Validation Of D.C. Machines Laboratory Experiments

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Abstract- *Completion of the lab experiment picked during Continuous Internal Evaluation (CIE) or Semester End Exam (SEE), evaluator checks for the calculations and verifies the results manually. This paper discusses on validation of the experiment carried out over excel. Any student completes his/her experiment, the same can be verified within no time over excel. Calculations, graphs and any other parameters can be validated and discussed with students during CIE. The error can be shown if any to respected student within no time. All the parameters of the experiment are considered for validation. This method of verification helps both students and evaluator to save time and conduct error free in verification process.*

Keywords- DC Machine, Load test on shunt motort, Generator, compound generator etc

I. INTRODUCTION

D.C. generators are not much useful because direct current can be easily obtained with the help of rectifiers. However DC motors are widely used because of the following reasons.

*Speed of the motor can be widely changed.
*Good speed regulation.
*Torque speed characteristics of DC motors can be varied over a wide range while retaining high efficiency [1].

Because of these reasons DC motors are used to drive devices such as fans, pumps, hoists, punch presses etc.

List of experiments discussed in this paper are Load Characteristics of Self Excited DC Shunt Generator, Load Characteristics of DC Compound Generator, Load Characteristics of Shunt Motor and

Retardation Test.

Evaluator has to enter the tabulated data over excel and as per formulas the other rows and columns will be filled and if for the given experiment there is a graphical representation, the data for graph will be pulled. Thus reducing the time for evaluating and making the process error free.

II. EXPERIMENT 1

LOAD CHARACTERISTICS OF SELF EXCITED DC SHUNT GENERATOR

External Characteristics

If it is found that after generator is loaded, then its terminal voltage V drops with increase in load current. Such a drop in voltage is undesirable especially when the generator is supplying current for light and power for which purpose it is desirable that V should remain practically constant and independent of the load.

INTERNAL CHARACTERISTICS

This gives the relation between E and I_0. Now in a shunt generator

$I_0 = I + I_f$ - - - (1) and
$E = V + I_a R_a$ - - - (2)

Hence, E/I_a curve can be obtained from V/I curve. If load resistance is decreased the armature current increases up to a certain load current value. After that, any decrease in load resistance is not accompanied by increase in load current. Rather, it is decreased and the curve turns back [2].

Table1: Open Circuit Characteristics

Open Circuit Characteristics

Ir (A)								
Eg (V)								

Table 2: Load Characteristics

Load Characteristics

S.No	V_L (V)	I_L(A)	I_f(A)	$I_a = I_L - I_f$(A)	R_a	$E_g = V_L + I_a + R_a$
1				-		-
2				-		-
3				-		-
4				-		-
5				-		-

Examinee notes down the data with respect to supply voltage, line and field current. In excel once these data are entered it calculates armature current (for known armature resistance) and generated voltage (Eg).

Graph for Internal and external characteristics is plotted as the cells are linked shown in fig.1

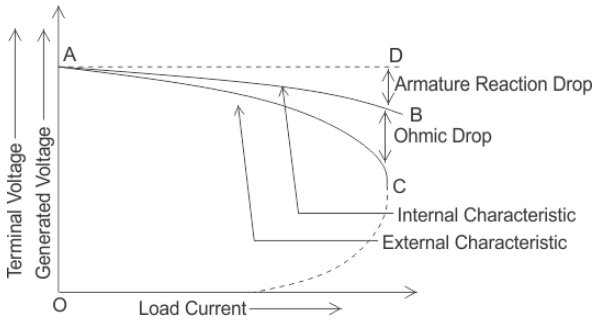

Fig.1 Internal & External characteristics

III. EXPERIMENT 2

LOAD CHARACTERISTICS OF DC COMPOUND GENERATOR

A shunt generator is unsuitable where constancy of terminal voltage is essential, because its terminal voltage decreases as the load increases. This decrease in V is particularly objectionable for lighting circuit where even slight change in the voltage makes an appreciable change in candle power of the incandescent lamps.

A shunt generator may be made to supply substantially constant voltage by adding few turns joined in series with either the armature or load. These turns are so connected as to shunt turns when the generator supplies load. As the load current increases the current through the series winding also increases by increasing the flux. Due to increase in flux induced emf is also increased by adjusting number of series turns this increase in emf can be made to balance the combined voltage drop in the generator due to armature reaction and armature drop. Hence V remains almost constant which means that field current is almost unchanged [3].

