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SIMULATION OF ELECTRONICS CIRCUITS USING SOFTWARE

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ABSTRACT
This paper describes the design and simulation of clipper circuits using Multisim software. Multisim is developed by National Instruments and it is a powerful tool for simulation and design of circuits virtually to save valuable time and money. Multisim is one of the best electronics design software which includes a wide variety of simulation tools and it has large component library for to quickly build the circuits. This paper utilizes the design of various clipper circuits (biased and unbiased, combination) and its simulation. The ideal diode as well as silicon diode (1N4007) have been used to design the clipper circuits. The simulation result has been shown in oscilloscope and input is given by function generator in Multisim software. We found that the simulation result obtained using Multisim software is very much similar to the Ideal result.

Keyword: Clipper, software, multisim, simulation, Design, electronic circuit, diode, IN4007, biased unbiased clipper, combinational clipper

INTRODUCTION

Clipper is an electronic circuit which used to “clip off” or remove the complete half cycle of sinusoidal AC input or a portion of cycle. Clipper circuits contains a semiconductor diode ans a load resistor. Depending upon the types of clipping and exrternal DC supply it can be mainly divided into two types [1].
Classification of clipper circuits.

1. Based on external supply applied.
2. Based on the input cycle clipped.
3. Based on connection of diode.

Based on external supply applied

Depending upon the external DC voltage applied to the clipper circuit it is mailnly divided into two parts:

- Unbiased Clipper
- Biased Clipper

Unbiased Clipper: When there is no external DC voltage applied to the clipper circuit then it is called unbiased clipper.

Biased Clipper: When there is an external DC voltage is applied to the clipper circuit, then it is called Biased Clipper.

Based on the input cycle clipped:

Depending upon the clipping or removal of the input waveform the clipper circuits are divided into two parts:

- Unbiased Clipper
- Biased Clipper
- Positive clipper
- Negative clipper

Unbiased Clipper: when a clipper circuits removes, or clipped off the complete half cycle (Positive or negative) of the input waveform then its known as unbiased clipper.

Biased Clipper: when the clipper circuits removes, or clipped off a portion of positive or negative cycle depending upon the application is known as Biased clipper.

Positive clipper: when the positive half cycle or a portion of positive half cycle is clipped off or removed then the circuits is called positive clipper circuits.

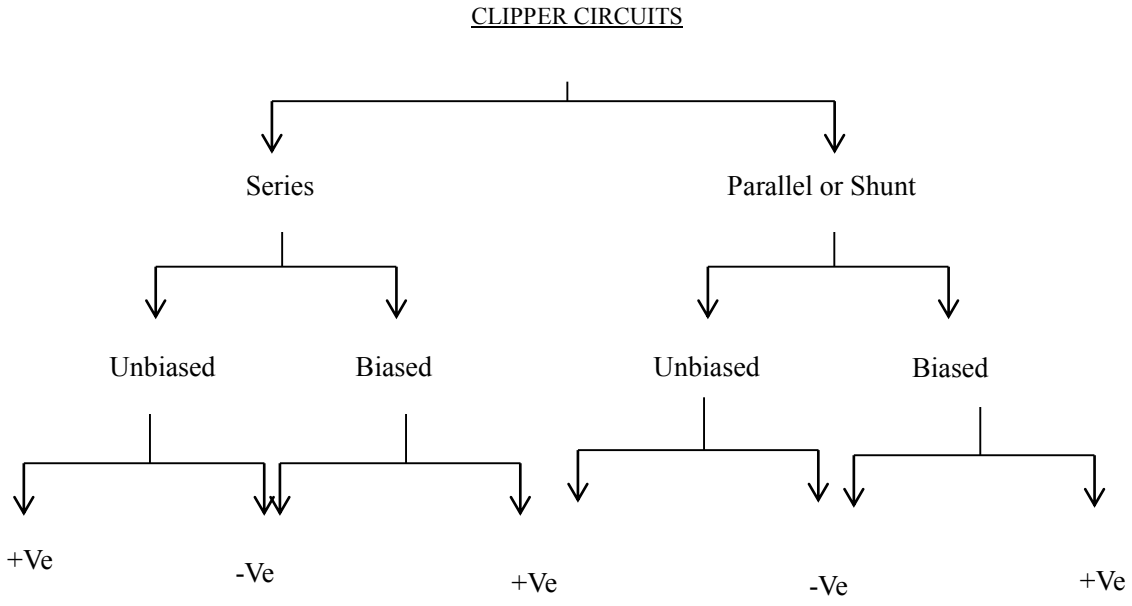
Negative clipper: when the negative half cycle or a portion of negative half cycle is clipped, or removed then the circuits is called positive clipper circuits.

