Simulation and Analysis of Diode Clippers and Clampers Using eSIM

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1. Introduction

Wave shaping circuits such as **clippers** and **clampers** play a crucial role in signal processing applications. Clippers (also known as limiters) are designed to remove portions of the waveform beyond a certain voltage level, altering its shape. Clampers, on the other hand, shift the entire waveform to introduce a DC bias without changing its form. These circuits are widely used in **communication systems, television receivers, and signal conditioning applications**.

This project focuses on simulating diode-based clipper and clamper circuits using **eSIM**, an open-source electronic simulation tool. The objective is to analyze the behavior of these circuits under different configurations and observe their impact on waveform transformation.

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2. Circuit Theory and Description

2.1 Clipper Circuits

- **Series Positive Clipper**: Removes the positive half-cycle of the input waveform.

- **Series Negative Clipper**: Removes the negative half-cycle of the input waveform.

- **Biased Clippers**: Allows clipping at a voltage level other than zero by introducing a bias voltage.
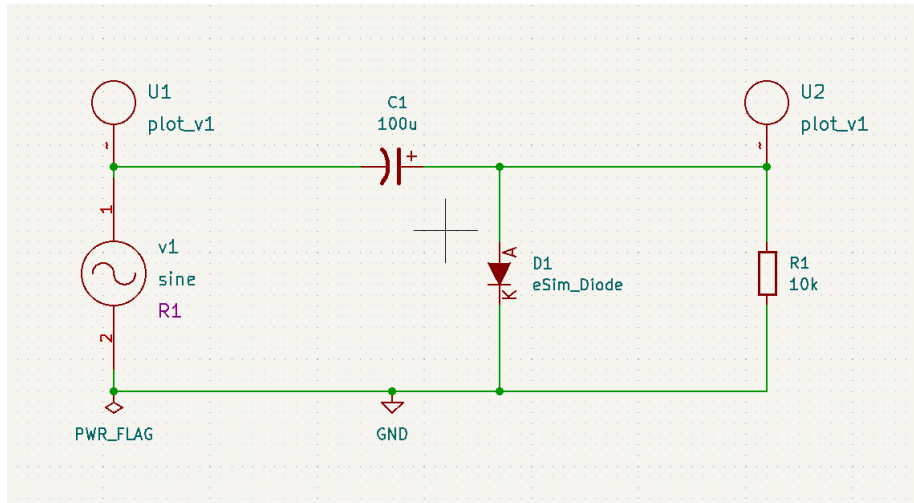
2.2 Clamper Circuits

- **Positive Clamper**: Shifts the waveform upward by adding a positive DC level.

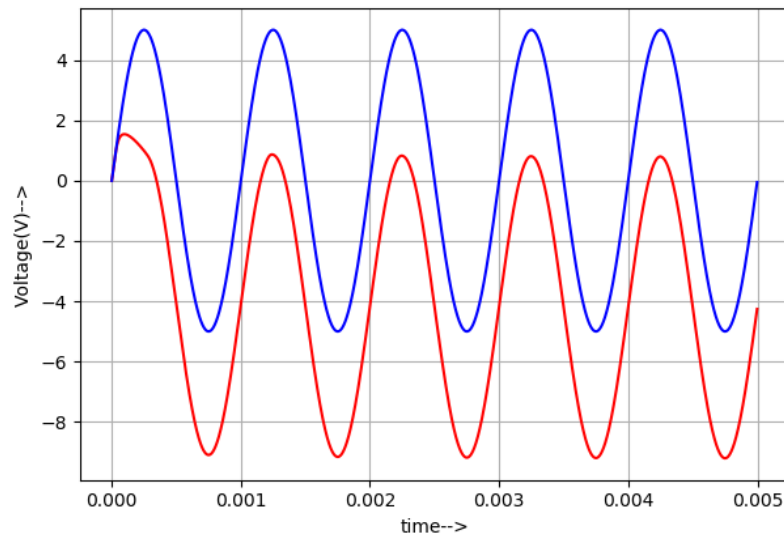- **Negative Clamper**: Shifts the waveform downward by adding a negative DC level.

