
EXPERIMENT 2: Analog Wave Shaping

Objectives: To understand different analog wave shaping techniques using diode function generator

Software:
Multisim 8

Theory:

Different analog wave shaping techniques will be examined in this lab. These includes

- 1) General transfer function synthesizer using diode function generator
- 2) Sine wave to square wave conversion
- 3) Triangular to sine wave conversion
- 4) Peak detector, clamper and voltage doubler

General Transfer Function Synthesizer

Figure below shows possible combination of diode, resistor and a battery. First diode conducts only when input voltage is more than V volts and then only the resistor comes into picture. Second diode conducts for all positive voltages and also conducts for negative voltage up to $-V$ volts. Third diode conducts for all the negative voltages, which are more negative than $-V$ volts and then only the resistor comes into picture. Fourth diode conducts for all the negative voltages and also conducts for positive voltage up to V volts.

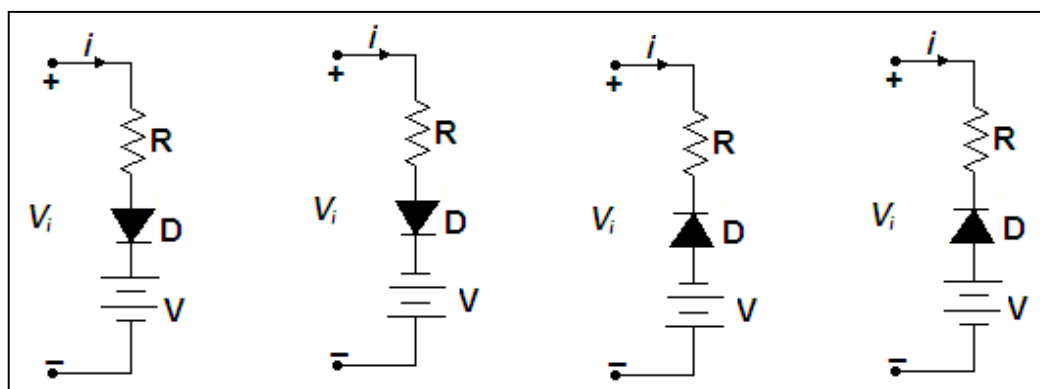


Fig: 1

Any type of non linear transfer function can be synthesized using the blocks shown in fig 1.

Triangular to Sine Wave Conversion

Just by shaping the peak of triangular wave, approximate sine wave can be generated as shown in fig 2.

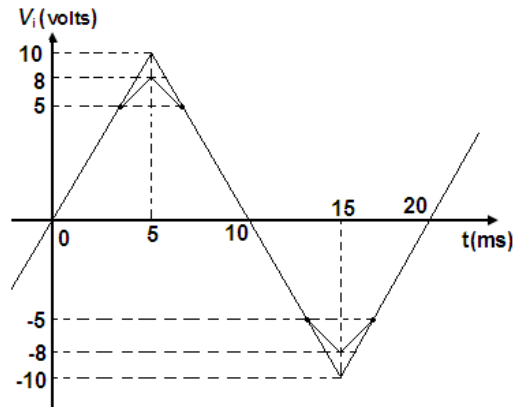


Fig 2: Triangular to Sine Wave Conversion (*Inner is synthesized sine*).

Peak Detector, Clamper and Voltage Doubler

Arrangement as shown in fig 3 can be used as a pick detector because the capacitor will charge up to the highest peak that is available in a given input. If we take the output voltage across the diode, it will act as a clamper circuit. The combination of peak detector and a clamper is used as a voltage doubler.

