EE3006* Experiment-8 Lab Report

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Power Measurement

A Digital wattmeter uses an ADC (Analog-to-Digital Converter) to digitize the voltage (or scaled down version of the voltage) across the load. It employs another ADC to simultaneously digitize another voltage signal that is proportional to the load current. A schematic of such an arrangement is shown in Fig. 1. The sampling frequency has to be sufficiently high, to reproduce the signal accurately in the digital domain. To compute the active power P, an average of the product of the samples of the ADC outputs is used. For this computation equation (1) can be used. In equation (1), N indicates the number of samples in a complete cycle. In the circuit given in Fig. 1, a small resistor Rs is connected in series with load. It acts as the current sensing resistor. The output vo of the Op-Amp OA (OP07) is given by () . The voltage vin (Vl) is taken as the voltage across the load. The voltages vin and vo can be sampled using an NI ELVIS board. The power across the load can be computed from the acquired signals using a LABVIEW Virtual Instrument (VI), by building an appropriate program that realizes equation (1).

$$P = \frac{1}{N}\sum_{j=1}^{N} v_{Lj} \cdot i_{Lj}$$

Figure 1: Lock-in amplifier

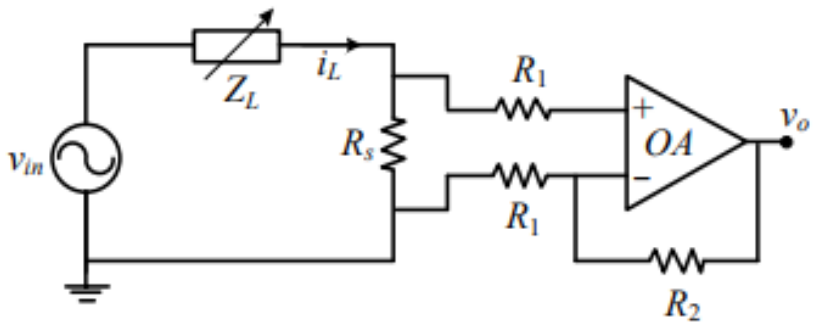

Fig1. Power measurement circuit

Expected

Rs = 1 ohm
R1 = 3 kohm
R2 = 120 kohm
R = ZL = 51 ohm

Pexpected = 0.2494

Actual

Rs =1.6 ohm
R1 =3 kohm
R2 = 119.5 kohm
R = ZL = 50.4 ohm
Pmeasured = 0.2601

Absolute error = 4.29%

Now adjusting the value of Rs such that error in measurment is within 1%, then we get
Pmeasured = 0.2471

New Absolute error = 0.922%

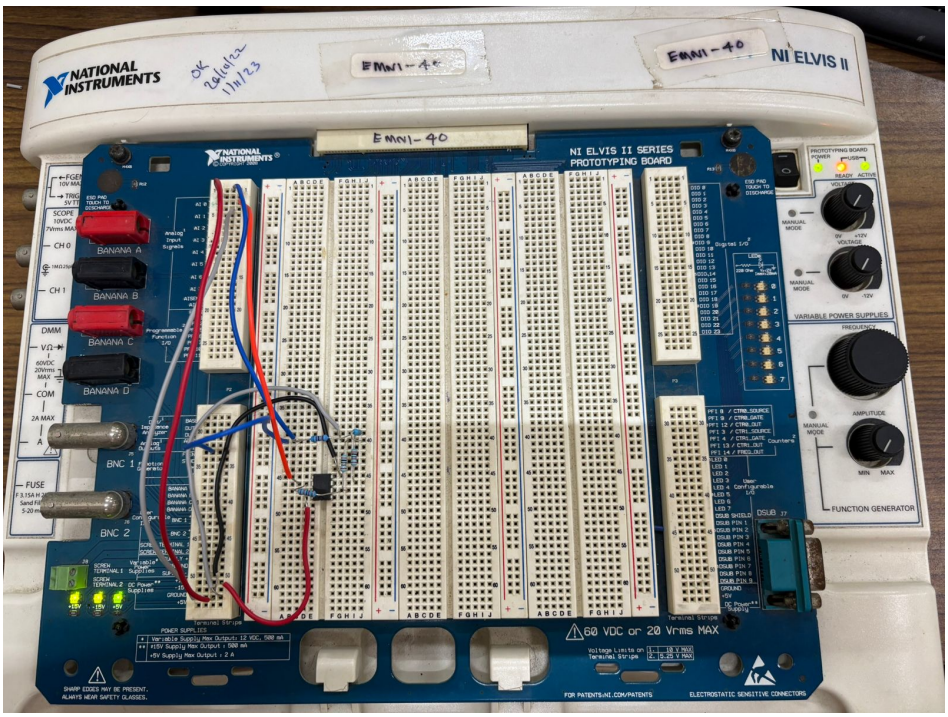

Figure 2: Elvis Board

Z_L	P at 50Hz	P at 100Hz	P at 200Hz
R = 51	0.255	0.256	0.262
R = 100	0.222	0.226	0.223
C = 25 uF	0.001	0.003	0.047
R = 51 in series with C = 25 uF	0.081	0.109	0.224
R = 100 in series with C = 25 uF	0.125	0.167	0.192

