University of North Carolina at Charlotte
Department of Electrical and Computer Engineering

Laboratory Experiment report # 5-1

Lab Report # 5-1

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Objectives

The objective of this lab is for students to get a better understanding of how to use matlab's simulink hardware section, the ability to make real life measurements based on the auto coder of said hardware section. The ability to check and make sure control panels are in proper working order, and how to interface between matlab simulink, a lab kit, and a control panel.

Equipment List

- Matlab Simulink
- F28379D Launchpad
- Hands-on Power Electronics
- Oscilloscopes
- 1 10 Ohms Resistor
- 1 0.318 millihenry Inductor

Relevant Theory/Background Information

Matlab Simulink is a powerful tool that, in conjunction with Code composer studio can use digital blocks to interface with real life components through on demand code generation that allows the bypassing of manual code making. By using the Hands-on Power Electronics in conduction with the F28379D Launchpad and an assortment of resistive elements students are able to freely change waveforms in real time and are able to get a feel for dynamic systems.

Experimental Data/Analysis

Exercise 0

Below in Figure 0-1, the set-up for the measurement can be seen where my oscilloscopes are on pins J39 and J40 to get the complementary waves that can be seen in Figure 0-2. The simulink set up that was used for the lab can be seen in Figure 0-3.

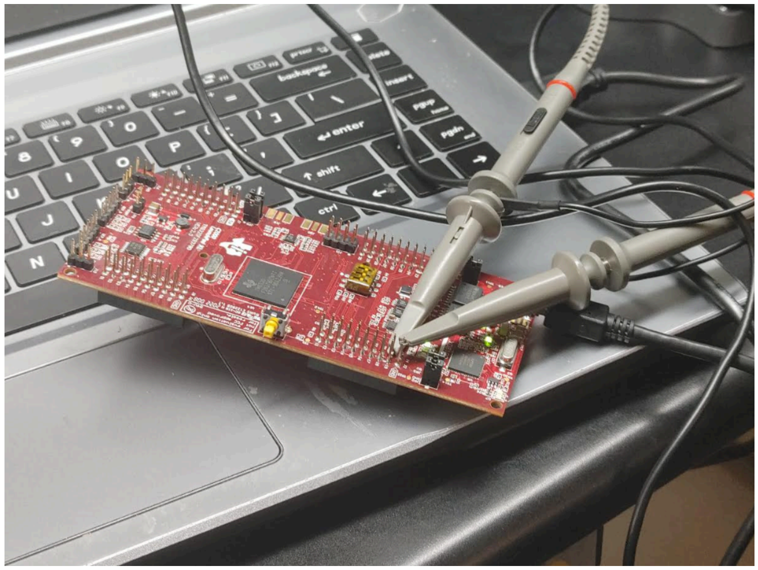

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Figure 0-1

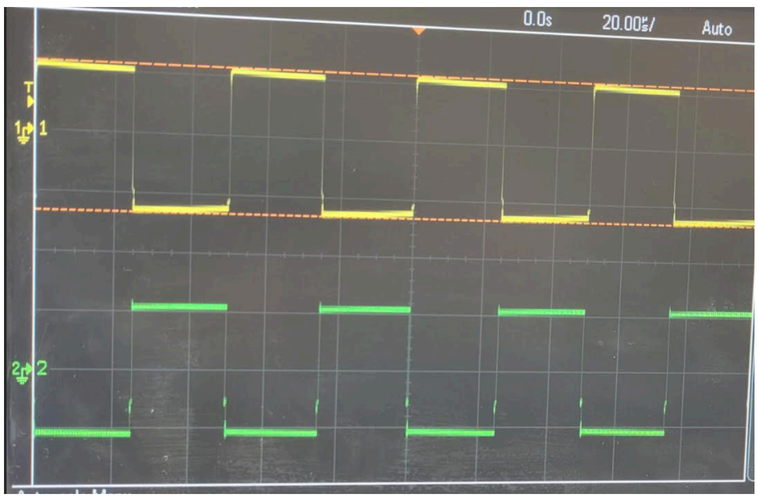

Figure 0-2

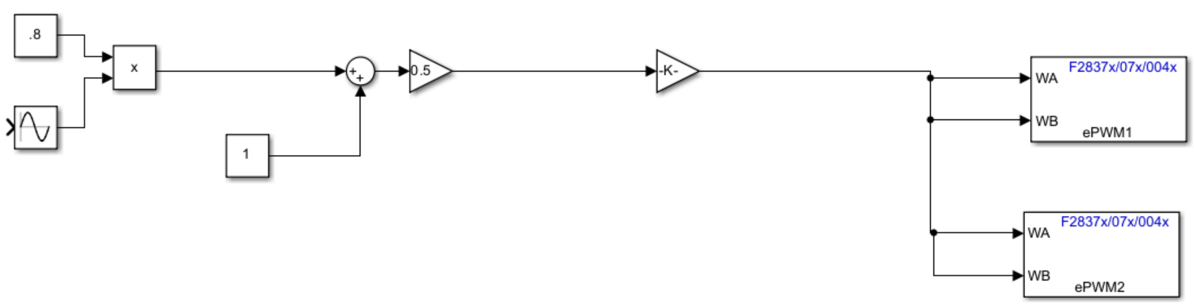

Figure 0-3

Exercise 1

Below in Figure 1, the set up for the lab can be seen where the 10 ohm resistor is situated on the cardboard plate and the induction is wound to the right of it. This setup was used due to a previous mishap with the lab equipment so the TA made this for demonstration purposes.Using the formula L = (d^2 * N^2) / (18d + 40l) the inductor had 44 turns using copper wire that has a permeability of 1.256629e-6, with a radius of .5 cm, and a length of 6 cm, the inductor's inductance is 0.318 millihenry.

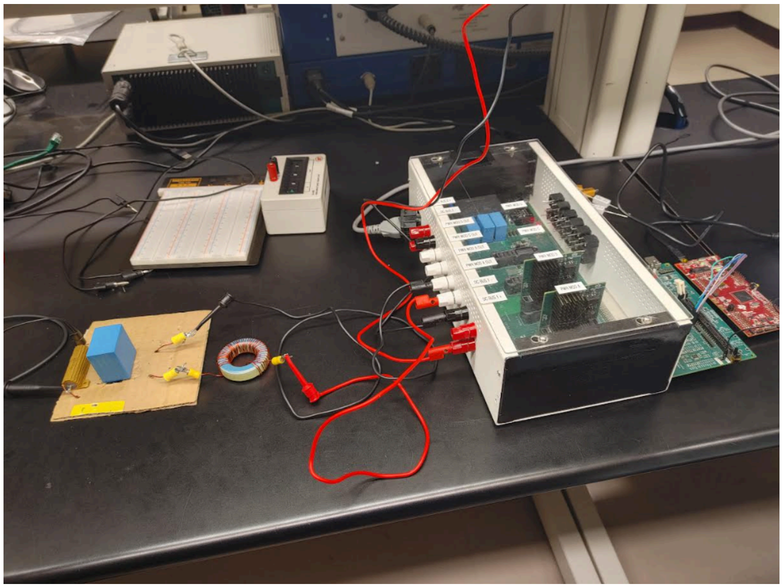

Figure 1

Exercise 2

Below in figure 2 where the Launchpad is correctly connected to the Hands-on Power Electronics Console

