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5. **Objectives**

The objective of this lab is to design a circuit that will change the input waveform into a new waveform shape. We use diodes and its properties in order to accomplish this. The reason this is possible is because the diode characteristic is nonlinear and is impossible without it in a linear circuit.

1. **Schematics/Simulation Results**

**E1.**

Scatter chart

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**Figure 1. This figure shows the circuit which will be simulated and whose waveforms will be recorded.**

Chart

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**Graph E1(a). This graph displays the voltage output signals of the Figure 1 circuit at certain nodes.**

Chart

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**Graph E1(b). This graph shows the transfer characteristic of the circuit in Figure 1.**

**E2.**

Timeline

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**Figure 2. Similar to Figure 1, however, R5-R10 resistance values have been multiplied by 10.**

Chart

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**Graph E2(a). This graph displays the voltage output signals of the Figure 2 circuit at certain nodes.**

Chart

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**Graph E2(b). This graph shows the transfer characteristic of the circuit in Figure 2.**

**E3.**

Chart

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**Figure 3. This figure is similar to Figure 2, but adds capacitors between the R5-R10 resistors.**

Chart

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**Graph E3(a). This graph displays the voltage output signals of the Figure 3 circuit at certain nodes.**

Graphical user interface, chart

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**Graph E3(b). This graph shows the transfer characteristic of the circuit in Figure 3.**

1. **Conclusions and Remarks**

**C1.**

Based on the graphs P3(b) and E1, we can determine that the output waveform of Figure 1 is sinusoidal clipping. This can be confirmed with both Graph E1 and Graph P3(b). This is because the shape of Graph E1 appears as the typical shipping graph.

**C2.**

The transfer characteristics are similar. The general shape is the same and the values at which they flatline are the same as well. However, the discrepancy between the two is that there is an indent in Graph P3(b). This is due to the calculations and values used, as they might be a little different.

**C3.**

In the case of Graphs P1 and P5(b)/P6(b), there is no discrepancy. This is due to the values being taken in the prelab being incorrect. This made the graphs extremely similar. The main consideration for the resistor values taken was the instructions in the lab manual. While the values of the resistors were unknown at the time, the answer I arrived at was very close to those of the lab kit. When the choice between two of the resistor values was presented, I selected the lower one, as stated per the lab manual (value below 3.7k Ohms). That was why the values used were selected, even if they were off by 20 Ohms when calculated, which may have changed the graphs slightly.

**C4.**

The transfer characteristic of Graph P1 and P6(b)/P7(b) are very different. While in graph P6(b) the transfer function rapidly flatlines, the graph P7(b) continues in a shape similar to Graph P1. The reason there is this difference is because of the addition (or lack) of the capacitors. The role of the capacitors is to maintain the voltage signal in the circuit that flows through it. It P6(b) there are no capacitors, while in P7(b), there are. This drastically changes the output characteristic of our circuits.

1. **Appendix/Prelab**

Please note that the values used for some calculations during the experiment and prelab sections were slightly incorrect as values for resistors were used that were not in the lab kit, as I had not known which values were available. A certain instance of this is using 3320 Ohms instead of 3.3k, as you may see in some situations. Please keep this in mind.

Prelab 4 – Wave shaping circuit Danilo Zelenovic Feb. 15th, 2022

**P1.**

A picture containing text, whiteboard

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**Graph P1. Characteristic graph of Figure 1.**

**P2.**

Letter

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**P3.**

A picture containing calendar

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**Figure P2. Multisim design to be simulated.**

Chart

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**Graph P2(a). Simulated waveforms of Figure 2.**

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**Graph P3(b). Characteristic graph of Figure 3.**

**P4.**

Table

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**P5.**

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**Figure P3. Multisim design to be simulated.**

Chart

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**Graph P5(a). Simulated waveforms for Figure 3.**

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**Graph P5(b). Characteristic graph of Figure 3.**

**P6.**

Diagram, schematic

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**Figure P4. Design to be created in multisim and simulated.**

Chart

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**Graph P6(a). Simulated waveforms of Figure 4.**

A screenshot of a computer

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**Graph P6(b). Characteristic graph of Figure 4.**

**P7.**

Chart

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**Figure P5. Design in multisim that will be ran.**

Chart

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**Graph P7(a). Simulated waveforms of Figure 5.**

Chart

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**Graph P7(b). Characteristic graph of Figure 5.**