Modulation Waveforms

Third Laboratory Report for CENG 3331

Submitted by

Michael Lanford

1816337

Computer Engineering

University of Houston-Clear Lake

Houston, Texas 77058

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Abstract

The goal of this lab was to learn modulation and modulation techniques by using Multisim. The major results that we gathered from this lab were that as we modified frequency in the task 2 square wave, its period either grew or reduced in size, an inverse change compared to frequency.

Write-Up

Introduction

Modulation is the process of altering one or more properties of a waveform to transfer information. There are several ways to modulate a signal: by amplitude, by frequency, and by shift keying. To view how these different types of modulation affect a carrier signal, we used Multisim.

Task 1:

We began our experiment by constructing an amplitude modulation transmission signal using 11 components: 3 grounds, 3 transistors, 2 AC power sources, 1 multiplier, 1 oscilloscope, and 1 spectrum analyzer in Multisim. This circuit can be seen in the appendices section under Figure 1. We viewed the output of the signal in the oscilloscope, which can be seen in Figure 2. Finally, we opened the spectrum analyzer and viewed the center frequency produced, the output of which can be seen in Figure 3.

Task 2:

For task 2, we continued the experiment by constructing an amplitude shift keying transmission signal using 9 components: 3 grounds, 2 resistors, 2 function generators, 1 NPN bipolar planner low power transistor, and a 4 probe oscilloscope. This circuit can be seen in the appendices section under Figure 4. We viewed the initial output of the signal in the oscilloscope, which can be seen in Figure 5. After this, we increased the frequency of the square wave, which resulted in a smaller period, and this output can be seen in Figure 6.

Task 3:

In this final task, we concluded the experiment by constructing a frequency shift keying transmission signal using 17 components: 4 grounds, a NOT, 5 resistors, 2 capacitors, a NPN bipolar planner low power transistor, an oscilloscope, a Vcc, a timer, and a function generator. This circuit can be seen in the appendices section under Figure 7. As you can see by Figure 8, the input values we had from out function generator were: a 1 Hz frequency, a 50% duty cycle, a 10 Vp amplitude, and a 0 V offset. The oscilloscope output of this signal can be seen in Figure 9 in the appendix.