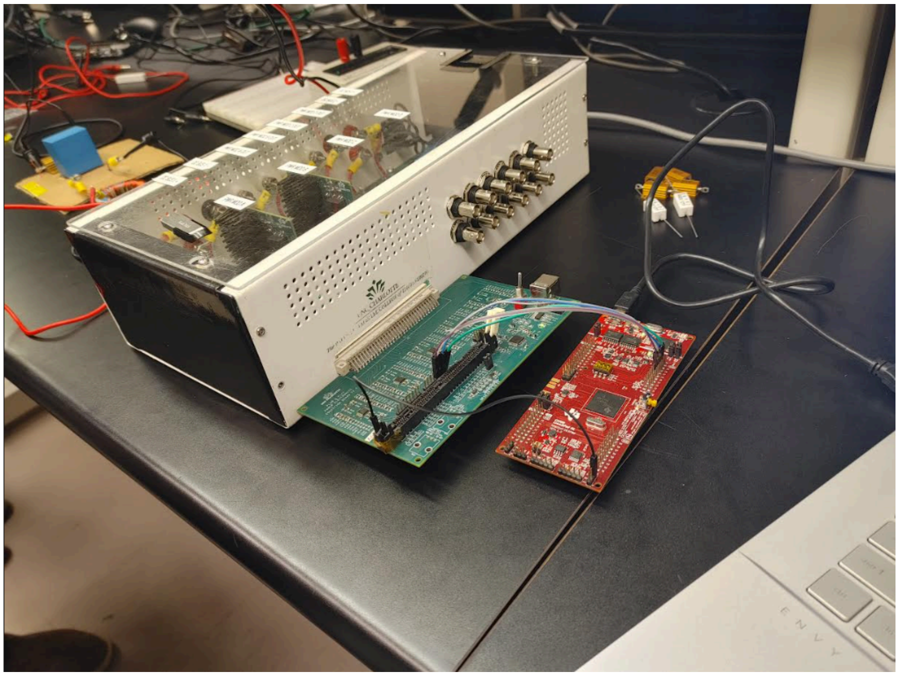

Figure 2

Exercise 3

The three different sets of modulation can be seen with win Figures 3-1, 3-2, and 3-3 with them being 0 modulation, .5 modulation, and .25 modulation respectively.

