Indonesian Journal of Science and Education
Volume 2, Number 2, October 2018, pp: 146 ~151
p-ISSN: 2598-5213, e-ISSN: 2598-5205, DOI: 10.31002/ijose.v2i2.625
e-mail: ijose@untidar.ac.id, website: jurnal.untidar.ac.id/index.php/ijose

Effect Number of Wire to DC Generator Prototype with Variation Diameter Wire

Rifki Ramadhan*, Ferindra Nugrahendi, Tika Erna Putri**
Electronic and Instrumentation, Departement of Electrical and Informatics
Vocational College, Universitas Gadjah Mada, Indonesia
*email: rifkiramadhan17@gmail.com
**coresponding author: tika.erna.p@ugm.ac.id

Received: 23 February 2018 *Revised: 30 July 2018* *Accepted: 4 October 2018*

ABSTRACT

The modern era as now the needs of electricity is enormous. This makes the supply of non-renewable resources dwindling (coal and natural gas). This makes the emergence of smart ideas and innovations by using alternative energy. By using alternative energy we can save the use of non-renewable resources and can create energy efficient environmentally friendly. This study aims to analyze the output power in DC motors by using variations in the number and diameters of the outer coils in order to produce maximum output power value. The research method used is the design and manufacture of tools and experiments by conducting a descriptive research approach. The results of the test using different diameter variations of wire are 0.15 mm, 0.20 mm and 0.25 mm. The voltage test obtained voltage of 0.40 V for wire diameter 0.15 mm, 0.46 V for wire diameter 0.20 mm, and 0.52 V for 0.25 mm wire diameter. Simultaneous current and voltage gain can further improve the efficiency.

Keywords: dc generator, magnet, coil

INTRODUCTION

The development of technology in the modern era is currently impacting on the need for huge electrical energy, both in developed and developing countries like Indonesia. Renewable power generation or alternative energy is a smart innovation in meeting the needs of the world's electric energy given the depletion of petroleum energy which has always been the main commodity in power generation systems.

The problem is the continued use of non-renewable energy causes the supply of energy continues to thin. The number of these problems is not supported by efforts to overcome the adverse impact that will be generated. The use of petroleum from fossils for vehicles also triggers CO2 emissions. Carbon dioxide (CO2) is a chemical compound consisting of two oxygen atoms bonded covalently with a carbon atom. This CO2 is gaseous at the state of standard temperature and pressure and is in the Earth's atmosphere. Therefore, innovative and more innovative are needed to take advantage of more environmentally friendly renewable energy. To cope with this, there are many studies that examine the utilization of other energy sources such as water, wind, and ocean waves that require low-voltage generators without additional expectations to generate electricity.

However, in previous studies no one has examined the effect of winding variations on electric generator prototypes with wire diameter variations in diameter. Therefore in this study the authors want to make research on the development of prototype design of low speed dc generator by varying the number and diameter of the wire winding to produce the required currents and voltages. Development of research on low rotary generator which is developed by using axial and radial flux

method, this research uses radial flux that utilizes motor stator which will be designed and made into radial fluid dc generator without the need of additional excitation.

METHOD

Device Planning

The work procedure of this study is to determine the variation in the number and diameter of the winding in the rotor space which will produce electromagnetic energy to move the stator. Stator movement produces electromagnetic energy so as to produce voltage and current which will be amplified through voltage amplifier circuit. The current and the resulting voltage can be used to turn on the 4 LED 1.5 V. The current and the resulting voltage are used for data retrieval research.

To do related research, the thing to do first is to design the device. The design of the device itself is done so that the object that made the research will have results that meet the expectations of researchers. System design tool is designed in the form of prototype because it is still a simulation, the focus of this research is the influence of variation in the number and diameter of the winding so as to produce the current and voltage required.

In the design of this tool is divided into 2 of them electronic design and design of prototype generator dc flux radial. The point that will be described at this point is how the performance of this device.

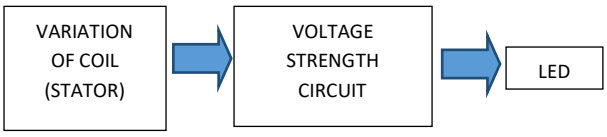

Figure 1. Block Diagram

Design of Electronics

The design of electronic devices used is to use a voltage amplifier circuit as the main component to raise the current and voltage that is influenced by copper wire winding variations.

