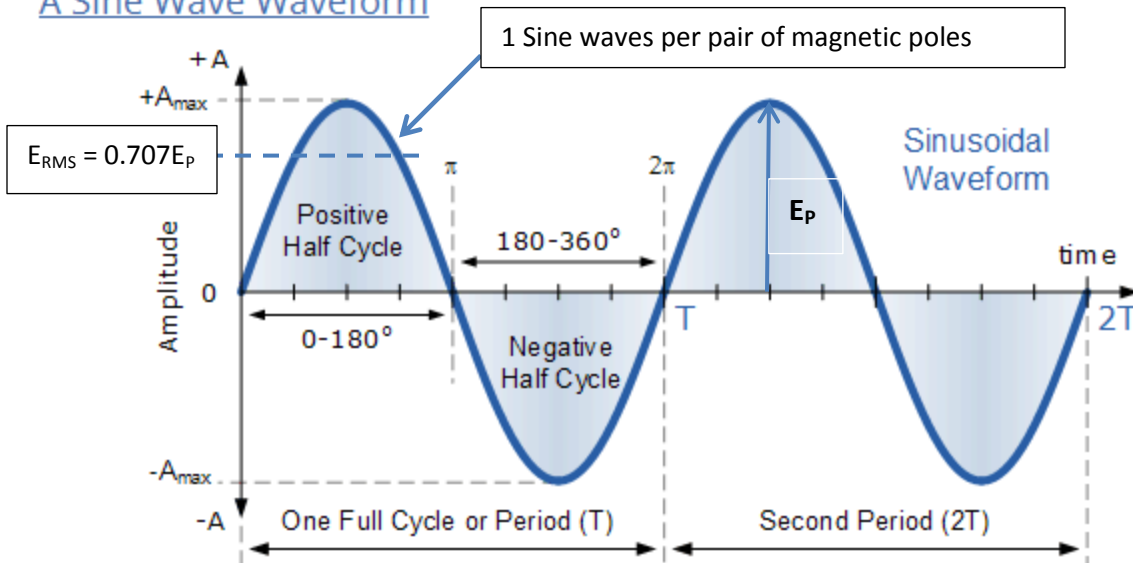


4.0 Turbine Subassembly Power Generation Test

Connect the wind shaft to the drill press chuck. Use a Digital Voltmeter (DVM), to measure the generator voltage. Use a tachometer to measure shaft rotation rate in revolutions per minute (RPM). The shaft rotation can also be measure using the generator voltage frequency. Remember that for a four pole generator, each shaft revolution produces two sinewaves, or 2Hz and a revolution per second corresponds to 60RPM. Therefore there is 1Hz per 30 RPM.

<http://www.electronics-tutorials.ws/waveforms/waveforms.html>

A Sine Wave Waveform



Units of periodic time, (T) include: Seconds (s), milliseconds (ms) and microseconds (μ s).

Adjust the drill speed as close as possible to the tachometer and target frequency (Hz).

Use the following table to record the generator data varying the drill speed and the load resistor. This data must be placed in your engineering journal.

The following variables and equation will allow us to predict the open circuit voltage generated by the turbine.