Figure 3-1

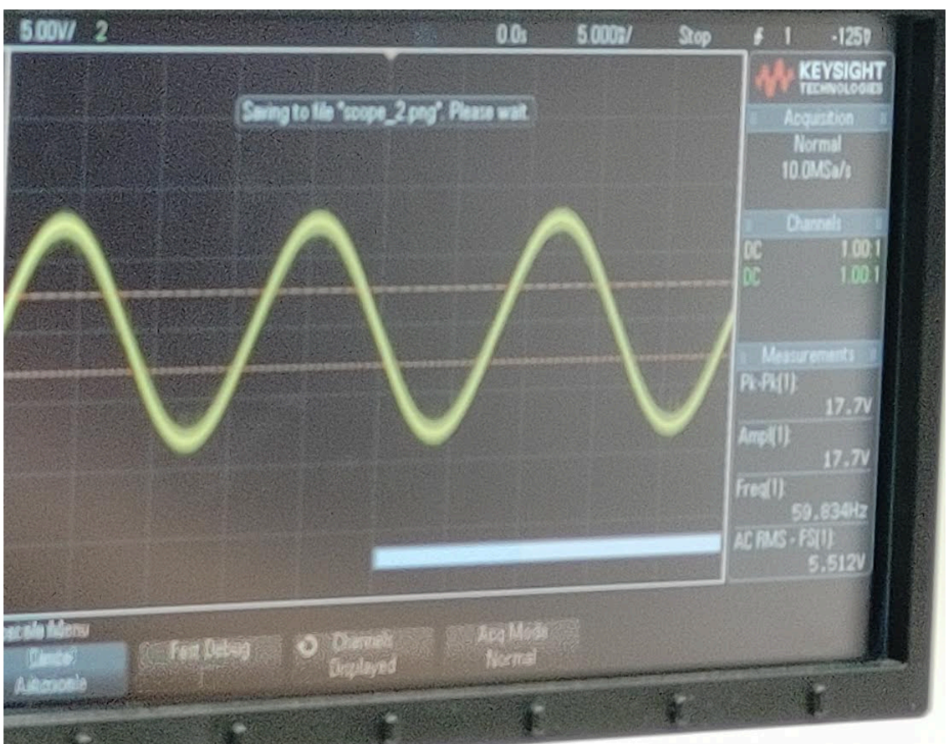

Figure 3-1

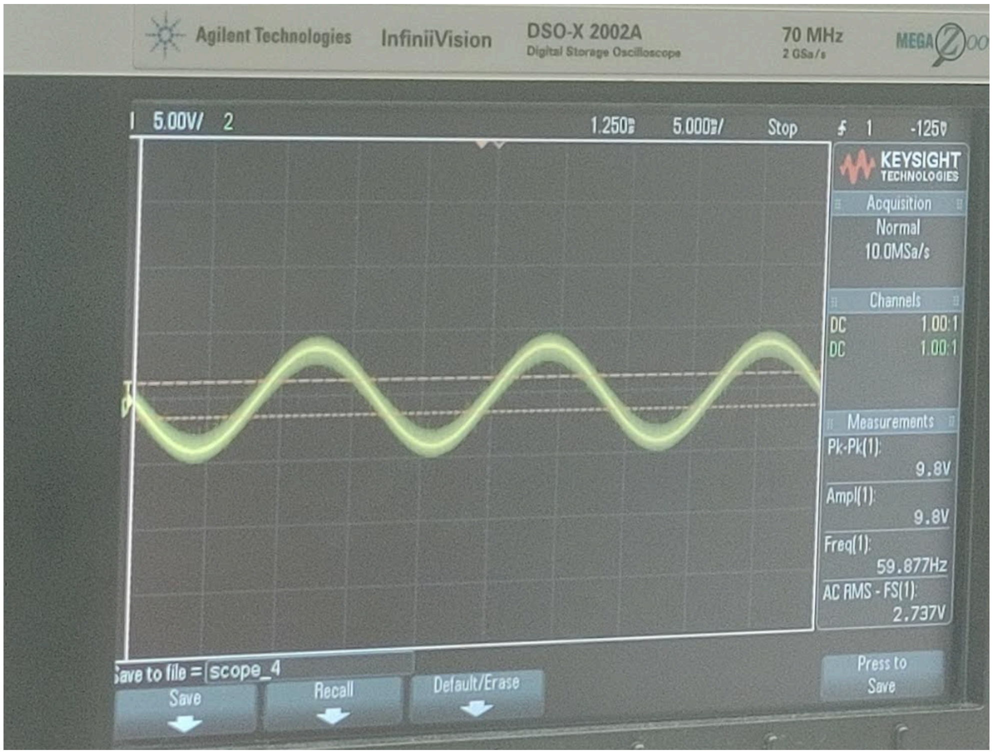

Figure 3-1

Since we know the impedance of all the resistive materials that were in our control , the resistor and the inductor, the total resistance of the circuit is calculated using the equation: Z=R2+(XL−XC)2 where xc will calculated as 0 due to lack of knowledge. XL is calculated by the equation 2πfL making the XL for modulation 0 as .0426 ohms, modulation .5 has an XL of .1196, and modulation .25 has an XL of .1196. Using the equation for total impedance for each gives us 10.000009 for modulation 0, 10.0007 for modulation .5, and 10.0007 for modulation .25. Using the equation I = V/Z we can find the AC current is in the table 3-1 Below

Table 3-1

Modulation index	Amplitude of the AC output voltage	Frequency of the AC output voltage	Amplitude of the AC current	AC current equation
0	.760 V	21.3 Hz	.075999 A	I = .760 V / 10.000009 ohms
.5	27.7 V	59.834 Hz	2.7698 A	I = 27.7 V/ 10.0007 ohms
.25	9.8 V	59.877 Hz	.9799 A	I = 9.8 V/ 10.0007 ohms

Conclusion

While the AC output voltage for modulation = 0 was not 0, we suspect that this was due to noise in the system as unlike the other two waveforms the wave does not last across the full graph. While we did not calculate XC, looking at the data sheet, most if not all the capacitors in BUS 2 were .1 uF which leads me to believe that just like the inductor, their influence on the overall impedance on the system is minimal at best. Calculating the inductance was a bit of a challenge as there were many different formulas that claimed to do the job but the one that was chosen also used the permeability in the calculation which is why it was chosen.