Table 3: Values for Ra and Rse

Cumulative - Long Shunt

R_{SE}	**0.3**
R_a	**4.7**

Table 4: Load Characteristics of DC Compound Generator

LOAD CHARACTERISTICS OF DC COMPOUND GENERATOR

S.No	V_{in} (V)	I_L (A)	I_{sh} (A)	$I_a = I_L - I_{sh}$ (A)	$E_g = V_{in} + I_a(R_a + R_{SE})$
1				0	0
2				0	0
3				0	0
4				0	0
5				0	0

Examinee notes down the data with respect to supply voltage, line and field current. In excel once these data are entered it calculates armature current (for known armature resistance and Series resistance) and generated voltage (Eg).

Graph for Internal and external characteristics is plotted as the cells are linked shown in fig.2

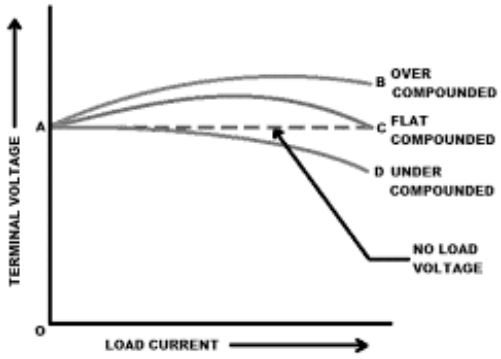

Fig.2: Load Characteristics of DC Compound Generator

IV. EXPERIMENT 3

LOAD CHARACTERISTICS OF DC SHUNT MOTOR

A) Ta/Ia Characteristics

Assuming flux to be practically constant, we find that Ta is directly proportional to Ia. Hence the electrical characteristics is practically a straight line through the origin.

B) N/Ia Characteristics

If flux is assumed constant, then N is directly proportional to Eb. As Eb is also practically constant, speed is, for most purposes constant. For all practical purposes, shunt motor is taken as a constant-speed motor.

C) N/Ta Characteristics

It can be deduced from Ta/Ia Characteristics and N/Ia Characteristics [4].

Table 5: Load Characteristics of Shunt Motor

LOAD CHARACTERISTICS OF SHUNT MOTOR

Ra	0.1105

S.No	V_{in}	I_{in}	F_1	F_2	$F=F_1-F_2$	N	T	P_{in}	P_{out}	η
1					0		0	0	0	#DIV/0!
2					0		0	0	0	#DIV/0!
3					0		0	0	0	#DIV/0!
4					0		0	0	0	#DIV/0!
5					0		0	0	0	#DIV/0!

Examinee notes down the data with respect to supply voltage, line and mechanical load on motor. In excel once these data are entered it calculates total force applied on motor, torque developed, input and output power in British Horse Power.

Graph for its characteristics is plotted as the cells are linked shown in fig.3

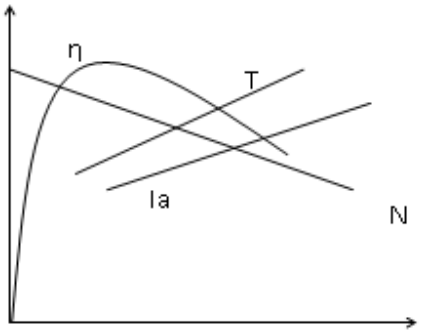

Fig.3: Load Characteristics of DC shunt motor

V. EXPERIMENT 4

RETARDATION TEST- ELECTRICAL BRAKING METHOD

In this method, first time taken to slow down, say by 5%,ie noted with armature alone [5]. Next, a retarding torque-mechanical or preferably electrical is applied to the armature and again time is noted. This method i'd do using electrical torque-mechanical. The double throw switch while cutting of the armature from supply, automatically joins it to a non-inductive resistance [6].

The power drawn by thus resistance acts as a retarding torque-mechanical on the armature, thereby making it slow down comparatively quickly.

Table 6: Retardation Test

RETARDATION TEST

SL NO	SPEED	VOLTAGE	CURRENT	TIME
1				
2				

Table 7: Average power and Stray losses

Average POWER	Stray Losses
0	#DIV/0!

Examinee notes down the data with respect to supply voltage, line current, speed and time taken for the motor to reach standstill. In excel once these data are entered it calculates Average power and stray losses.

VI. CONCLUSION

This paper discusses the validation process in excel for the experiments conducted in DC machines laboratory. The data for respected experiments are entered respected sheets in excel. Once the data are entered, based on the typed formulas it calculates other parameters respectively. If an experiments has graphical representation, its reflected here too.

Evaluator in no time can compare the calculation steps, graphs if any and other parameters and acquaint examinee about its status.

Thus ensuring the validation process is fast and error free over excel for all the laboratory experiments.

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