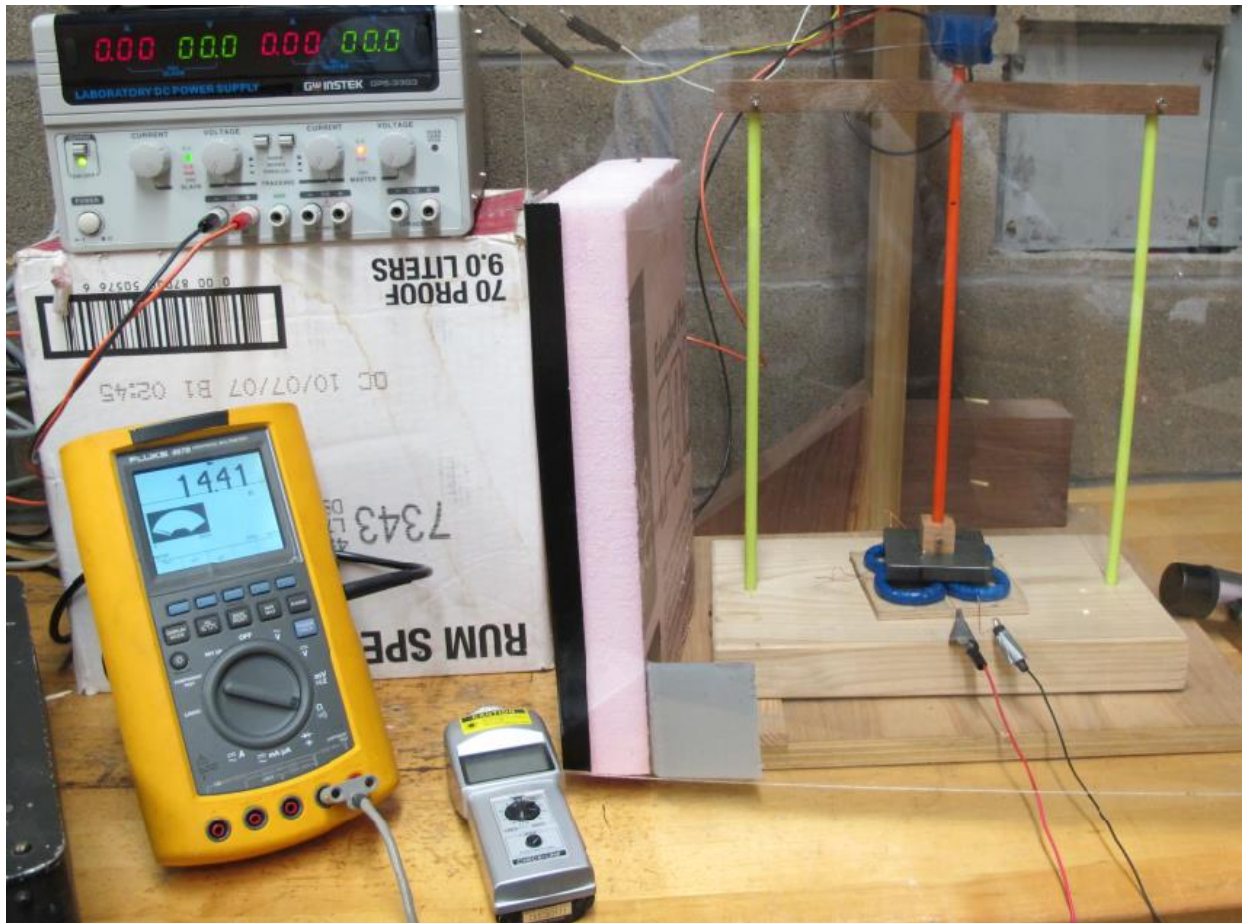
	Nominal
N - Number of loops of wire	888
A - Area enclosed by loop (m^2)	0.001154
P - Number of Magnetic poles	4
B - Magnetic pole strength (Tesla)	0.1
Z - Rotational velocity of magnets (rps)	below
F - Frequency of Voltage (Hz)	below

Calculated No-Load rms Voltage

$$V_{rms} = 0.707 * N * A * P * B * Z$$



Load Resistors



Generator Test Setup

Generator Test Procedure

1. Align the turbine shaft in the drill press chuck.
2. Carefully tighten the chuck, allowing the shaft to center itself.
3. Connect the DVM to the generator coils. (the ones not connected to anything).
4. Measure the resistance using the ohmmeter. You should get the total coil resistance plus the test lead resistance (approximately 14 ohms). If you do not get this troubleshoot the problem (loose wire?)
5. Change the DVM to ac Volts.

6. Turn the power supply voltage knob the extreme counter clockwise position.
7. Turn on the power supply.
8. Adjust the power supply to start turn the shaft. You should start to see waveform appear on the DVM screen.
9. Continue to increase the voltage until you get close to the target RPM and frequency.
10. Record the actual voltage, RPM and frequency.
11. Repeat the procedure for the target values in the table below.
12. Repeat the steps to obtain the LOAD Test data.
13. Record all data in your journal.

Prototype Wind Turbine Drill Press Data -No Load							
Target Values			Measured (Actual)			Calculate	
RPM rev/min	F (Hz) 4-Pole	Z (rps) rev/sec	RPM rev/min	F (Hz) 4-Pole	V _{rms} -MES (volts)	Z (rps) rev/sec	V _{rms} -CAL (volts)
120	4.00	2.00					
180	6.00	3.00					
240	8.00	4.00					
300	10.00	5.00					
360	12.00	6.00					
420	14.00	7.00					
480	16.00	8.00					
540	18.00	9.00					
600	20.00	10.00					

Load Testing

$$R_g = \boxed{}$$

RPM rev/min	F (Hz) 4-Pole	Load R _L (ohms)	Measured Load Volts V _L	Calculated Load Volts V _L
480	16.00	10000		
480	16.00	27		
480	16.00	15		
480	16.00	10		
480	16.00	5		
480	16.00	1		