Brake Test of Dc machines using LabVIEW

by,

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Contents:

Introduction:

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a graphical programming environment which has become prevalent throughout research labs, academia, and industry. It is a powerful and versatile analysis and instrumentation software system for measurement and automation. DC Machines can be tested by three different methods namely Direct Method, Indirect Method and Regenerative Method. Direct Method of testing of DC Machine, also known as Brake Test. Here I'm going to perform Brake test using LabVIEW.

Problem Statement:

To create a VI to perform Brake Test

Objective:

To perform brake test and with its reading draw required graphs and required values. This can be also done using Text-bases programming languages but here we are using graphical based programming language which works on the basis of flow of data. In this project we are going to get input from the user in .csv format (comma separated value file), then perform the calculations with the information from the input file and going to draw graphs

Algorithms:

The Algorithms used in this project are given below:

Step1: Get the file path of the required reading(.csv format)

Step2: Read the csv file using "Read Delimited Spreadsheet.vi"and separate the files into Header file and Readings array.

Step3: Separate the Readings array into several 1D array by using Index array function.

Step4: Then using indicators display the separated values for the conformation

Step5: Using the brake test formula, Proceed the circuit. The formula is given by,

Torque=(w1-w2)*9.81*R N-m

Input Power= V_L*I_L kW

Output Power=(2*π*N)T/60 kW

% ή= Output Power/Input Power*100

where w1,w2=weights in spring balance ,

V_L=Voltage,

I_L=Current,

N=Speed,

T=Torque,

% ή =%Efficiency

By using numerical operations wire the circuit.

Step6: Again, display the obtained output by using the array indicator

Step7: To do this iteration for n number of values use while loop.

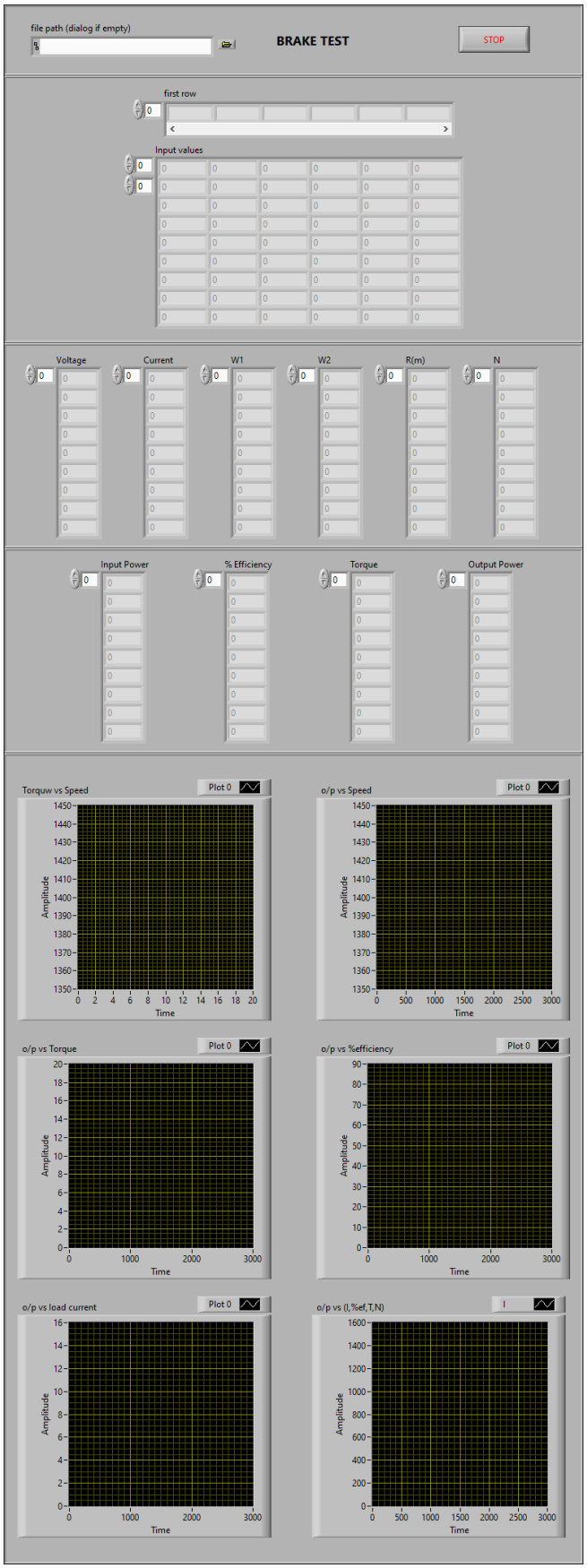
Step8: To draw the graph between two value, group them into a 2D array using bundle function from cluster palette.