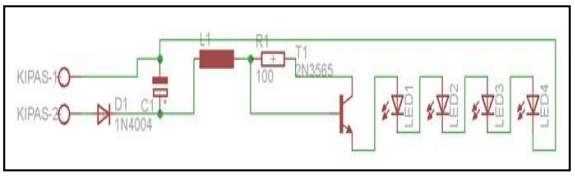

Figure 2. Schematic Design

Design of DC Radial Flux Prototype Generator

The design of a radial flux dc prototype generator that has two main components namely the stationary (stator) and the rotating part (rotor). In the dc generator to be made, the stator is placed on the inside and the rotor on the outside.

a) Stator

The stator used modified windings, consisting of 4 coils with the number of 1000 turns on the wire 0.15 mm, 0.20 mm, and 0.25 mm. Stator winding connected series with a single phase output voltage and the coil is made to the maximum size of winding that can be rolled on the stator.

In the stator there is an iron core that serves to facilitate the path of magnetic flux generated by electric current through the coil. The stator used is 0.15 mm in diameter, 0.20 mm, and 0.25 mm. with the direction of each coil windings are different, this is so that the direction of the current flowing the same and the resulting voltage is large.

Table 1. Stator Spesifications

Parameter	Symbol	Value
Dimension of the stator coil	P	23 mm
	L	20 mm
	T	10 mm
Number of reel	Nm	4
Number of winding 0.15	Ns	800
Number of winding 0.20	Ns	800
Number of winding 0.25	Ns	800
Number of Phasses	Nph	1

b) Rotor

The radial flux generator rotor used utilizes a used magnet motor with 4 magnets inside. The rotor is then connected to the prime drive shaft of dc motor. The rotation speed of the rotor

affects the amount of voltage generated and the frequency generated. The radial flux generator dc generator consists of 4 pieces of ferrite permanent magnets arranged radially on a cylindrical plane.

System Implementation

System Implementation is the result of the implementation of stator type design with electronic circuit in the form of a step-up circuit. In amplifier circuit itself include elco capacitor, inductant, c383 transistor, diode, and resistor. Each plays an important role such as the elco capacitor as a temporary storage (battery), inductant as current amplifier, c383 swicthing transistor, diode as rectifier, and resistor as anchoring. Until finally the last output is LED.

At this stage, the researchers make the electronic circuit play a very important role as a voltage amplifier. In this study, the authors have changed the standard copper wire in the psu fan stator which initially only about 400 windings and the diameter of 0.40 mm wire thickness as in Figure 3.4, replaced with copper wire with diameter of 0.20 mm as many as 800 loops. The current and voltage are amplified through this amplifier circuit aimed at turning on the 1.5 V LED.

RESULT AND DISCUSSION

System Testing Analysis

The overall system design analysis of this research is to prove the effect of the ratio of variation in number and the diameter of the winding used to the voltage (V) and current (I) and the resistance (Ω).

This research will take data from several load voltage measurements on the LED output. The first test is to determine the range of winding data that will be used. In this study used a range of 200-1000 copper wire windings to fill the rotor space. The coil of copper wire which initially only about 400 turns with 0.4mm diameter is replaced with 0.2 mm diameter copper wire which will be wrapped around the rotor of 800-1000 windings.

This is because the variation of data in the range of 800-1000 winding that is able to produce electromagnetic energy required for the voltage generated motor can turn 4 LED 1.5 V through voltage amplifier circuit.

Figure 3. Design of The Device

Replacement of copper wire aims to get the current and voltage to be produced. The more winding, the greater the voltage will be generated. The thickness of the copper wire also affects the resulting current, because the thicker the diameter of the stator thickness, the more obstacles will be obtained. This affects the resulting current, therefore it uses 0.2 mm copper wire as a stator to produce the required current. Then the process of coiling the copper wire on the rotor is made back and forth to fill the rotor space. It aims to keep the motor current and voltage.

This device is designed with a simple concept that variations in the number of turns on the rotor determine the amount of electromagnetic energy. Electromagnetic energy was used to move the motor to produce current and voltage that will be amplified through the amplifier circuit. The energy produced is stored on the capacitor contained in the step-up circuit. Furthermore, stored energy is distributed to turn on 4 LEDs. This system aims to examine the effect of winding variations with the number and diameter of the wire.

Variations of windings

Testing the first method based on the number of turns. The fixed variable in this test is the thickness of 0.2 mm copper wire diameter. The thickness value of 0.2 mm is used because it is capable of generating the current and the voltage required to turn on the LED.

