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Effect of Internal Resistance on Electric Current in a Closed Circuit

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ABSTRACT- The research aims to determine the effect of internal resistance on electric current in a closed circuit. The Sample of this study of 20 sample variation.The research method used was the ex post facto method, by not providing treatment but directly conducting related evaluations. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung= 4.282 and Freg-table = 4.130 (Freg-count > Freg-table), so the conclusion of this study is that there is a very large effect of internal resistance on electric current in a closed circuit.

KEYWORDS: Internal Resistance; Electric Current; Closed Circuit

I. INTRODUCTION

Electricity is one of the basic human needs today. All activities of daily life require electricity to help sustain these human activities.for electricity in a closed circuit, continuity works if there is an electric current. The greater the electric current, the better for electrical energy [1].

Electrical resistance affects the electric current. for electric current in a closed circuit there are two electrical resistances, external resistance and internal resistance are usually included in the total resistance [2].

A closed electrical circuit is a series of electrical components, such as sources of electric current, cables and electronic devices, where the two ends of the cable are connected to the two poles of the electric current source so that electric current flows in the circuit [3].

During the flow of current, we can notice that the current flows from positive to negative terminal in the external circuit but flows from negative to positive through the electrolyte of the cell. As a result, the electrolyte providesresistance to the current flow. This is Internal Resistance [4].

The relationship between internal Resistance (r) and e.m.f. (e) of an electric cell in the presence of external resistance (R) across the cell is – e = I (r + R)……..(1)

We can also write this equation as: e = Ir + IR. The terminal voltage of a cell (V) = current flowing in a conductor (I) Resistance of the conductor (r). The equation for electromotive force changes to: e = V + Ir e = V + v...(2) [5].

How big is the effect of the internal resistance on the electric current, this is what is raised in this paper.

II. RESEARCH METHODS

This research method is Ex post facto. The definition of ex post facto is after the fact, namely research conducted after an incident occurred [6].

This method was chosen because researchers cannot control independent variables through manipulation or experimental treatment because treatment already exists and has occurred before by other people who are not researchers [7]. Thus, Researchers did not look at other factors besides factors including voltage, external resistance, internal resistance and electric current strength.

The general equation of simple linear regression is

$Y = a + b X$……..(3)

Then calculate the value of F using the formula:

$F=S^2_{reg}/S^2_{sisa}$……..*(4)*

F-count compared to F-table with dk quantifier = 1 and denominator = n-2 uses an error level of 5% with the criteria F-count > F-table [8]. Then determine the correlation coefficient between the two variables using the rough product moment correlation formula as follows:

$$r_{xy} = \frac{n\Sigma X_i Y_i - (\Sigma X_i)(\Sigma Y_i)}{\sqrt{\left(n\Sigma X_i^2 - (\Sigma X_i^2)\right)\left(n\Sigma Y_i^2 - (\Sigma Y_i^2)\right)}}$$

……(5)

By criteria; if the price of Freg > Ftable with a significant level of 5% then the data is significant [8,9].

III. RESULTS AND DISCUSSION

Tabel 1: Frequency Distribution of Data from internal resistance for fixed voltage

No	R	r	E	I
1	1,0	0,1	20	18,18
2	1,5	0,2	20	11,76
3	2,0	0,3	20	8, 70
4	2,5	0,4	20	6,90
5	3,0	0,5	20	5,71
6	3,5	0,6	20	4,88
7	4,0	0,7	20	2,26
8	4,5	0,8	20	3,77
9	5,0	0,9	20	3,39
10	5,5	1,0	20	3,33
Amount	2,7	0,55	20	6,02

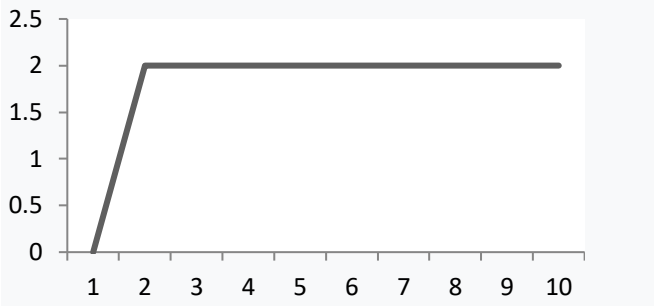

Figure 1: Frequency Distribution of Data from internal resistance for fixed voltage

For fixed data the mains voltage is 20 Volts, with varying internal and external resistance.
For an internal resistance of 0.1 ohm, an external resistance of 1.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 18,18 A
For an internal resistance of 0.2ohm, an external resistance of 2.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 11,76 A
For an internal resistance of 0.3ohm, an external resistance of 3.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 8,70 A
For an internal resistance of 0.4ohm, an external resistance of 4.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 6,90 A
r an internal resistance of 0.5ohm, an external resistance of 5.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 5,71 A
For an internal resistance of 0.6ohm, an external resistance of 6.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 4,88 A
For an internal resistance of 0.7ohm, an external resistance of 7.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 2,26 A
For an internal resistance of 0.8ohm, an external resistance of 8.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 3,77 A
For an internal resistance of 0.9ohm, an external resistance of 9.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 3,39 A
For an internal resistance of 1 ohm, an external resistance of 11 ohm, an electric voltage of 20 Volts, an electric current is obtained 3,33 A
For a fixed voltage of 20 Volts, the external resistance and internal resistance vary, an electric current of 6,02 A.