Based on connection of diode:
Depending upon the diode connection in the clipper circuits with respect to the load resistance it is further divided into two parts.

- Series clipper
- Shunt (parallel) clipper

Series clipper: when diode is connected in series with the load resistance or input supply it known as series clipper.

Shunt (parallel) clipper: when diode is connected in parallel with load resistance then it is called parallel or shunt clipper.



Design and Simulation using Multisim Software

Unbiased Positive clipper

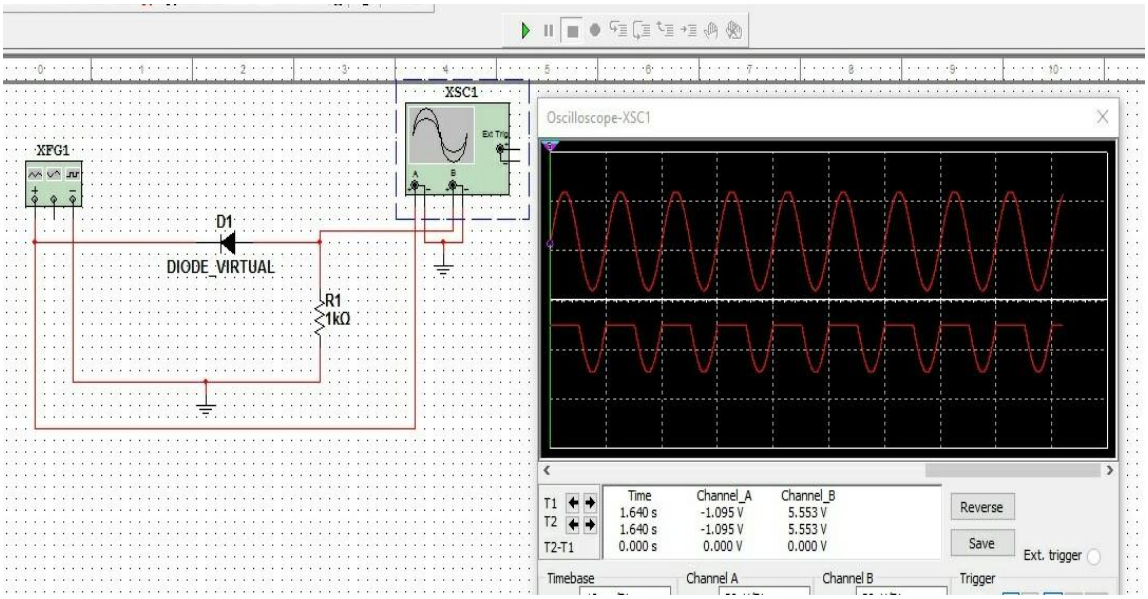


Figure 1: Unbiased Positive clipper and its simulation result in Multisim software

From the figure 1, it can be seen that the virtual diode (Ideal diode) diode is connected in series with the input supply. The function generator is used in place of input supply and sinusoidal signal is given as the input to the clipper. A load resistance of 1 kilo ohm is connected across which output is measured in CRO. It can be visualized that the positive half cycled of the sinusoidal signal is clipped off and only negative half cycled is obtained [2].