The independent variable in this test is the number of windings and the dependent variable is the current and the resulting voltage. This test uses a series of stator modifications which are connected to a step-up circuit that works to amplify the output voltage.

Table 2. Variation Value of Winding

No	Value of Winding (N)	Voltage (V)	Current (mA)	Obstacles (10^{-4} Ω
1	200	0.29	0.30	3.86
2	400	0.38	0.24	8.56
3	600	0.47	0.18	12.84
4	800	0.56	0.12	16.49
5	1000	0.65	0.06	20.95

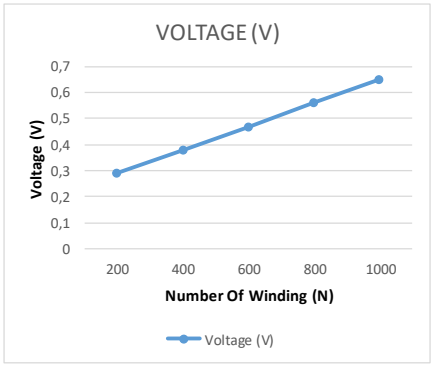

Figure 4. Graphs of the data variation in the number of turns with the resulting voltage

In this graph described the data obtained by the initial experiment using 200 windings capable of producing a voltage of 0.29 V. The second experiment uses 400 turns resulting in a voltage of 0.38 V. The third experiment with 600 turns produces a voltage of 0.47 V. The fourth experiment uses 800 loops resulting in a voltage of 0.56 V. The last experiment using 1000 windings yields a voltage of 0.65 V.

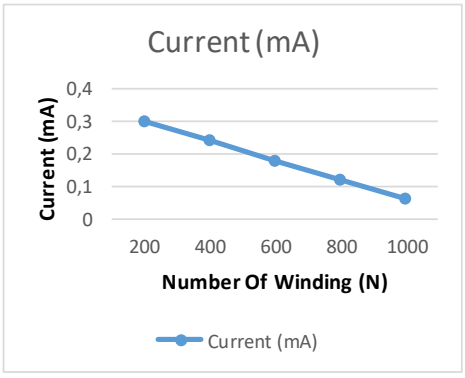

Figure 5. Graph of the data variations of the number of winding with the current

In this graph described the data obtained by the initial experiment using 200 loops capable of producing a current of 0.30 mA. the second experiment using 400 turns produces a current of 0.24 mA. The third experiment with 600 turns produces a current of 0.18 mA. The fourth experiment using 800 loops produces a current of 0.12 mA. The last experiment using 1000 loops generated a current of 0.06 mA.

In this graph also explained about the data obtained with initial experiments using 200 loops able to get a resistance of 3.86 Ω. the second experiment using 400 windings get a resistance of 8.56 Ω. The third experiment with 600 turns encountered an obstacle of 12.84 Ω. The fourth experiment using 800 loops obtains an obstacle of 16.49 Ω. The last experiment using 1000 windings get a resistance of 20.95 Ω.

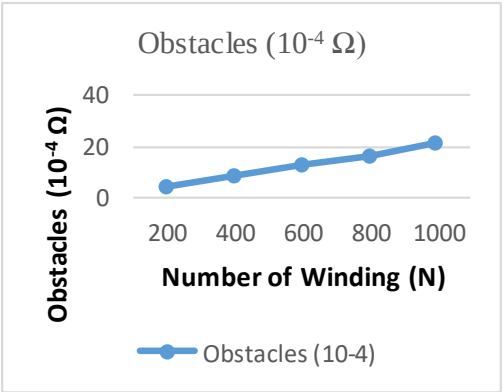

Figure 6. The graph of the variation in the number of circumferences with the obtained resistance

Variation of Diameter

Testing of second data variation based on wire diameter variation. The guarded variable is the number of windings of 800 loops. The independent variable is the source of the power supply in the form of wire diameter variation. While the dependent variable is the current and the resulting voltage.

