GUI based Testing Tool for DC Machine

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ABSTRACT

The objective of this paper is to develop an educational toolbox for analysis of DC machine for students and lecturers. GUI (Graphical User Interface) based simulation tool has been developed for DC machines lab and can be used as an educational tool for analysis of dc machines. GUI figure file is developed for swine burns test , retardation test and hopkinsons test . All this kinds of problems consists of various methods of mathematical calculation which is difficult to perform by using manual calculation (formula and calculator). The existence of this educational toolbox will help the user to calculate the parameter hence the calculation become faster and easier. The user can enter the data and obtained the results quickly in the form of data or figures. The students can also observe the effect of variation of input parameters on performance of machine.This educational toolbox was developed by using MATLAB software (M-File and Graphical User Interface).

Keywords:

Matlab, Graphical user interface, Different testing of dc machine

I. INTRODUCTION

DC machine is one of the most important electrical machines. There are various tests conducted on DC machine viz swineburne's, retardation and Hopkinson test to determine the performance. Efficiency is very important performance parameters in DC machine. This parameter can be pre determined by conducting these tests.

Swinburne's test is a simple method in which losses are measured separately and from their knowledge, efficiency at any desired load can be predetermined in advance. The only running test needed is no load test. However this test is applicable to those machines in which flux is practically constant i.e., shunt and compound wound machines. The machine is running as a motor on no load at its rated voltage, voltage stamped on the name plate. The speed is adjusted to the rated speed with the help of shunt regulator[1].

Retardation test is the best and simplest method to find the efficiency of a constant-speed dc machine. In this method, we find the mechanical(frictional and windage losses) and iron losses of the machine. Then knowing the armature and shunt copper losses at any load, the efficiency of the machine can be calculated at that load.[2]

Hopkinson's test is a full load test which can be carried out on two shunt machines, preferably identical ones, without wasting their outputs.   The two machines are mechanically coupled are so arranged that one of them works as motor and other works as generator. The mechanical output of the motor drives the generator and the electrical output of generator is used in supplying the greater part of input to the motor. If there were no losses in the machines, they would have run without any external power supply. But due to these losses, generator output is not sufficient to drive the motor and vice versa. The losses are supplied by an extra motor which is connected to the motor generator set.[2]

To understand analysis dc machine in computers one should have good mathematical knowledge and Problem solving skills. Most of the topics require lot of calculations which takes lot of time. To analysis problems in computers the user has to go for programming. But this way of analysis is complex as it involves change of program for every case. In order to reduce this GUI based tool is developed for the analysis and testing of dc machine in MATLAB/GUI environment.

II. GUI AND MATLAB

2.1 **Matlab**

MATLAB is well known for its numerical problem solving power. Traditionally programs written by engineers have very simple interfaces, and often only the author is the one who uses the program once it is completed. There are occasions where a more polished user interface, specifically a graphical user interface (GUI) is desired.

2.2 GRAPHICAL USER INTERFACE

A graphical user interface (GUI) is a graphical display that contains devices, or components, that enable a user to perform interactive tasks. The GUI components can be menus, toolbars, push buttons, radio buttons, list boxes, and sliders. In MATLAB, a GUI can also display data in tabular form or as plots, and can group related components.

A graphical user interface (GUI) is a pictorial interface to a program. A good GUI can make programs easier to use by providing them with a consistent appearance and with intuitive. The GUI should behave in an understandable and predictable manner, so that a user knows what to expect when he or she performs an action. For example, when a mouse click occurs on a pushbutton, the GUI should initiate the action described on the label of the button.

The three principal elements required to create a MATLAB Graphical User Interface are:

i) Components.

Each item on a MATLAB GUI (pushbuttons, labels, edit boxes, etc.) is a graphical component. The types of components include graphical controls (pushbuttons, edit boxes, lists, sliders, etc.), static elements (frames and text strings), menus, and axes.

ii) Figures.

The components of a GUI must be arranged within a figure, which is window on the computer screen.

iii) Callbacks.