Step9: Then Using XY graph display the graph format for the obtained output values. To plot multiplot in single XY graph use build array function in array palette then give the output to the XY graph.

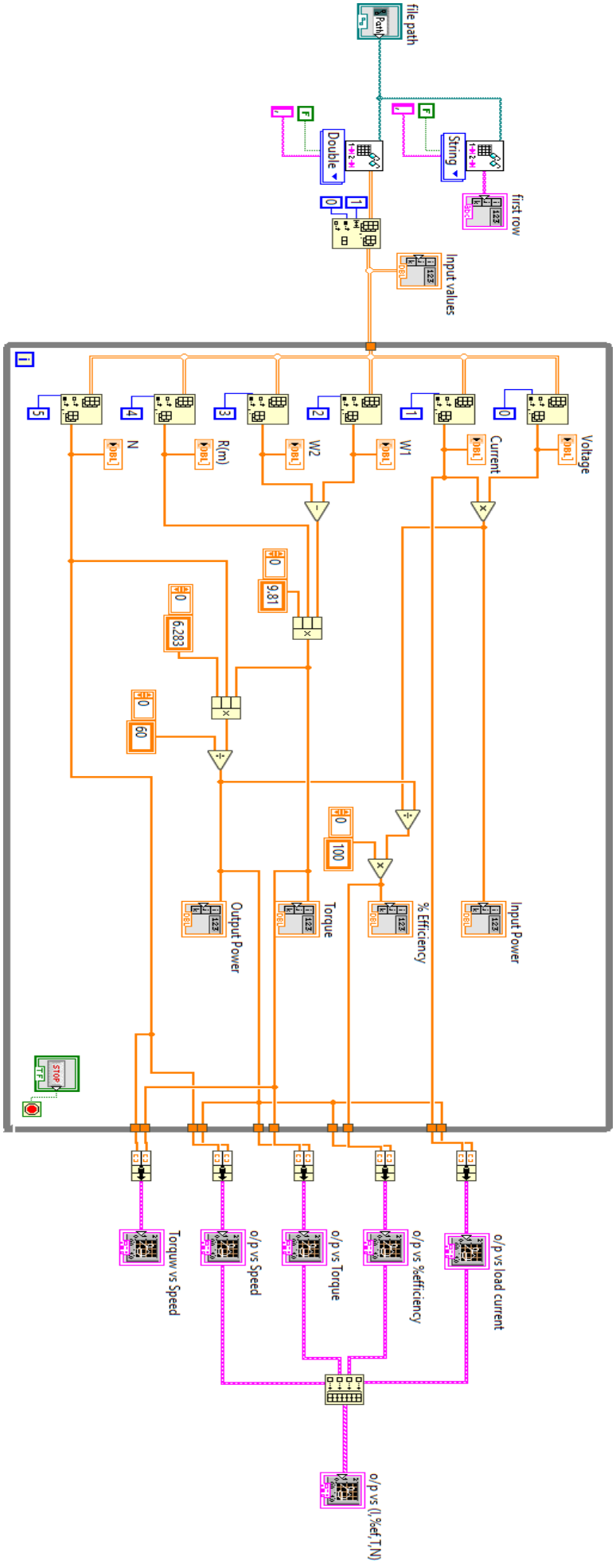
Step10: Draw Output vs Torque,Speed,%efficiency and Torque vs Speed graph.

Step11: Run the vi to see the output values and waveform graphs.