Table 1: 6x4 Table Example

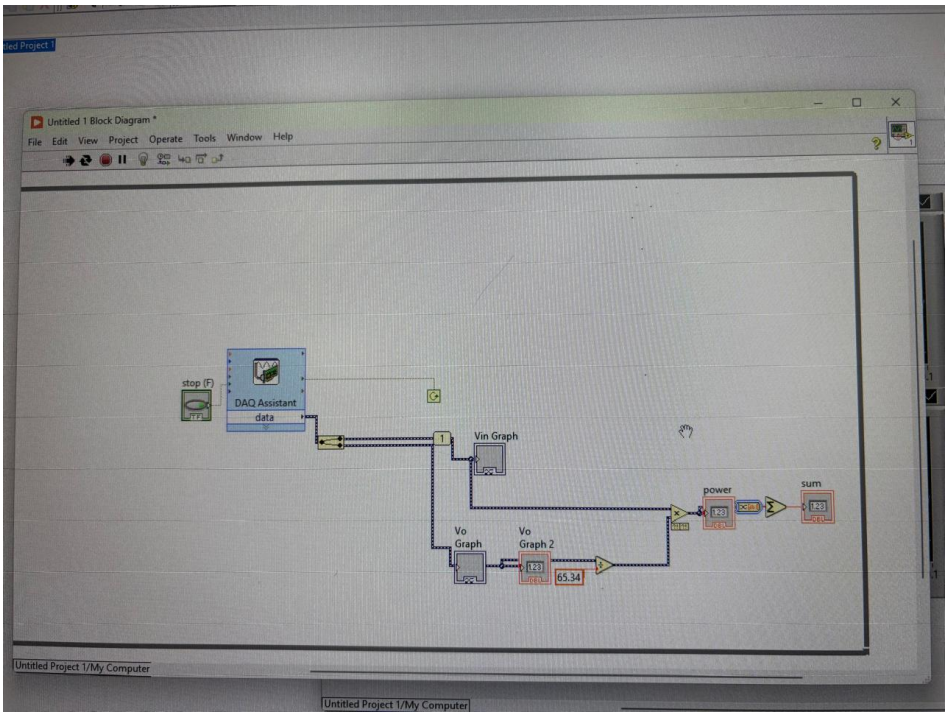

Figure 3: LABView

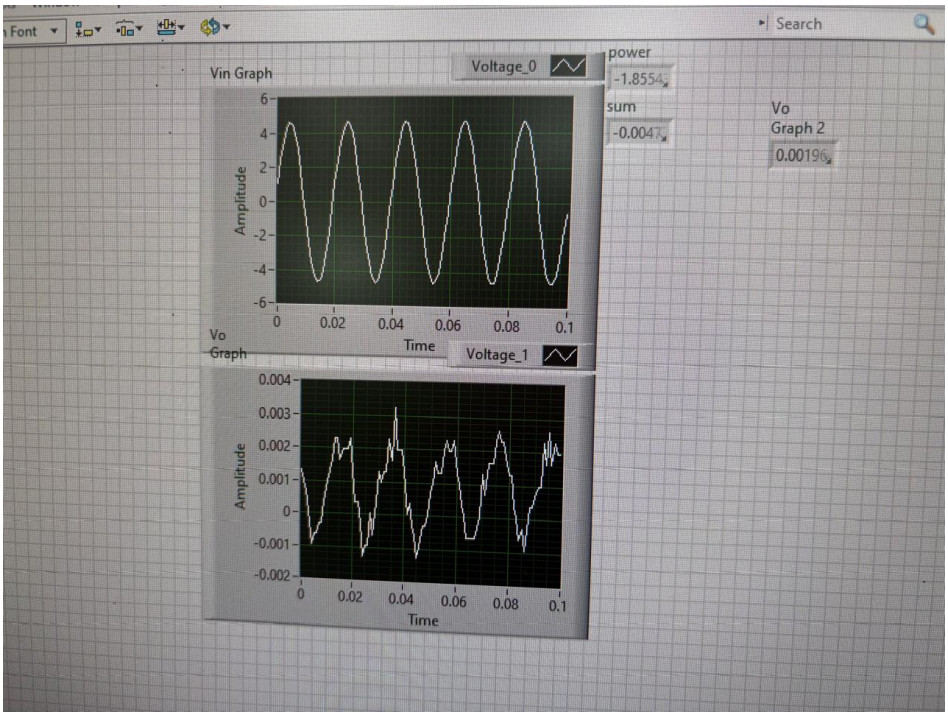

Figure 4: V and I Graphs