These circuits employ **diodes, resistors, capacitors, and function generators** to shape the signal.
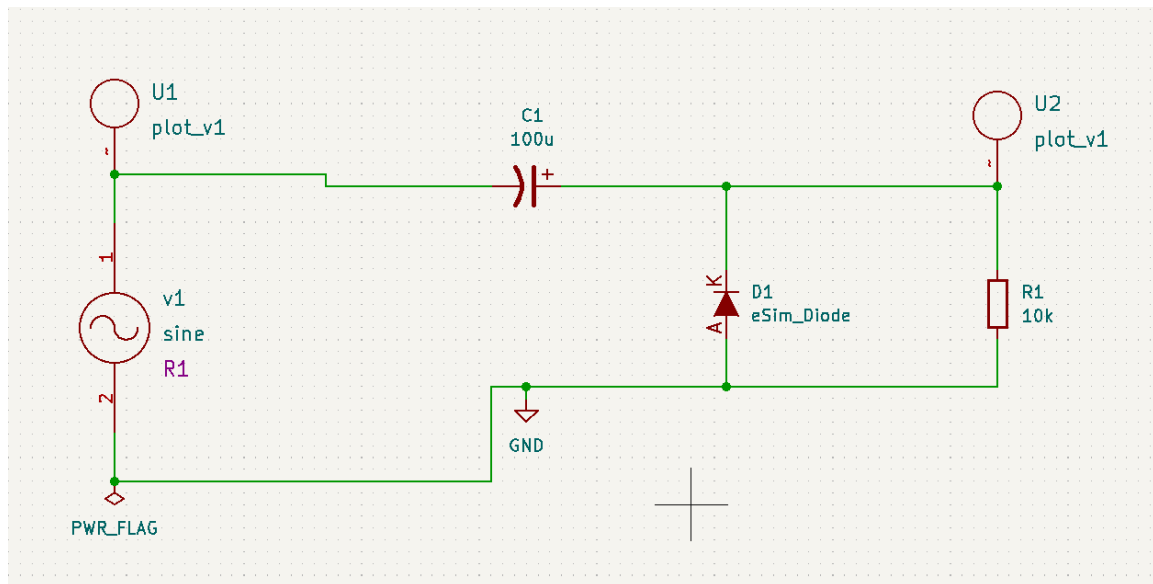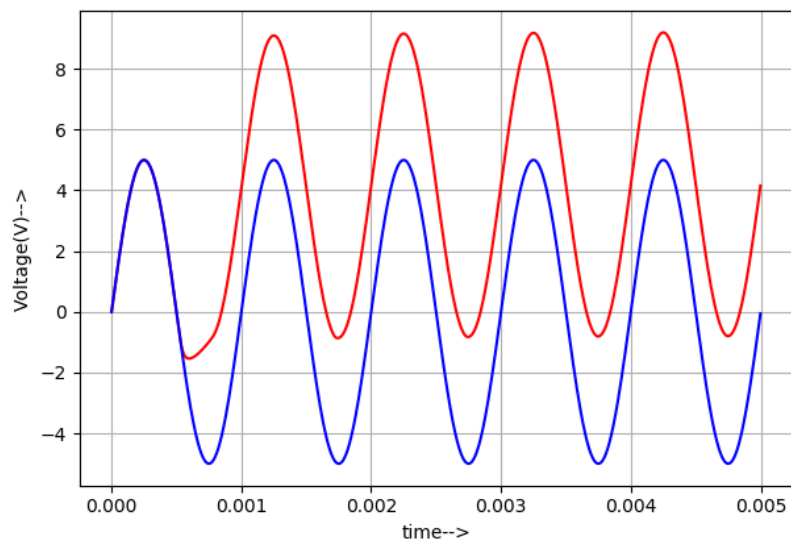
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3. Circuit Diagram(s)
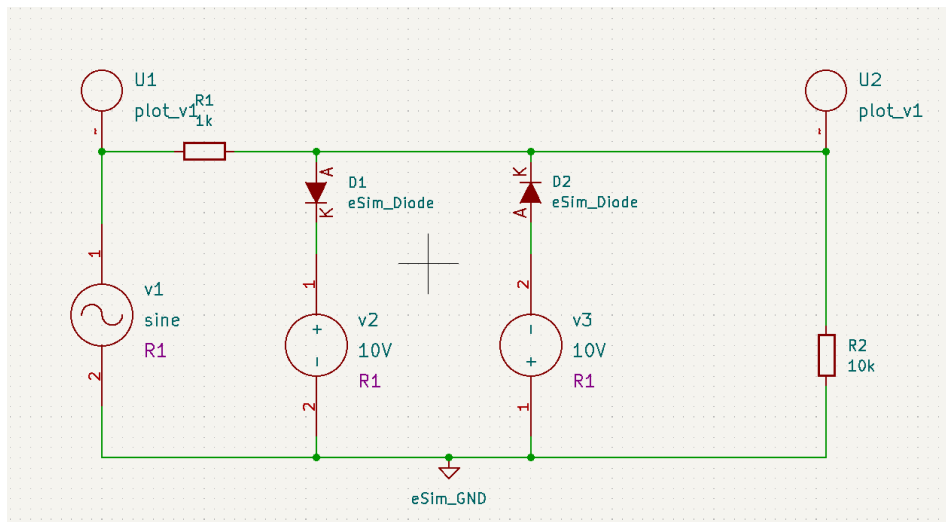
Negative Clamper Circuit
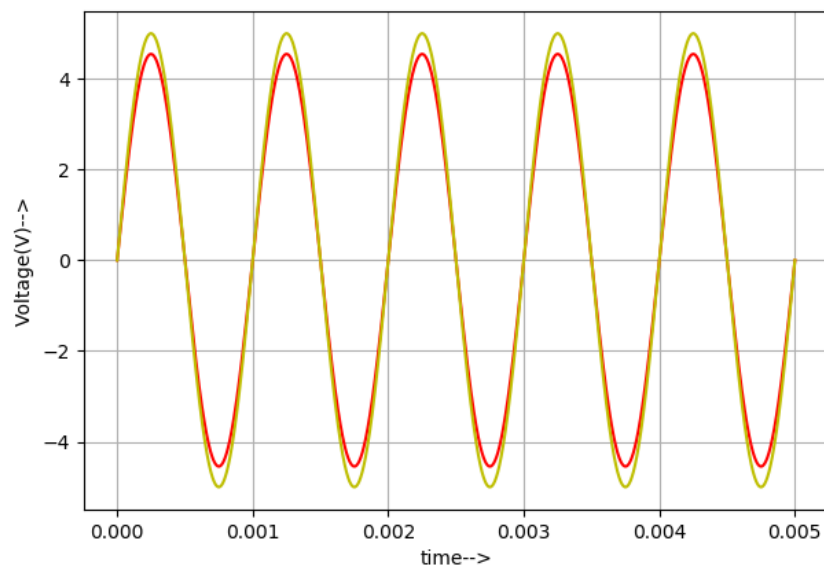