Appendix

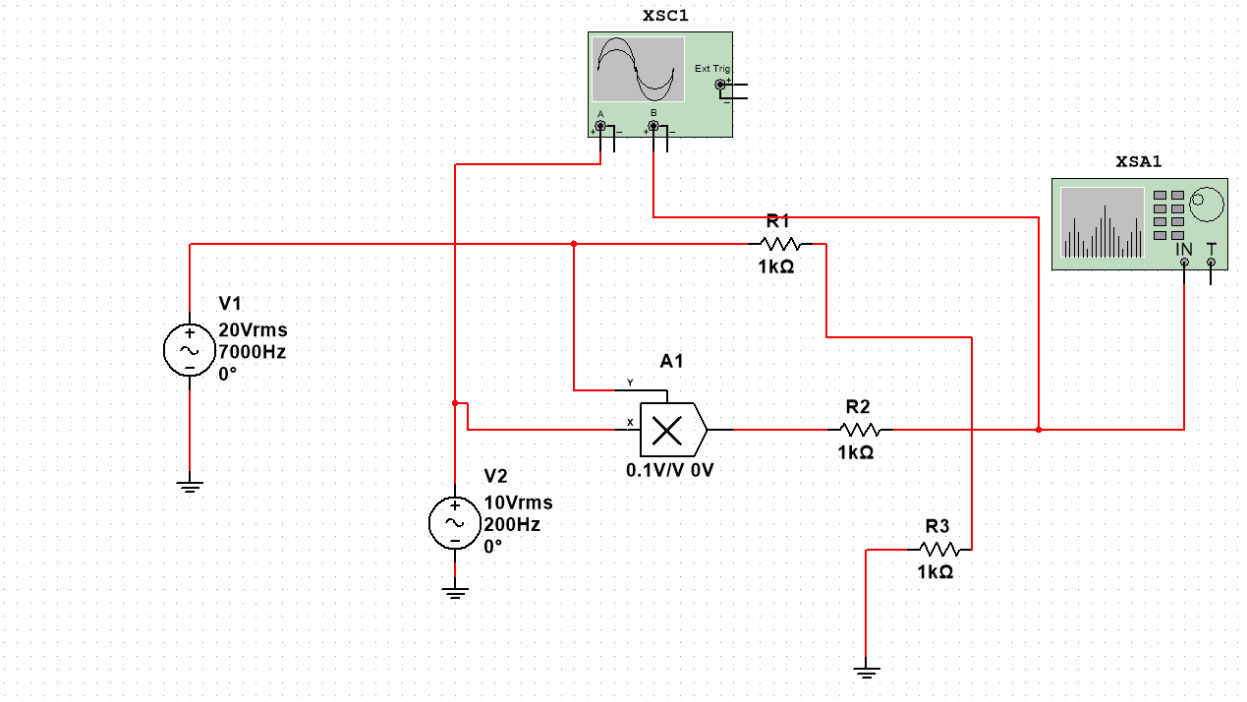

Fig. 1. Circuit Diagram Task 1

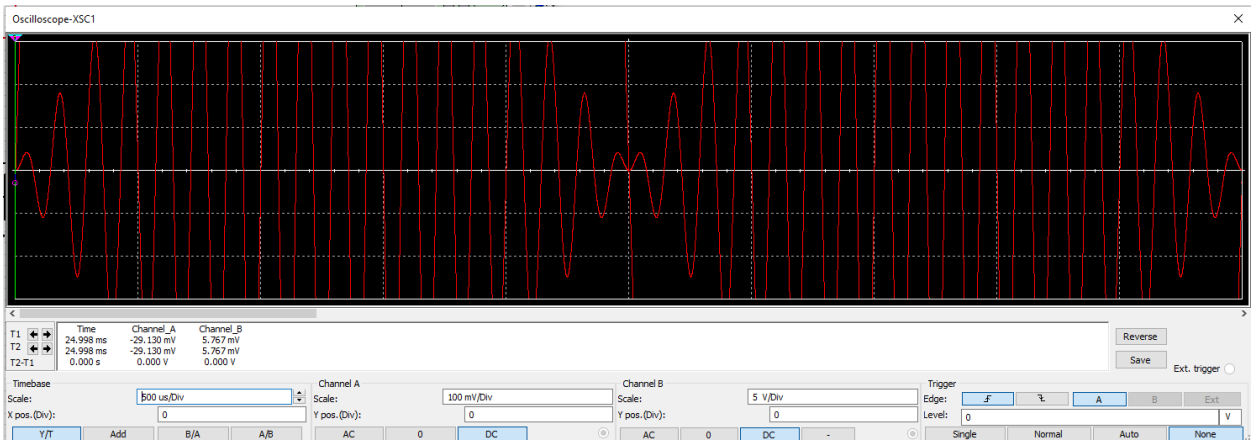

Fig. 2. Task 1 Oscilloscope wave

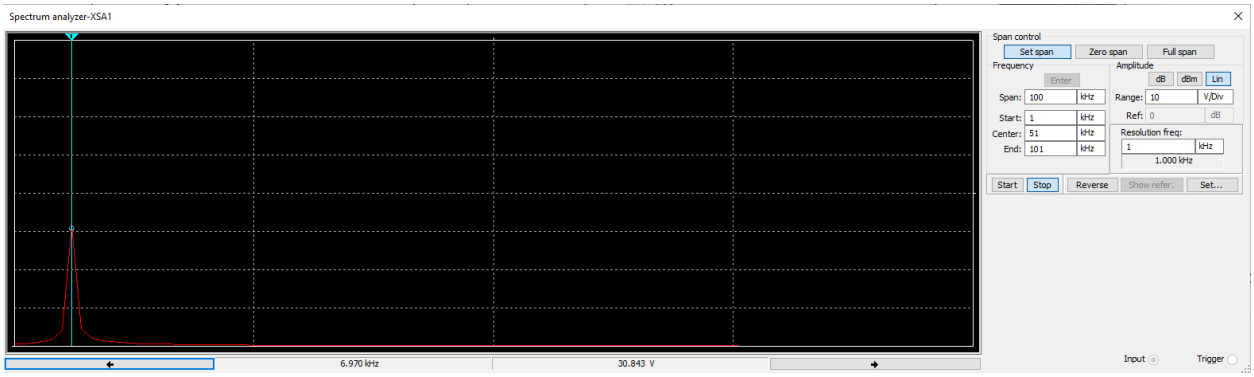