Unbiased Negative Clipper:

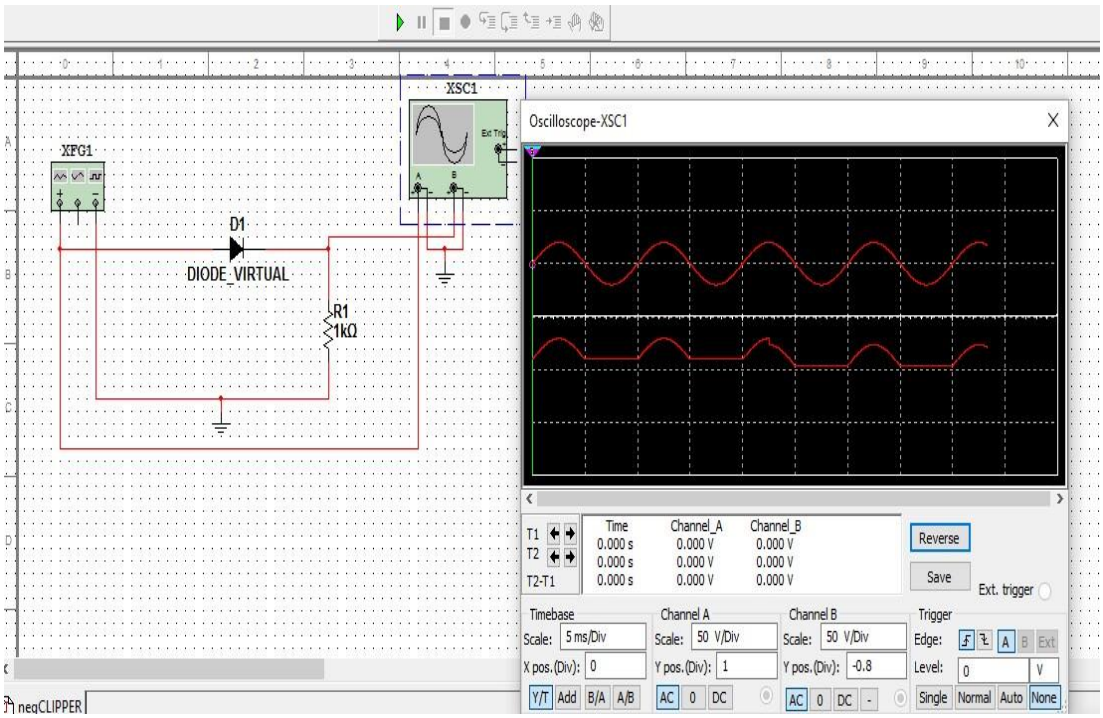


Figure 2: Unbiased Negative clipper and its simulation result in Multisim software

Similarly, the negative series clipper is designed by reversing the direction of diode. All other values are keeping constant and the result is displayed in CRO. From figure 2, it can be seen that the Negative half cycle of the sinusoidal signal given using function generator is clipped off and only positive half cycled is obtained.

Biased Positive and Negative Clipper

Biased positive and negative shunt clipper is designed using Multisim software. From the figure 3, it is visualized that the biasing DC voltage of 12 volts in shunt with the load resistance of 1 kilo ohm. The simulation result is observed in CRO of multiset software. In figure 4, the negative biased clipper with its simulation result has been visualized. The accuracy level of biased clipper is not so accurate as compared to unbiased clipper [3]. The output of biased clipper observed in figure 3 and 4 is reduced as compared to input but the clipping portion is not clearly visible. Hence we designed combined clipper in Multisim software to compare the result.