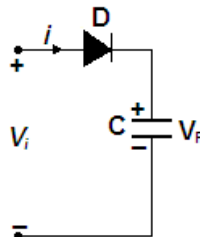


Fig: 3

General Transfer Function Synthesizer

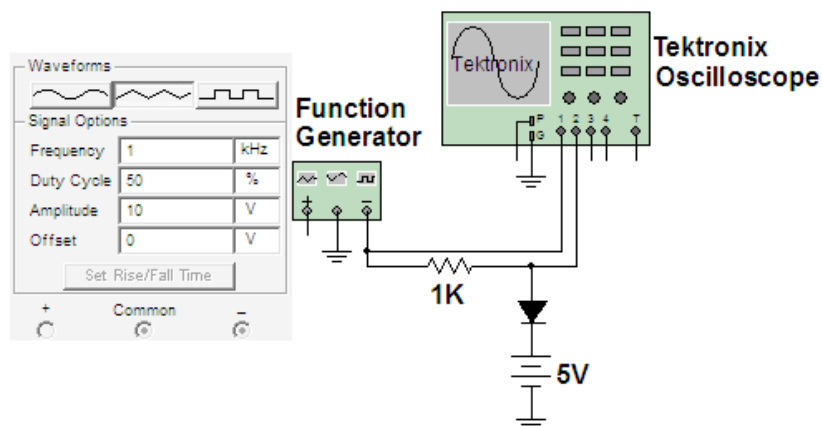


Fig: 4

Procedure

1. Connect the circuit as shown in fig 4.
2. Set the input to 1 kHz triangular wave of 10V amplitude.
3. Connect CH1 and CH2 of oscilloscope to input and output respectively.
4. Set CH1 and CH2 to 5 volt per division.
5. See the output in YT mode.
6. Change the display setting to XY mode and sketch the output.
7. Change the polarity of battery to -5V (*Double Click*) and see the output in both YT mode and XY mode.
8. Set the battery to 0V and see the output in both YT mode and XY mode. Determine cut-in voltage of diode.
9. Connect 5V battery in its own place and reverse the polarity of diode.
10. Sketch the output waveform in both YT mode and XY mode.
11. Connect the circuit as shown in fig 5 and sketch the output in both YT mode and XY mode. (*Input is 1 kHz triangular wave @ 10V amplitude*)

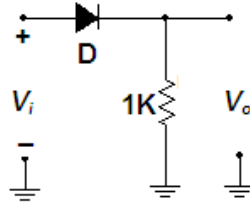


Fig: 5

12. Apply +5V and then -5V across the resistor in fig 5 and sketch the output waveform in both XY mode and YT mode.

Waveform Converter

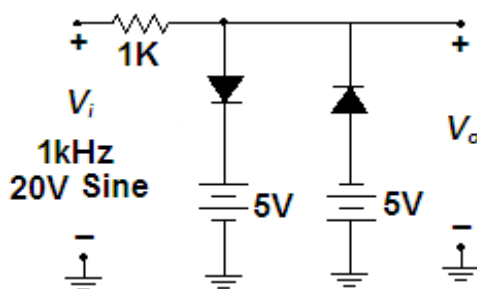


Fig: 6

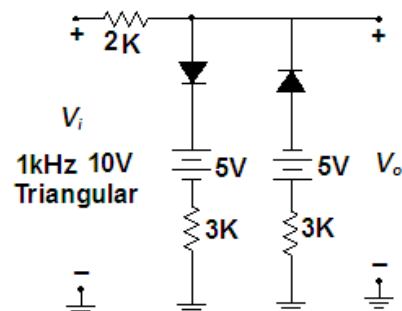


Fig: 7

Procedure

1. Connect the circuit as shown in fig 6.
2. Set the input to 1 kHz sine wave @ 20V amplitude.
3. Sketch the output waveform in both YT mode and XY mode.
4. Connect the circuit as shown in fig 7.
5. Set the input to 1 kHz triangular wave @ 10V amplitude.
6. Sketch the output waveform in both YT mode and XY mode.

Peak Detector and Clamper

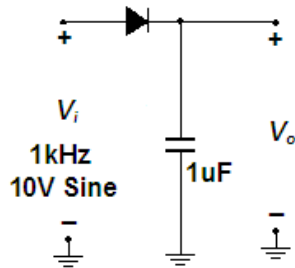


Fig: 8

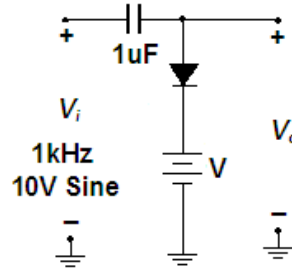


Fig: 9

Procedure

1. Connect the circuit as shown in fig 8. Set both channels of oscilloscope at 10 volt per division.
2. Sketch the voltage output across the capacitor.
3. Connect the circuit as shown in fig 9.
4. Set $V=0V$. Sketch the waveform across the diode in YT mode.
5. Set $V=3V$, 20V and then -3V and sketch the waveform across the diode.
6. Reverse the polarity of diode and set $V= 0V$. Sketch the output waveform.
7. Set $V=3V$, 20V and then -3V and sketch the waveform across the diode.

Voltage Doubler

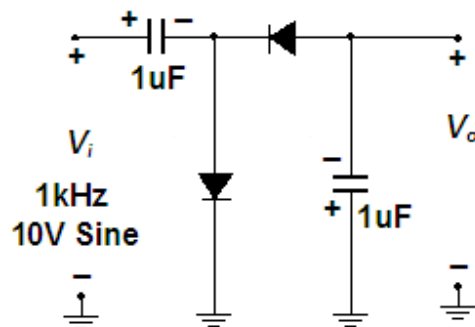


Fig: 10

Procedure

1. Connect the circuit as shown in fig 10. Set the oscilloscope in 10 volt /div.
2. Sketch the output waveform.
3. Reverse the polarity of both diodes and sketch the output waveform.