Fig. 3. Task 1 Spectrum Analyzer wave

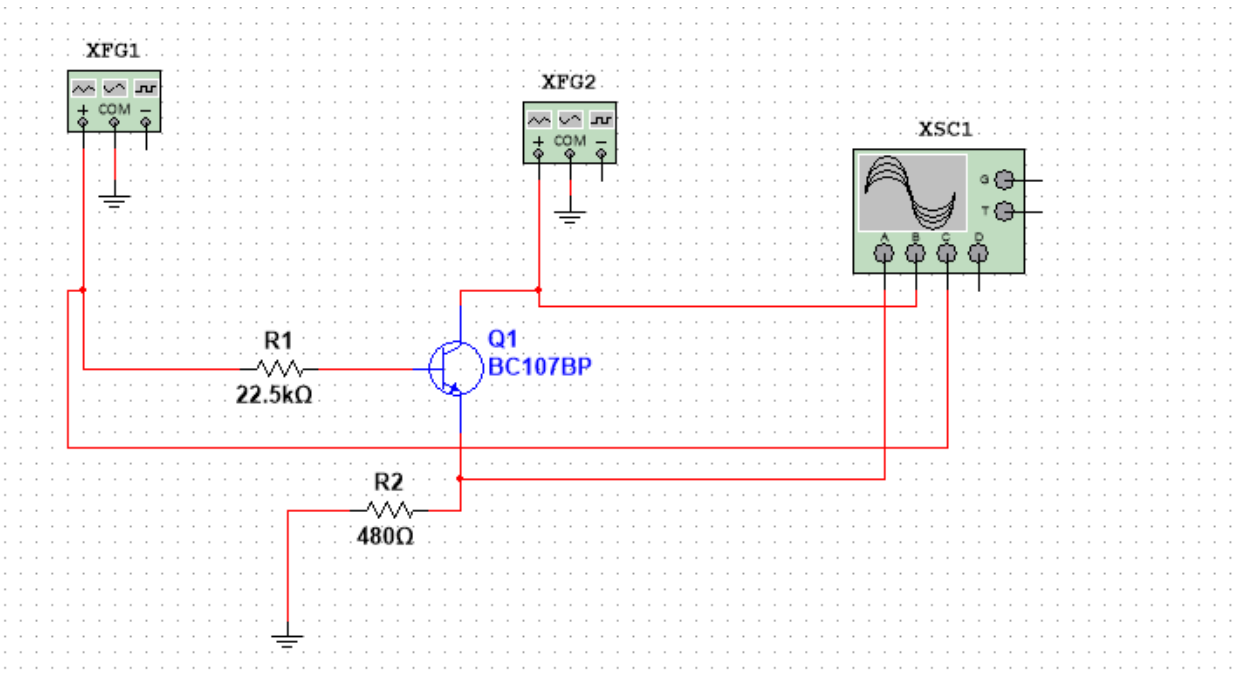

Fig. 4. Circuit Diagram Task 2

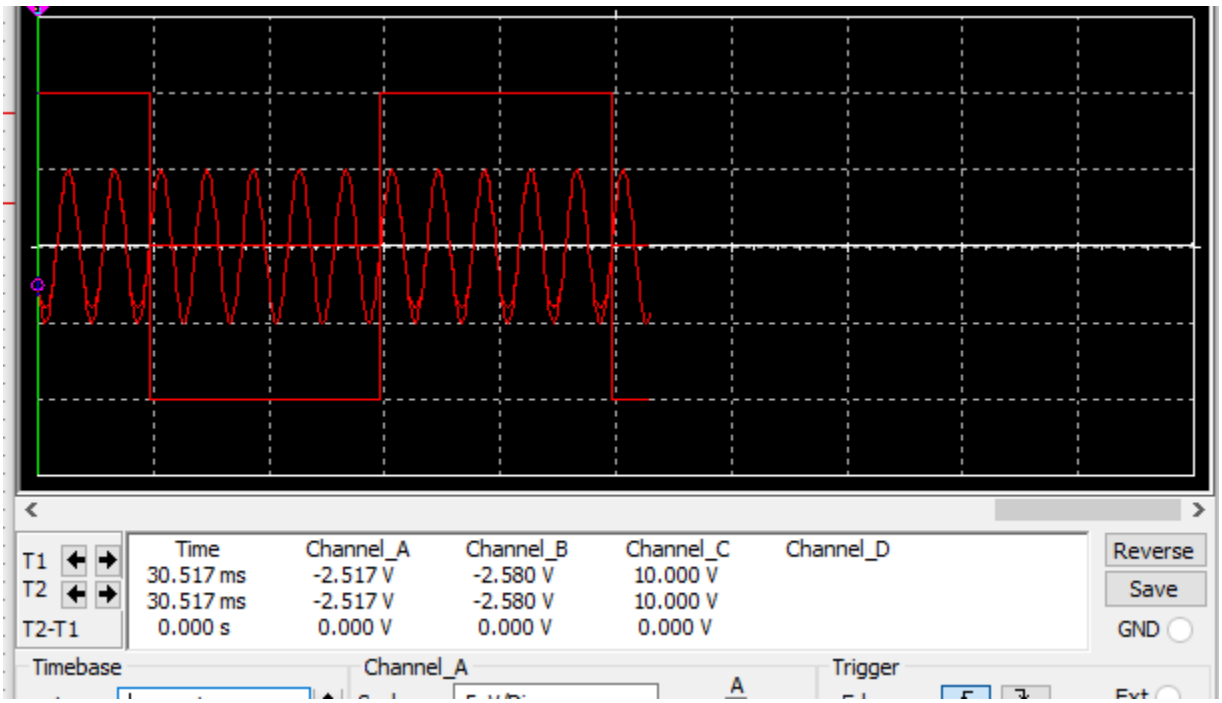

Fig. 5. Task 2 Oscilloscope wave

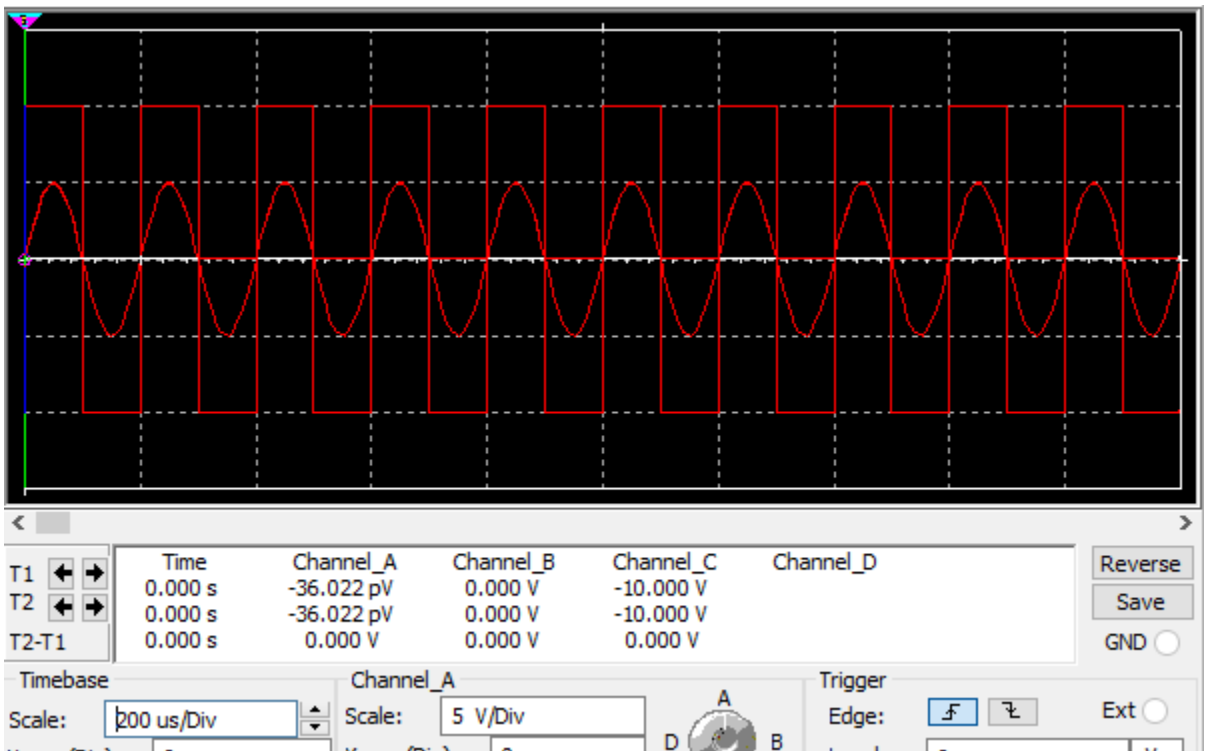