Finally, there must be some way to perform an action if a user clicks a mouse on a button or types information on a keyboard. A mouse click or a key press is an event, and the MATLAB program must respond to each event if the program is to perform its function. For example, if a user clicks on a button, that event must cause the MATLAB code that implements the function of the button to be executed. The code executed in response to an event is known as a call back. There must be a callback to implement the function of each graphical component on the GUI.[4]

III. STRUCTURE OF DEVELOPED GUI

The GUI figure file is developed for analysis of dc machine by using (a) Swinburnes test (b) Retardation test (c) Hopkinson's test. The structure of the proposed model is as shown in Fig 1. Here three pushbuttons are there for this model. When the particular pushbutton is pressed it will cause that particular figure file to open.
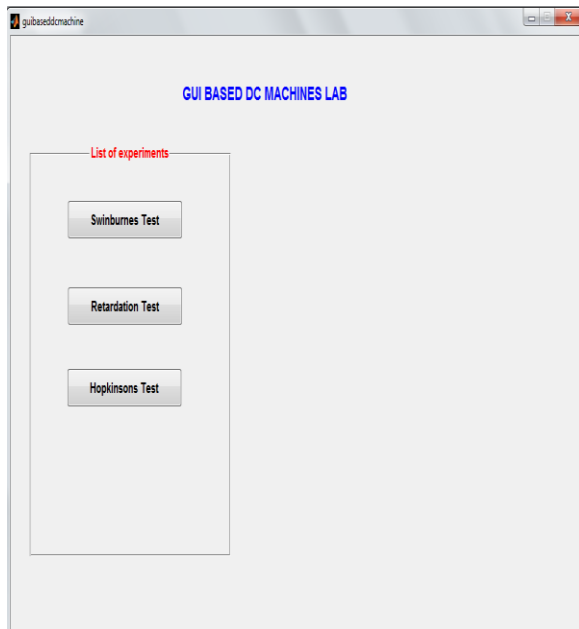

Fig 1 Structure of developed GUI

Swinburne's Test:

When Swinburne's test figure file is pressed on gui based dc machine figure file fig 2 is opened. This figure file accepts no load data such as no load supply voltage, no load supply current, field current and armature resistance, current rating of machine as inputs. Based on this data and entered fraction of load current this figure file calculates constant losses, efficiency and maximum efficiency of the machine after pressing execute button . An option is also given to change the machine to generator and calculate the same. A graph of efficiency of motor and generator versus load current is also displayed in figure.
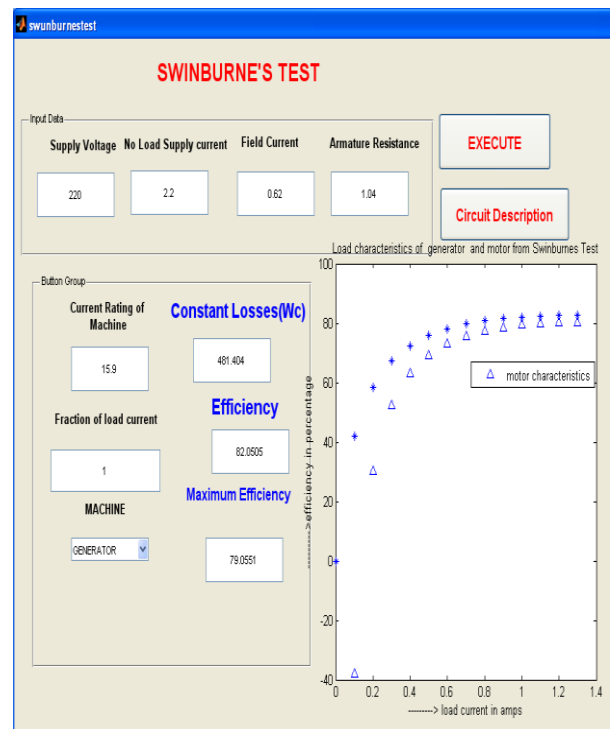