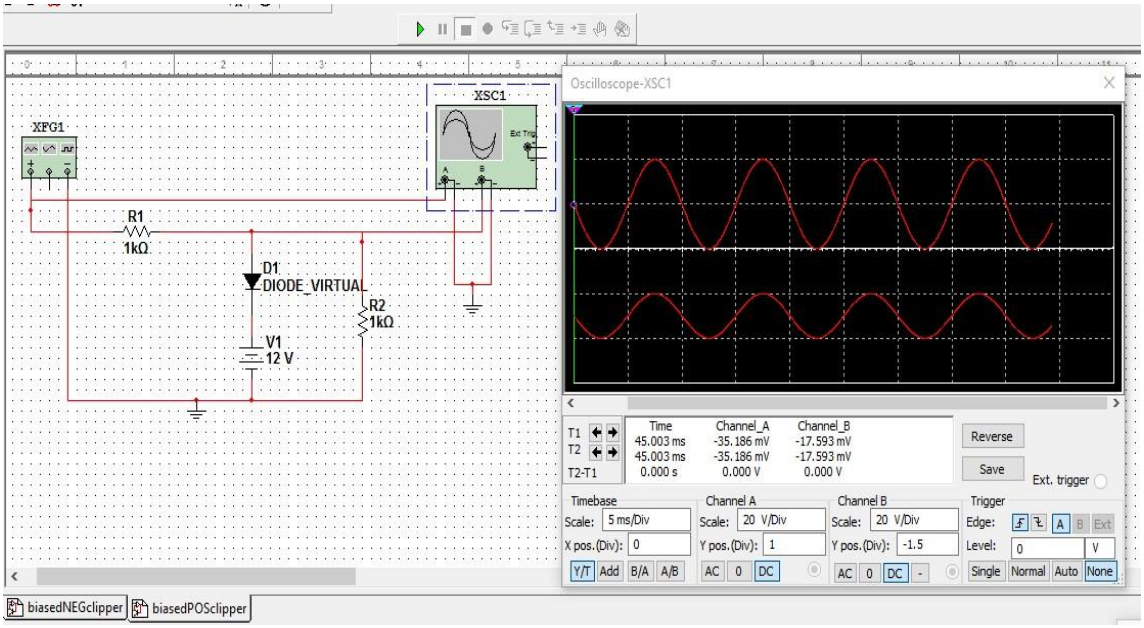


Figure 3: Biased positive clipper and its simulation result in Multisim software

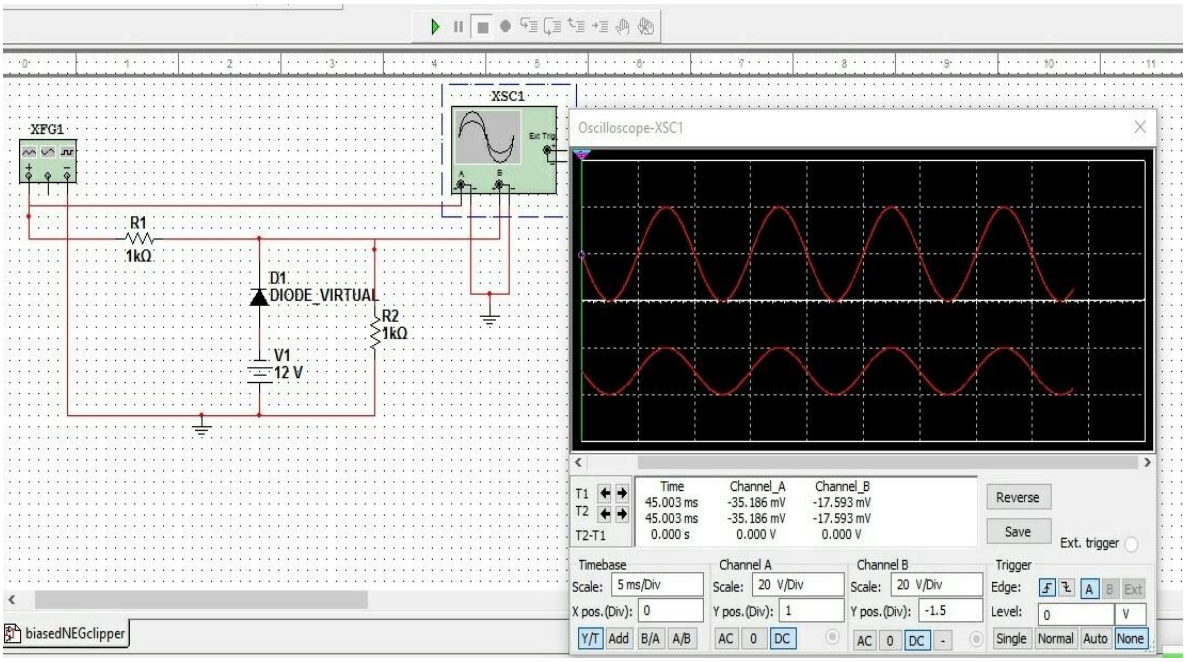


Figure 4: Biased Negative clipper and its simulation result in Multisim software

Combination Parallel clipper

Combination clipper is an electronic circuit which is basically a combination of biased shunt positive and biased shunt negative clippers. Since it is a biased clipper hence the portion of both cycle will be clipped off. We have designed the combination clipper by using two diode D1 and D2 (1N4007) opposite to each other in shunt with the load resister. Here, instead of using virtual diode in Multisim we have used