Fig. 6. Task 2 Oscilloscope wave with modified frequency

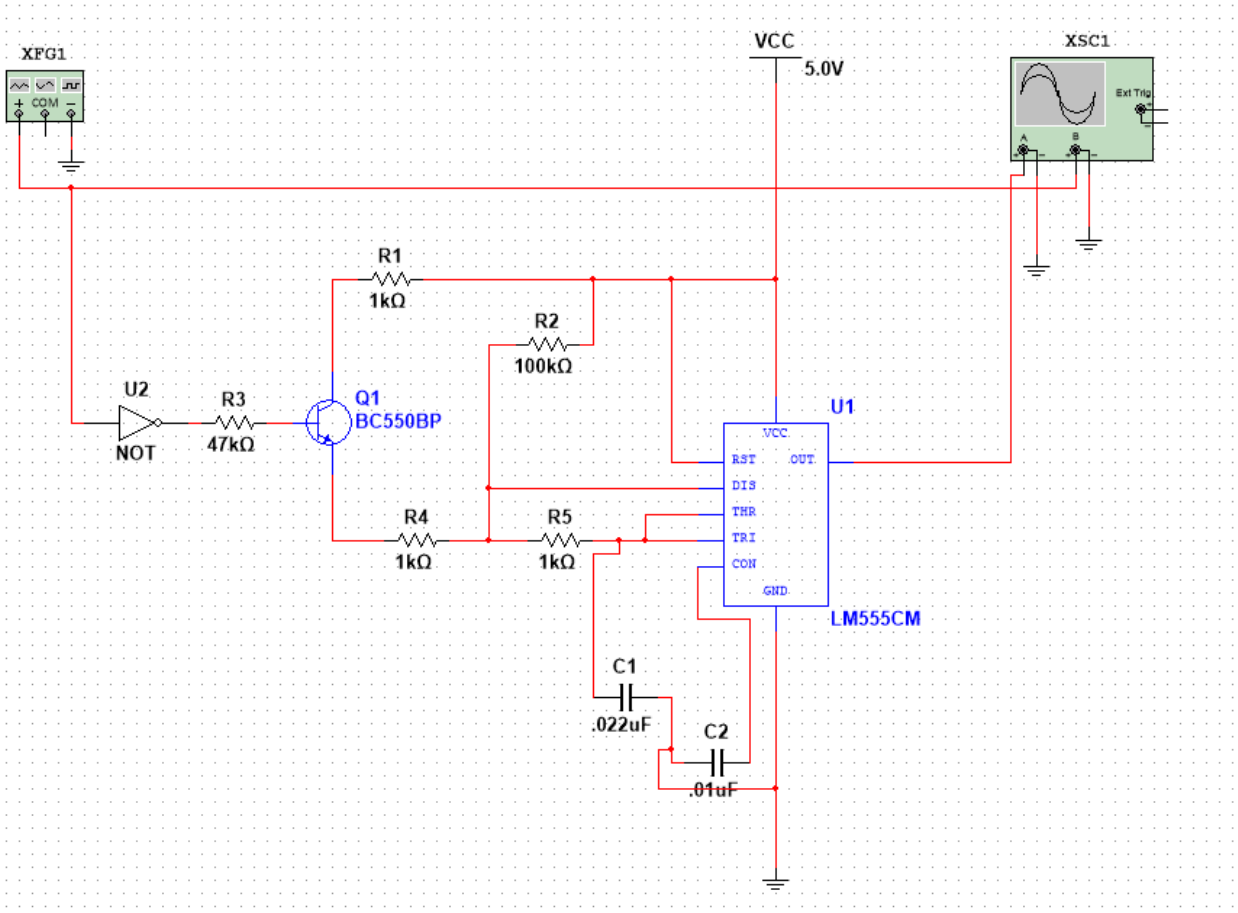

Fig. 7. Circuit Diagram Task 3

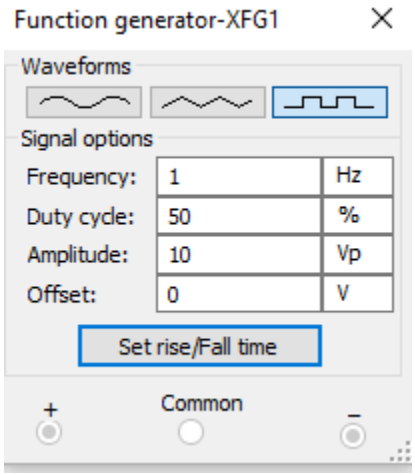

Fig. 8. Task 3 Function generator values