Table 3. Variation of Wire Diameter

No	Diameter of Coil (mm)	Voltage (V)	Current (mA)
1	0.15	0.40	0.16
2	0.20	0.56	0.12
3	0.25	0.72	0.08

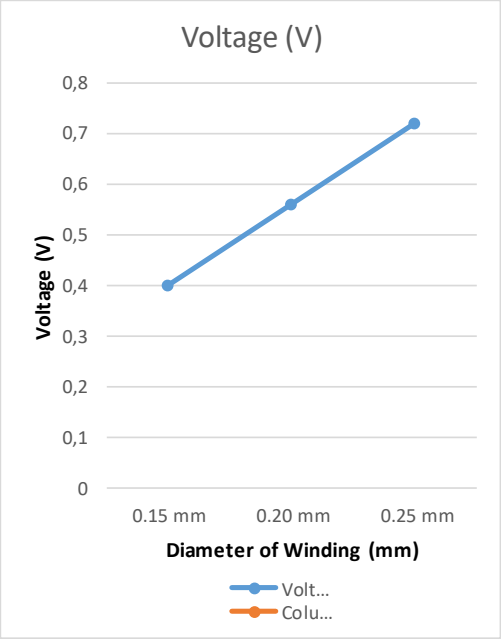

Figure 7. Graphs of variation of circumferential diameter data with the resulting voltage

In this graph graph described the data obtained with the initial experiment using the type of stator 0.15 mm capable of producing a voltage of 0.40 V. the second experiment using the type of stator 0.20 mm to produce a voltage of 0.56 V. The third experiment with the type of stator 0.25 mm produces a voltage of 0.72V.

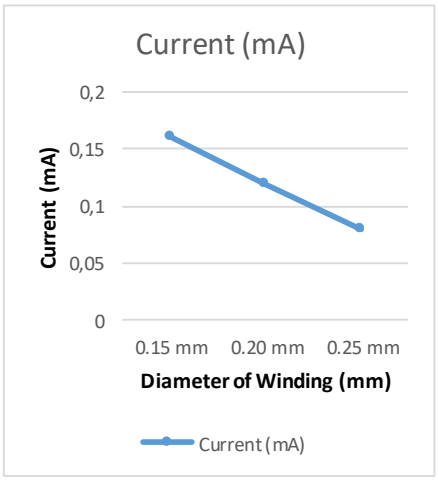

Figure 8. Graphs of variation of circumferential diameter data with the resulting current

In the graphic Figure above is explained about the data obtained by the initial experiment using the type of stator 0.15 mm capable of producing a current of 0.16 mA. a second experiment using a 0.20 mm stator type produces a current of 0.12 mA. The third experiment with the 0.25 mm stator type produces a current of 0.08 mA .. The data on the output voltage above is the result of the modified stator eletromagnetic energy with the amplification by the step-up sequence.

CONCLUSION

Based on the results of research that has been done from the design stage to system testing it can be drawn conclusion as follows: (1) The winding variation with the number of 800 windings and the stator diameter variation of 0.20 mm with the step-up collaboration can produce 0.12 mA current and 0.46 V voltage. (2) The thicker the diameter of the wire is used then the resulting voltage is greater and the resulting current is smaller, because the thicker the diameter of the wire the barriers obtained are also greater. (3) The more the number of windings the greater the obstacles are obtained.

REFERENCES

Alfred, H.. (1929). *The original hubbard coil design.* Geoff Egels All Natural Energy Web site.

Alonso, M. (1994). Dasar-dasar Fisika Universitas, Edisi Kedua, Jilid 2. Jakarta: Erlangga.

Dharmawan, R. (2014). Perbandingan unjuk kerja generator sinkron magnet permanen fluks aksial dengan variasi jumlah lilitan stator, *Skripsi*, Universitas Gadjah Mada.

Grabel, A. (1981). *Dasar dasar Elektroteknik,* Edisi Kelima, Jilid 2. Jakarta: Erlangga.

Haliday, D. (1996). *Fisika,* Jilid 2. Jakarta: Erlangga.

Ishaq, M. (2007). *Fisika Dasar,* Edisi 2. Jakarta: Graha Ilmu.

Panglipuradhi, B. (2016). Proses perbaikan lilitan ulang pada stator motor induksi tiga fasa 110 KW 330V, *Tugas Akhir*, Universitas Gadjah Mada.

Prianto, E. (2013). Mesin pembuat lilitan motor listrik berbasis mikrokontroler pada industri perawatan dan perbaikan motor listrik, *Tesis*, Universitas Gadjah Mada

Serway, Jawett. (2012). *Physic for Science and Engineering.*

Soedjojo, P. (1999). *Fisika Dasar*. Yogyakarta: ANDI.

Soemanto. (1995). Pengenalan Motor Listrik

Subodro, R. (2015). Pengaruh ukuran poli dan penambahan jumlah lilitan spooel pada alternator konvensional terhadap voltage yang dihasilkan, *Jurnal AUTINDO*, 2 (1), 16-24.

Suyamto. (2008). Fisika bahan listrik, cetakan 1. Yogyakarta: Pustaka Pelajar.