Negative Clamper Output Waveform

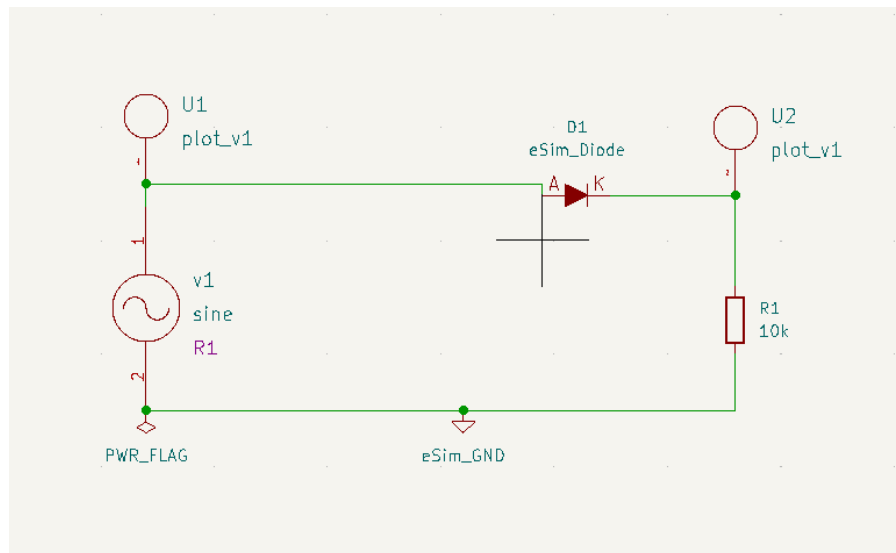**Positive Clamper Circuit**
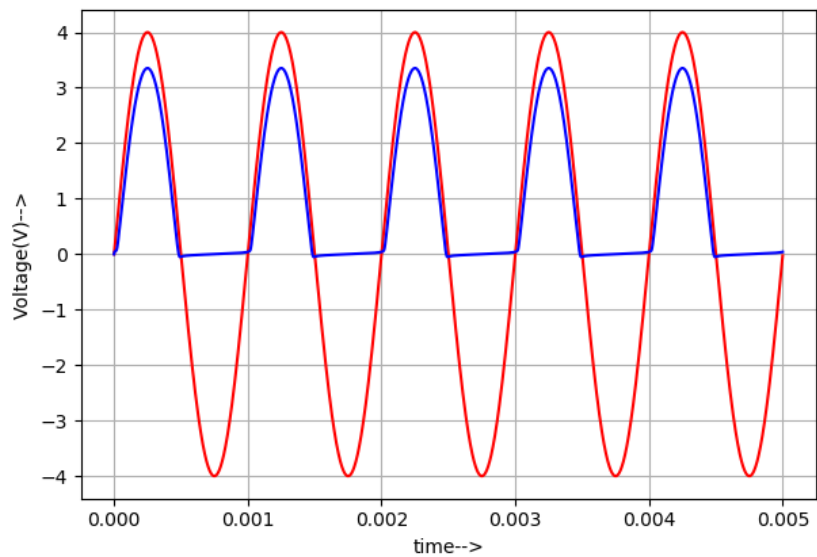