the piratical diode and the biased voltage 10 volt positive and negative in series with each diode. The load resistance of 10 kilo ohms is connected where the output was observed in CRO connected across load. The figure 5 shows the circuit design of combination clipper in Multisim software [4,5].

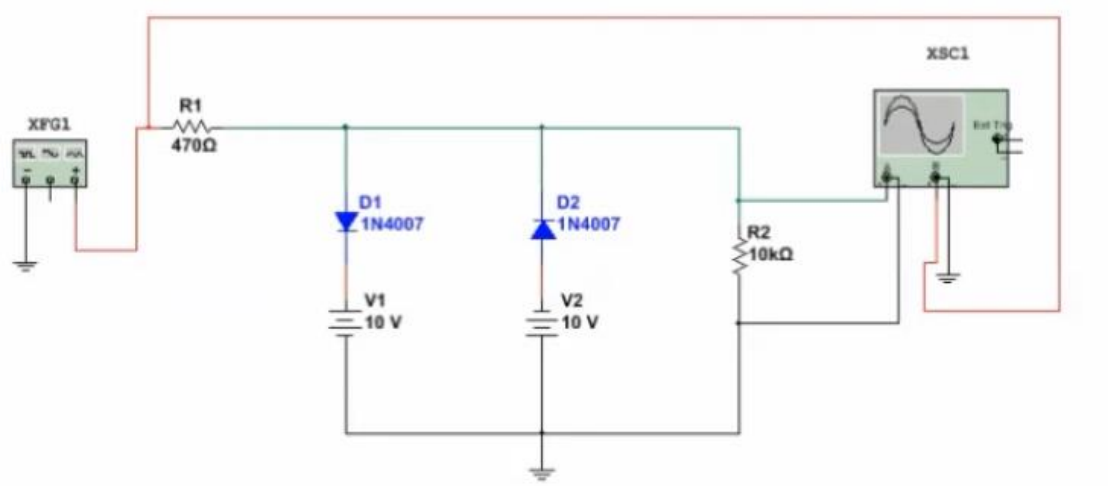


Figure 5: Design of combination clipper circuit in Multisim software

The simulation result of combination clipper is shown in figure 6. We have set the frequency of 1 KHz and amplitude of 5-volt peak and biasing voltage is 10 V. It is observed that in this there is no clipping takes place because the biasing voltage is 10 V and input Voltage is 5 V.