Block Diagrams and Front Panel:



Block Diag:


file path
Double
String
first row
Input values
N
R(m)
W2
W1
Current
Voltage
9.81
6.283
60
100
Output Power
Torque
% Efficiency
Input Power
STOP
Torquw vs Speed
o/p vs Speed
o/p vs Torque
o/p vs %efficiency
o/p vs load current
o/p vs (I,%eff,T,N)

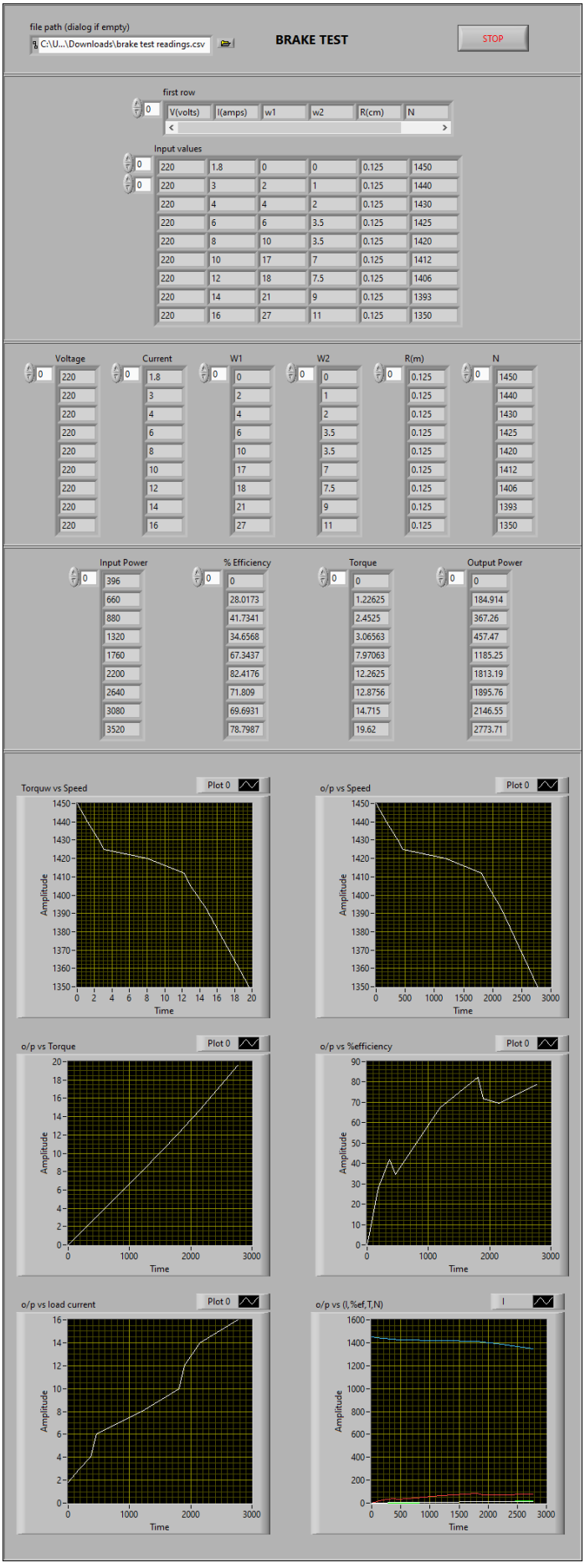
Front panel:

In this diagram the first portion of the front panel contains file path text path where you have to paste the path of the measurement file and has a stop button to stop the vi. Next section contains the input given in the csv file in which the header is displayed in the file array and the following values are displayed below. Third section of this panel contains the separated value which is the total multi-dimensional array into several single dimensional arrays. This is to verify whether both the input and separated values are same. The fourth part of this panel contains the calculated new values which are displayed. Final part of this panel having several XY graph which displays the graph of the corresponding values

Block Diagram:

In this block diagram, there are several functions used, and the main function used are depends on the multi-dimensional arrays. First of all we get the input values form the csv file format using read delimited file function. Then file is separated into header and values. Then the separated value array is further broken into single dimensional array by using index array function then the required calculations are made to obtain the torque, output power , input power and efficiency . By using bundle function and XY graph function plot the graphs between two values. For plotting multiple axis we use build array function. Then represents the graph using XY graph