Fig 2 Swinburne's Test

When circuit description button is pressed it will cause figure 3 to be opened which gives details about swinburnes test.
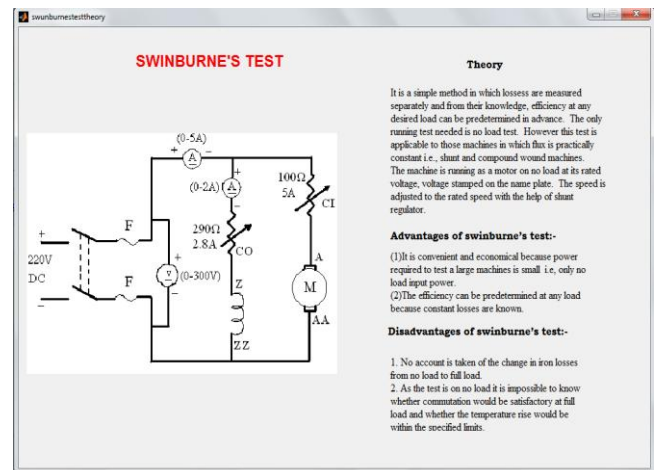

Fig 3 Circuit Description of Swinburne's test

Retardation Test

When the retardation test pushbutton is pressed on gui based dc machine figure .4 is opened. In this figure file two voltage values (V1 and V2), corresponding current values (I1 and I2), corresponding time required (t1 and t2), field current values are entered. The rating of machine voltage rating, current rating, fraction of load current, armature resistance and the machine is specified. After entering all the values press Execute button is pressed to display the value of constant losses, efficiency and maximum efficiency of specified machine. A graph of efficiency of generator and motor versus load current is displayed.
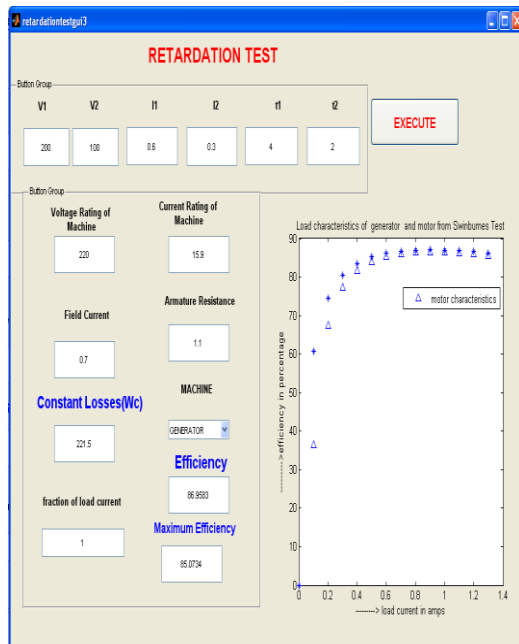

Fig 4 Retardation Test

Hopkinsons Test

When Hopkinsons test pushbutton is pressed on gui based dc machine figure 5 is opened. For this figure file input voltage, field current and armature currents of both machine, armature resistance of both machines, Line current and brush drops are entered as inputs. After entering all the data press Execute button to display the value of Stray losses per machine , efficiency of both generator and motor.
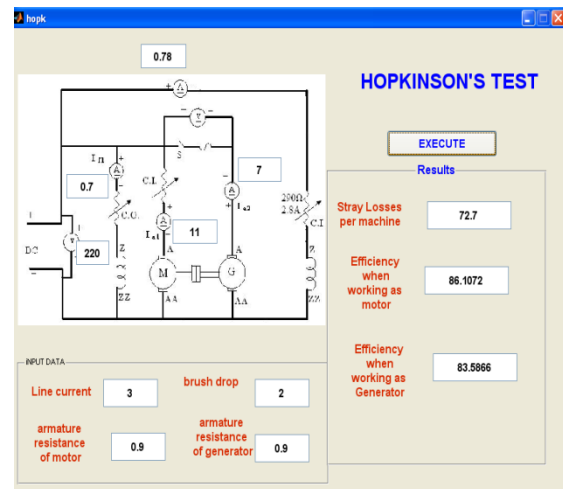

Fig 5 Hopkinson's Test

1V.CONCLUSION

A MATLAB/GUI based education tool has been developed to demonstrate the dc machines lab. This gui will demonstrate different types of testing of dc machines. This software provides a user-friendly interface to help the student to understand the dc machine analysis.. After running the dc machines gui the user can select the particular type of test, enter the data and display the results. The effect of variation of any input parameter can also be observed. Student can verify solution of any problem with this tool. This interface can be used as an educational tool for analysis of DC machine.

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