Tabel 2: Frequency Distribution of Data from internal resistance for non fixed voltage

No	R	r	E	I
1	1,0	0,1	10	9,09
2	1,5	0,2	20	11,76
3	2,0	0,3	30	13,04
4	2,5	0,4	40	13,79
5	3,0	0,5	50	14,29
6	3,5	0,6	60	14,63
7	4,0	0,7	70	14,89
8	4,5	0,8	80	15,09
9	5,0	0,9	90	15,25
10	5,5	1,0	100	15,38
Amount	2,7	0,55	5,5	1,69

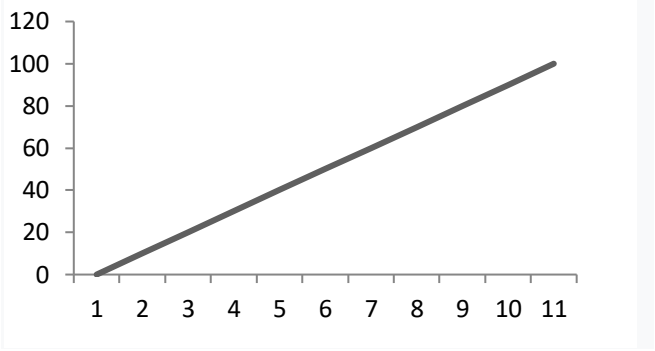

Figure 2: Frequency Distribution of Data from internal resistance for non fixed voltage

For Non fixed data the mains voltage is 20 Volts, with varying internal and external resistance.
For an internal resistance of 0.1 ohm, an external resistance of 1.0 ohm, an electric voltage of 10 Volts, an electric current is obtained 9,09 A
For an internal resistance of 0.2ohm, an external resistance of 2.0 ohm, an electric voltage of 20 Volts, an electric current is obtained 11,76 A
For an internal resistance of 0.3ohm, an external resistance of 3.0 ohm, an electric voltage of 30 Volts, an electric current is obtained 13,04 A
FoFor an internal resistance of 0.4ohm, an external resistance of 4.0 ohm, an electric voltage of 40 Volts, an electric current is obtained 13,79 A
r an internal resistance of 0.5ohm, an external resistance of 5.0 ohm, an electric voltage of 50 Volts, an electric current is obtained 14,29 A
For an internal resistance of 0.6ohm, an external resistance of 6.0 ohm, an electric voltage of 60 Volts, an electric current is obtained 14,63 A
For an internal resistance of 0.7ohm, an external resistance of 7.0 ohm, an electric voltage of 70 Volts, an electric current is obtained 14,89 A
For an internal resistance of 0.8ohm, an external resistance of 8.0 ohm, an electric voltage of 80 Volts, an electric current is obtained 15,09 A
For an internal resistance of 0.9ohm, an external resistance of 9.0 ohm, an electric voltage of 90 Volts, an electric current is obtained 15,25 A
For an internal resistance of 1 ohm, an external resistance of 11 ohm, an electric voltage of 100 Volts, an electric current is obtained 15,38 A
For Non fixed voltage of 10 until 100 Volts, the external resistance and internal resistance vary, an electric current of 1,69 A.
The effect of internal resistance on a closed electric current as shown in the table becomes an obstacle to the flow of electric current. The greater the internal resistance, the smaller the electric current in the closed circuit [10].

When compared to the use of internal resistance for a fixed voltage with a variable voltage, the electric current for a fixed voltage is getting bigger and bigger while for a variable voltage it is getting smaller and smaller[11,12].

IV. CONCLUSION

The Sample of this study of 20 sample variation. The research method used was the ex post facto method, by not providing treatment but directly conducting related

evaluations [14-16]. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung= 4.282 and Freg-table = 4.130 (Freg-count > Freg-table), so the conclusion of this study is that there is a very large effect of internal resistance on electric current in a closed circuit.

Resistance (R / resistor) affects the strength of the electric current. It can be described that the effect of resistance (R) on the current strength is like dirt that clogs the flow of water in a pipe. The more dirt (the greater the resistance), the weaker/smaller the strength of the water flow.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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