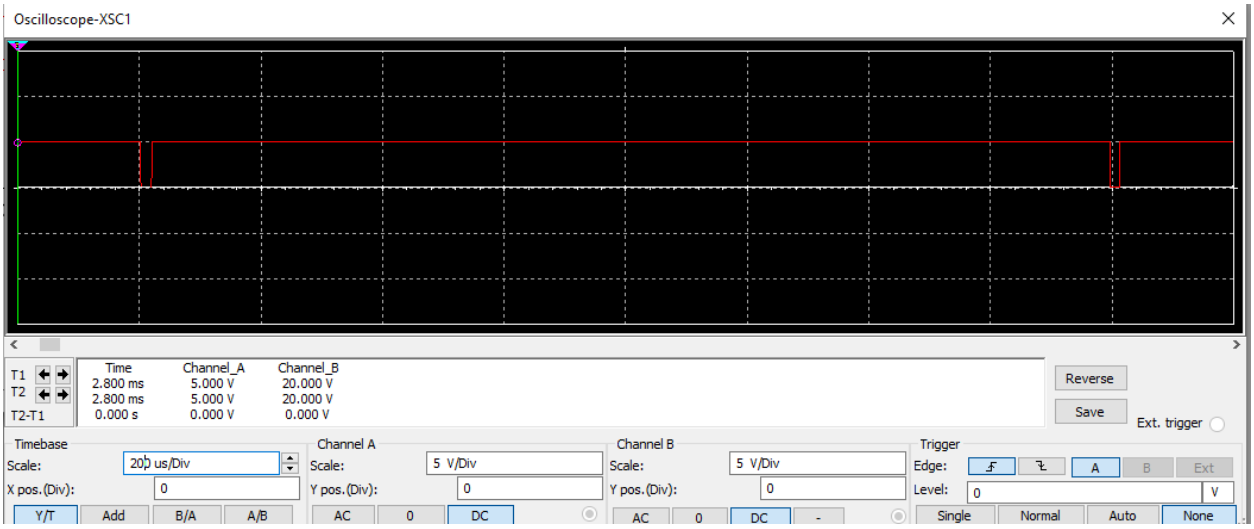

Fig. 9. Task 3 Oscilloscope wave

Conclusion

In conclusion, this experiment proved that frequency of a signal has an inverse relationship to the period of the signal. We also saw that for amplitude modulation the signal varied a lot based on the signal, for frequency modulation had a short period and a large bandwidth, and that shift keying resulted in straight binary signal lines in the oscilloscope.