Positive Clamper Output Waveform

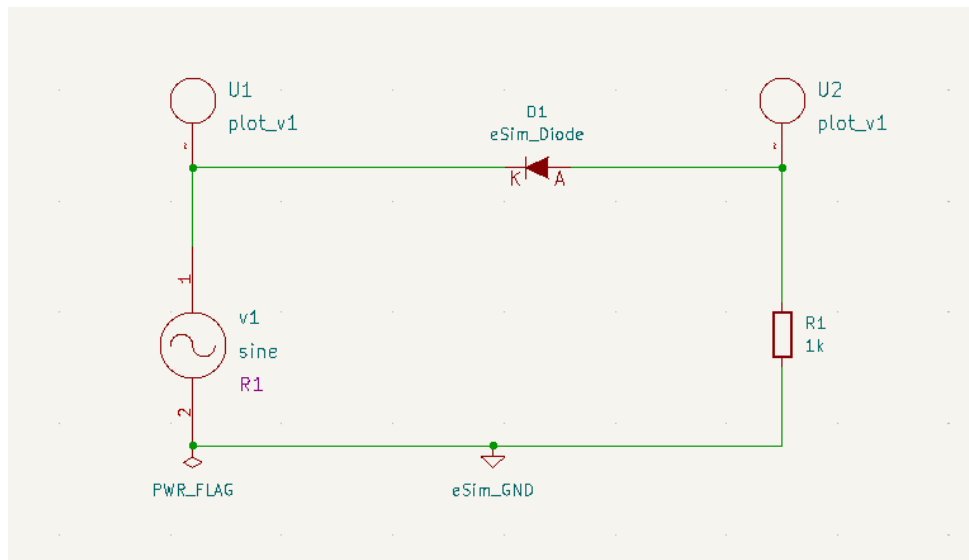**Biased Clipper with diode Circuit**

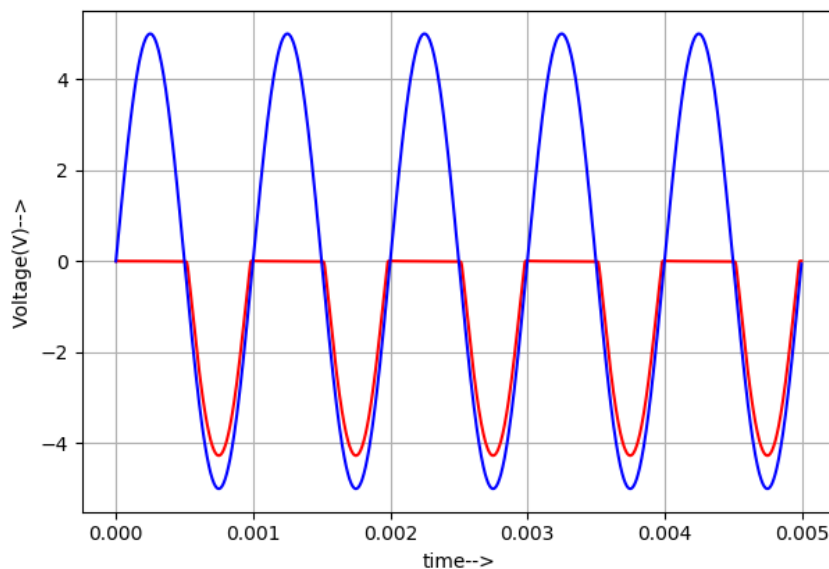**Biased Clipper with diode Circuit Output Waveform**

Negative Clipper Circuit

Negative Clipper Circuit Output Waveform

Positive Clipper Circuit

Positive Clipper Circuit Output Waveform

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4. Simulation Setup and Procedure

1. **Launching eSIM**: Open the eSIM software and create a new project.

2. **Circuit Construction**: Place the required components (**diodes, resistors, capacitors, and function generators**) in the circuit editor.

3. **Input Signal Configuration**: Apply a sinusoidal input signal of **1 kHz frequency and 5V amplitude**.

4. **Simulation Execution**: Run the simulation and analyze the output waveform using a virtual oscilloscope.

5. **Observations**: Compare the input and output waveforms to examine the clipping and clamping effects.

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6. Conclusion

This project successfully **simulated diode-based clippers and clampers** using eSIM. The results validate the expected modifications in the waveform caused by clipping and clamping circuits. The study highlights the significance of these circuits in practical applications, such as **signal modulation, wave shaping, and noise reduction** in electronic systems.

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7. References

1. **IRE Journals - Study and Analysis of Clipper and Clamper Circuits**
   https://www.irejournals.com/paper-details/1701522

2. **CircuitBread - Using Diodes as Clippers or Clampers**
   https://www.circuitbread.com/tutorials/using-diodes-as-clippers-or-clampers

3. **IEEE Xplore - Diode Applications in Nonlinear Wave Shaping Circuits**
   https://ieeexplore.ieee.org/document/793507