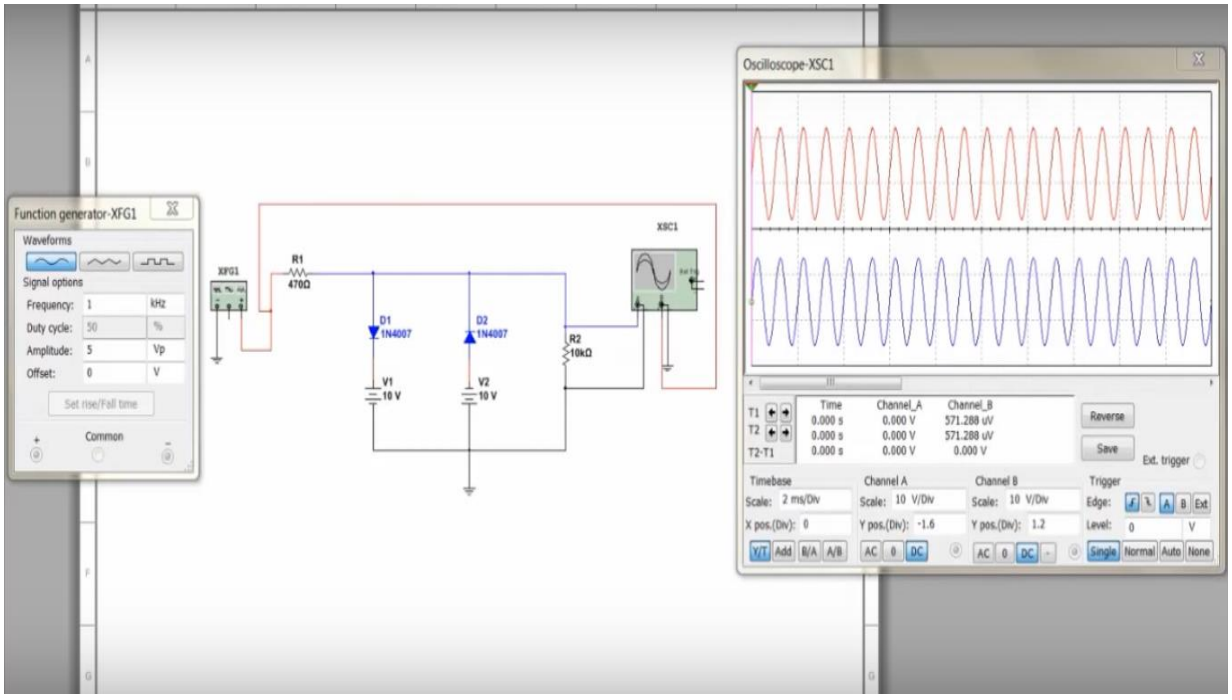


Figure 6: Combination clipper with biasing voltage 10V and its simulation result

In figure 7, The small portion of positive hale cycle and negative half cycle is clipped because we have applied. Since the diode used is 1N4007 which is basically a silicon diode whose Forward Voltage 0.7 volt approx. [6-9].