Output:

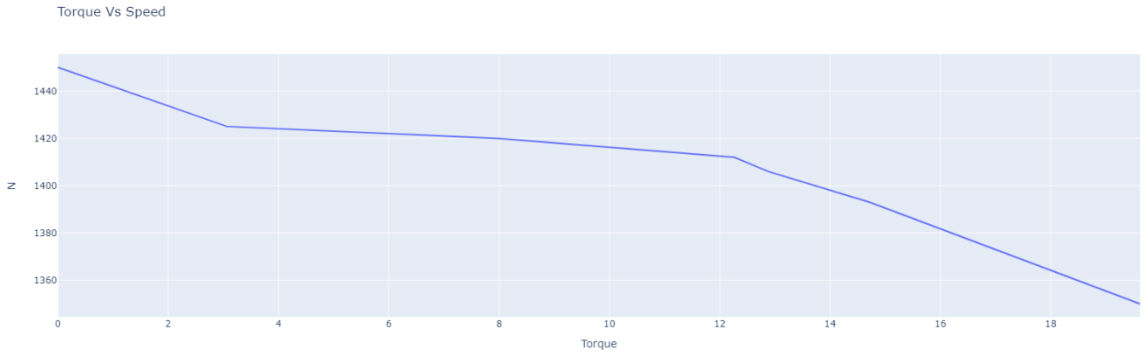

file path (dialog if empty)
C:\U...\Downloads\brake test readings.csv
BRAKE TEST
STOP
first row
V(volts) I(amps) w1 w2 R(cm) N
Input values
Voltage Current W1 W2 R(m) N
Input Power % Efficiency Torque Output Power
Torquw vs Speed
o/p vs Speed
o/p vs Torque
o/p vs %efficiency
o/p vs load current
o/p vs (I,%ef,T,N)
Plot 0
Amplitude
Time

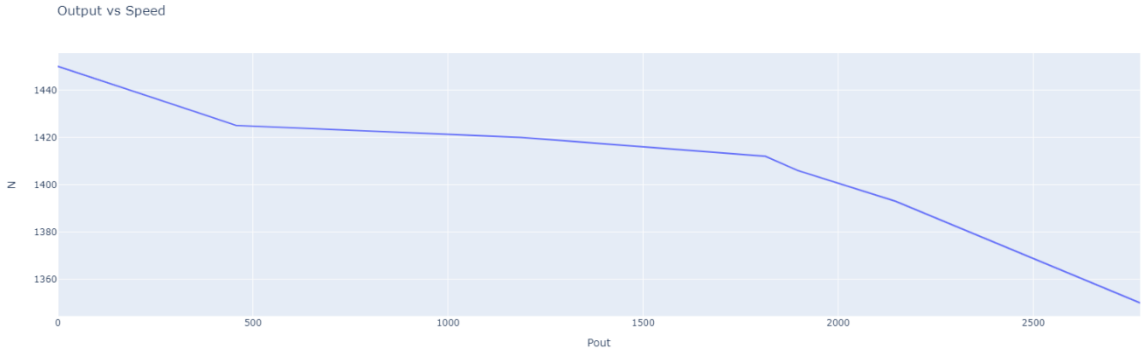
Observation:

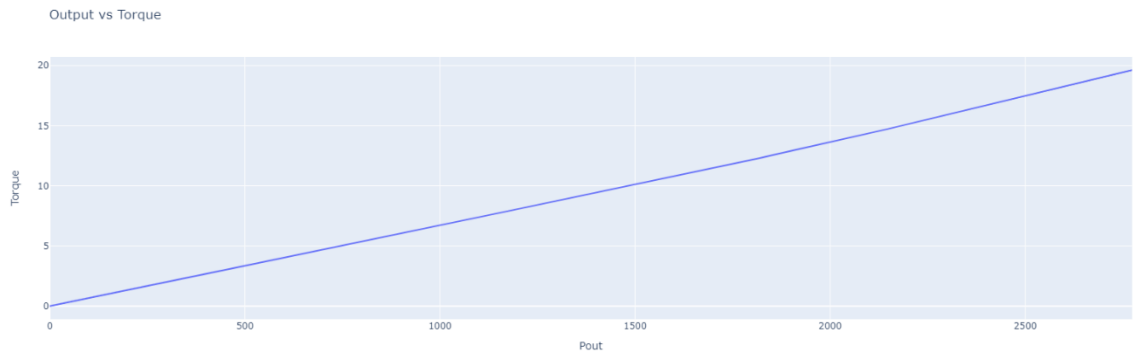
The load characteristics of a Dc machine can be concluded by this experiment. For this experiment I use LabVIEW to make it easier to analyse and work with. For the given reading the graphs are drawn and the value of torque, output power, input power and %efficiency is calculated.

