = -[AV_1 + BV_2 + CV_3]$$

Where $A = \frac{R_f}{R_1}$, $B = \frac{R_f}{R_2}$ $C \frac{R_f}{R_3}$

From this mesurement and observation section we can say that in scaled adder we can select gain by changing value of R_1, R_2 and R_f.

This scalling amplifier can be use as Audio mixuter & DAC.

- In Audio mixing high frequency signal can be superimposed on low frequency signal.
- we get output frequency which is lower.
- where amplitude remains same.

Conclusion:

From the proven results we can come to the conclusion that we can set gain of each input by selecting the value of R_f and R.

moreover we can also mix two freaquency with this scaled adder.

Refrence:

https://youtu.be/ysksfaFQdL4