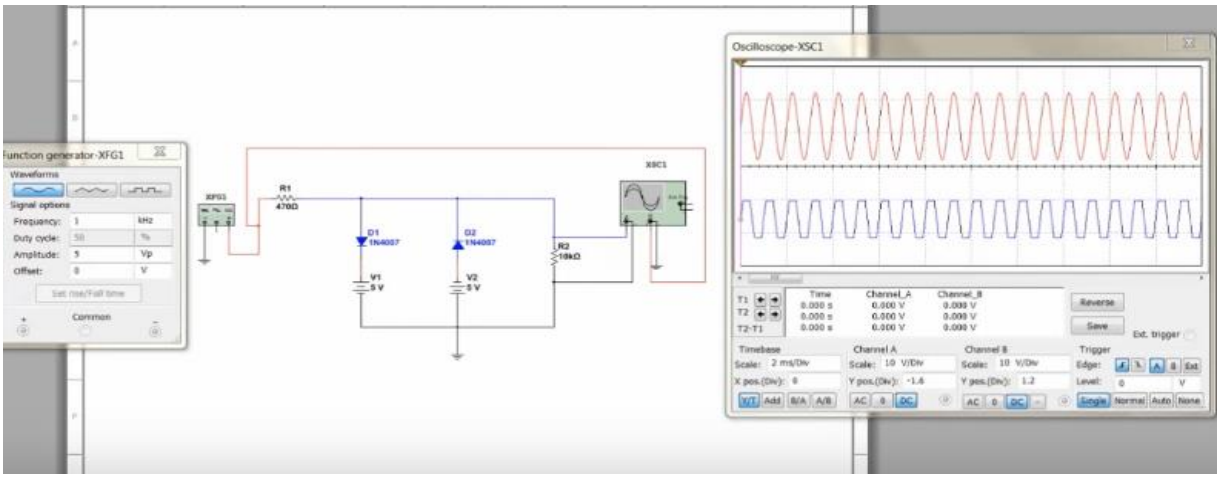


Figure 7: Combination clipper with biasing voltage 5V and its simulation result

But when biasing voltage is 2 V then the large portion of positive and negative cycle is clipped off which is shown in the figure 8.

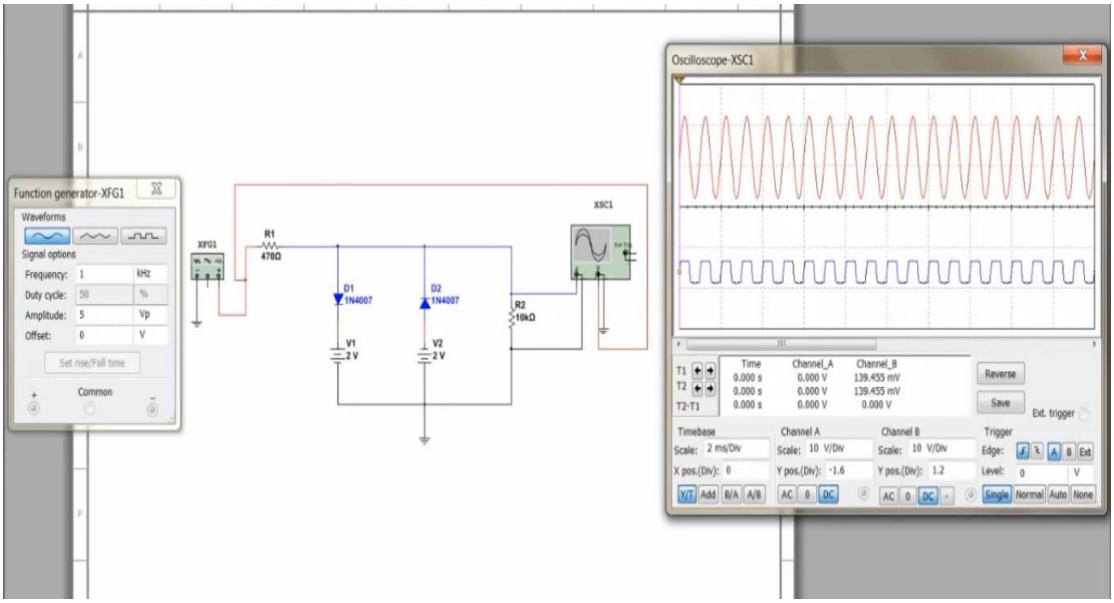


Figure 8: Combination clipper with biasing voltage 2V and its simulation result

CONCLUSION

This paper utilized Multisim software to design and simulate various clipper circuits. The biased, unbiased, positive, negative, series, shunt and combination clipper have been designed and simulated. The sinusoidal input is given by function generator and the simulates result is visualized in oscilloscope in Multisim. For the combination clipper, we found the when we use biasing voltage more than the input supply then no clipping takes place where as when we apply biasing voltage less than the input supply then the clipping is clearly visible. The clipper unbiased and biased clipper is designed using ideal diode whereas combination clipper is designed using silicon diode 1N4007. The simulated result using Multisim software of various clipper circuits are very close to ideal result.

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