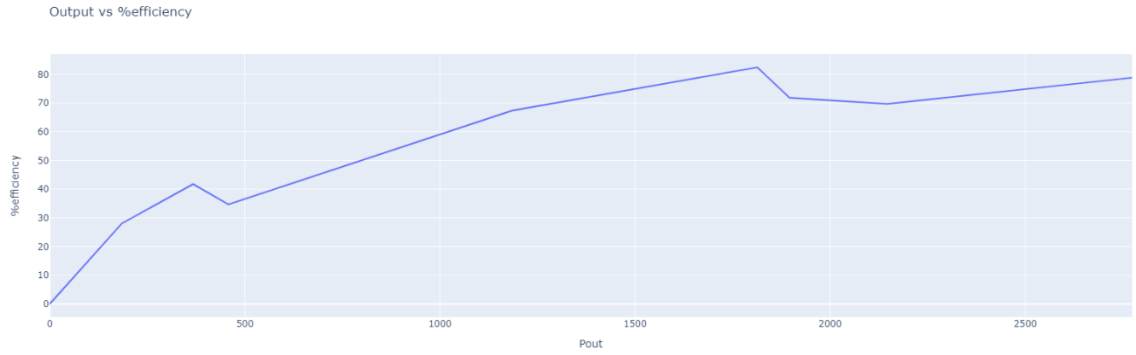
Comparison Graphical Based Programming and Text-Based Programming:

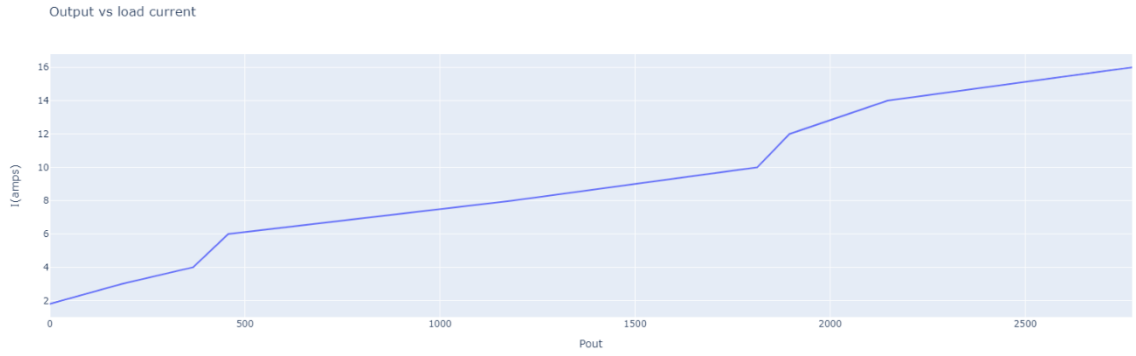
In my point of view both the text based and graphical based programming are similar in difficulties. Since This one is a smaller project, it seems to be a easier one, but in real time problems using Graphical based programming is easier than text based programming. In text-based programming languages we have to import several libraries to do data visualization, whereas in LabVIEW just by skimming the properties of the functions used, we can use them in any vi's. I attached the output of the Text Based programming language here.











Conclusion:

In this project, we use LabVIEW to calculate the required values and analyse the system by drawing graphs. As we are using graphical based programming this is much easier to do than in text-based programming language. We can take real time signal inputs from the dc machine by using DAQ.So by this virtual instrumentation we can do several real time operations.

GitHub link:

https://github.com/MuthuVignesh12/LabVIEW