Biased Shunt Clippers using Diodes

Diodes are used for waveshaping applications and they can limit or clip a portion of the signal. Such circuits are called clipper circuits. The clipper circuits are also called as limiter circuits which can eliminate a portion of a signal above or below a specified level. The removal of a portion of the signal happens without affecting the remaining part of the input signal.

Clipper circuits find extensive use in electronic systems. The circuits are classified into three types: series clippers, shunt clippers, and dual (combination) clippers. When the diode is connected series with the output load resistance, it is called a series clipper. When the diode is connected in parallel with the output load resistance, it is called as the shunt clipper. A combinational (dual) clipper circuit is used to remove a small portion of both positive and negative half cycles.

The series clippers are again classified into four types: series positive clipper, series positive clipper with bias, series negative clipper and series negative clipper with bias. The shunt (parallel) clippers are again classified into four types: shunt positive clipper, shunt positive clipper with bias, shunt negative clipper, and shunt negative clipper with bias.

The Objective of this lab simulation project is to simulate all the different types of shunt clippers with bias

1. Shunt positive clipper with positive bias

2. Shunt positive clipper with negative bias

3. Shunt negative clipper with positive bias

4. Shunt negative clipper with negative bias

Let the input voltage be Vi and the bias voltage be VB.

Positive shunt clipper with positive bias:

In this type of clipper, the negative of the diode is connected to the positive of the bias voltage as shown in Fig.1. The diode conducts when the input at the positive end of the diode is greater than VB by Vy(0.7V).

When the input is less than VB+Vy, the diode doesn't conduct and therefore, it acts as an open circuit. The output voltage is measured between the positive of the diode and ground. Hence, the output voltage is the same as the input voltage. When the input voltage exceeds VB+Vy, the diode conducts and a voltage of Vy(0.7V) appears across the diode. Therefore the measured output voltage is VB+Vy. Again when the input voltage reduces to less than VB+Vy, diode is off and the output measured will be same as input signal voltage.

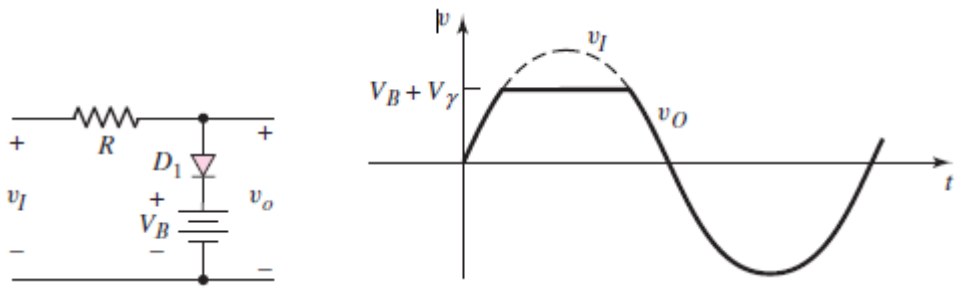

Fig 1. Shunt Positive Clipper with Positive Bias

Positive shunt clipper with Negative bias:

In this type of clipper, the negative of the diode is connected to the negative of the bias voltage as shown in Fig. 2. The diode conducts when the input at the positive end of the diode is greater than –VB by 0.7V. This happens till the input reaches –(VB-Vy). The diode conducts and the output voltage measured it –(VB-Vy). When the input signal reduces below –(VB-Vy) the diode doesn't conduct and it acts as an open circuit. Therefore, the output voltage measured is same as that of the input signal. Once, the input to the diode exceeds –(VB-Vy), the diode starts to conduct again and the voltage at the output is –(VB-Vy).

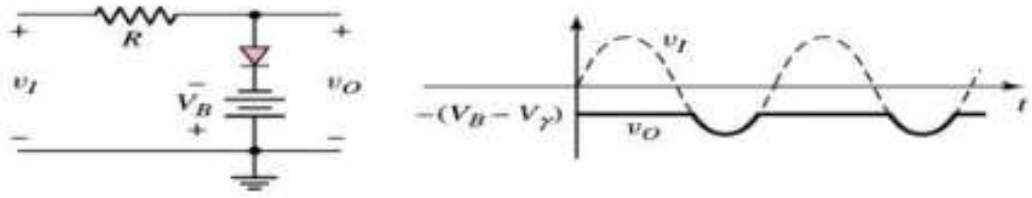

Fig. 2. Shunt Positive Clipper with Negative Bias

Negative shunt clipper with positive bias:

In this type of clipper, the positive of the diode is connected to the positive of the bias voltage as shown in Fig.3.

When the input is less than VB-Vy, the diode conducts and therefore the output voltage measured between the negative of the diode and ground is at VB-Vy. When the input voltage exceeds VB-Vy, the diode doesn't conduct and the input signal appears at the output. When the input goes below VB-Vy again, then the diode starts to conduct, and the output measured will be VB-Vy.

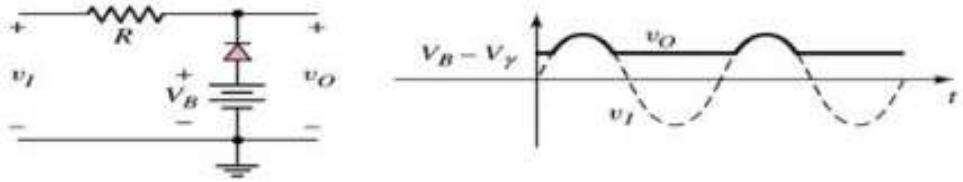

Fig. 3 Shunt Negative Clipper with Positive Bias

Negative shunt clipper with negative bias:

In this type of clipper, the negative of the diode is connected to the negative of the bias voltage as shown in Fig.4.

When the input is more than –(VB+Vy), the diode conducts and therefore the output voltage measured between the positive of the diode and ground is at –(VB+Vy). When the input voltage reduces below –(VB+Vy), the diode doesn't conduct and the input signal appears at the output. When the input goes above –(VB+Vy), then the diode starts to conduct again, and the output measured is –(VB+Vy).

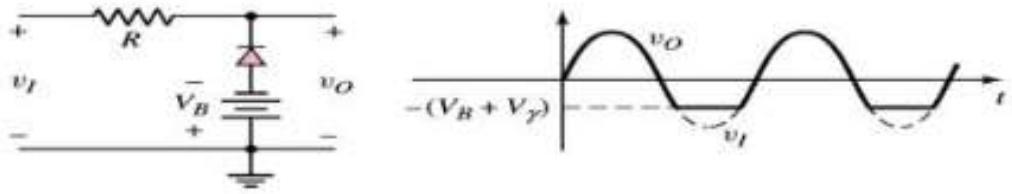

Fig.4. Shunt Negative Clipper with Negative Bias

N.Subhashini

VIT University, Chennai