B361

by Hr Hr

Submission date: 02-Apr-2023 02:37PM (UTC+0700)
Submission ID: 2053293896
File name: B361.pdf (293.63K)
Word count: 2625
Character count: 13652

Varying of Generator Design for Renewable Energy (Study Case for Ocean Wave Power Plant)

Hendra [1, a)*], Yenni Suhartini [2, b)], Anizar Indriani[2], FAD Hanuary[2], Hernadewita[3,c)], Frengki Hardian[4] and Hermiyetti[5]

[1]*Mechanical Engineering Dept. University of Sultan Ageng Tirtayasa Banten, Jl. Jenderal Sudirman KM. 3 Cilegon Indonesia*
[2]*Electrical Engineering Dept. University of Bengkulu, Jl. WR. Supratman Kandang Limun Bengkulu Indonesia.*
[3]*Magister of Industrial Engineering University of Mercubuana Jakarta, Kampus Meruya Jakarta Indonesia*
[4]*Magister of Notary University of Yarsi Jakarta, Jl, Suprapto Jakarta Indonesia*
[5]*Faculty of Economic University of Bakrie Jakarta, Jl, H.R. Rasuna Said Kuningan Jakarta Indonesia*
[*]*Design manufacture and material mechanic laboratory, CoE Petrokimia Sultan Ageng Tirtayasa Banten, Indonesia*

[a)] hendra@untirta.ac.id [b)]h7f1973@yahoo.com, [c)]hernadewita@mercubuana.ac.id

Abstract. In the power plant, a generator is the most important component. Generators are used in power plants that use renewable energy sources including water, wind, solar, sea, ocean waves, and soon. The voltage of the generator, type of motion mechanism of a generator, material component of a generator, and other factors all influence its performance. AC and DC generators are two types of generators that can be utilized in a power plant. The generator's motion mechanism is made up of rotational and translation generators. We will focus on the variation generator AC and DC with rotational and translational motion in this study, as well as variations in the rotation and load of the generator. The generator's input power was calculated manually using a rotation speed of 100-200 rpm and a load of 16.6 ohms from a lamp (12 w). This study employs an experimental approach to determine the performance of the generator in terms of voltage, current, and power. The performance of the generator AC with translation motion test is 42.7 volts at 200 rpm, and the generator DC with rotation motion is 77.4 volts [1] based on separate experimental testing of generators. The highest value of the output voltage generator is 31.14 volts for generator translation and 36.82 volts for generator rotation when a load is supplied [1]. The voltage is 8.8 to 9.8 volts by employing all generators AC with translation and rotation motion. Testing generator AC with rotation motion by a load of lamp 65 kΩ, where the resulting voltage and current are 15.3 V and 0.17 mA.

Keywords: Generator, Mechanism, Translation, Rotation, Load, Voltage.

INTRODUCTION

A power plant's generators are critical components. Mechanical energy is converted into electrical energy by the generator. Kinetic and potential energy, which can be found in wind or water power plants, are used to generate mechanical energy. Mechanical energy can be obtained from both renewable and non-renewable natural sources in power plants, particularly generators. Due to the limited supply of non-renewable natural resources, renewable energy sources have become a crucial aspect in the development of power generation. Wind energy, geothermal energy, solar energy, water, and the sea are all examples of renewable natural resources [2-15]. Non-renewable natural resources are derived from fossil fuels, which are in short supply.

Turbines, generators, batteries, solar cells, and other converter equipment are used to transform renewable sources into power. Components that can convert mechanical energy into electrical energy are found in generators for power generation. AC and DC generators are used to generate a voltage based on the outcome. Translational and rotational motion generators are the two types of generator motion mechanisms [1-4].

Shafts, blades, gears, pulleys, rotors, and stators, among other mechanical and electrical components, make up generator components [6-10]. A magnet and a coil winding make up the stator and rotor components. The generator handle, generator component material, generator handle shape, motion component, magnet type, coil winding, and other factors all affect generator performance. The generators employed in the prior investigation were an AC generator for translational motion and a DC generator for rotating motion. An extra component, a buck-boost converter, is used to help synchronize AC and DC voltage generators [12]. An AC rotating motion generator is made to reduce the requirement of additional components.

The focus of this research is on generator modifications that are used to generate ocean wave energy using translational and rotational motion. There are two types of motion generators used: translational and rotational motion generators. The generator for translational motion is an AC type with neodymium magnets, copper coil windings, and PVC tubes, and it uses a downward and upward kinematic motion mechanism. DC and AC generators are utilized for rotating motion generators. AC tubes with neodymium magnets and copper coil windings make up the AC generator.

The generator output voltage will be obtained in the form of voltage, current, and power from the test results of this generator variant.

RESEARCH METHOD

The method used in this study was experimental, beginning with the observation of the generator's design and operation. The literature review served as the theoretical foundation for the design of translational and rotational motion generators, which was followed by the production of AC generators for translational and rotational motion, and the testing of AC and DC generators for translational and rotational motion. Then, based on the various generators employed, conclusions are reached. Figure 1 shows the flow chart form of this research approach.

AC and DC generators are utilized, and they are powered by the rotation of pulleys or the action of the tidal components of ocean waves. Figure 2 shows the shape of the generator that was employed.

AC and DC generators with translational and rotational motion, neodymium magnets and copper coil windings for stator and rotor components, generator handle structures, motion mechanism components such as shafts and pulleys, and gears were among the tools and materials used in this investigation. Figures 3 and 4 show the components of this generator.

The phases of producing a generator holder for translational motion and vertical rotation are as follows:

1. The procedure of selecting stainless steel for the generator handle of translational and rotational motion.
2. The process of measuring and cutting stainless steel material for the translational motion and vertical rotation according to the parameters of the generator.
3. A stainless welding procedure is used to connect the generator seat material for the translational motion and vertical rotation.
4. Magnets, coil windings, generator tubes, generator shafts, translation and rotation generators, pulleys, gears, bearings, and other generator components are installed.
5. To evaluate the generator's performance in terms of translational motion and vertical rotation.

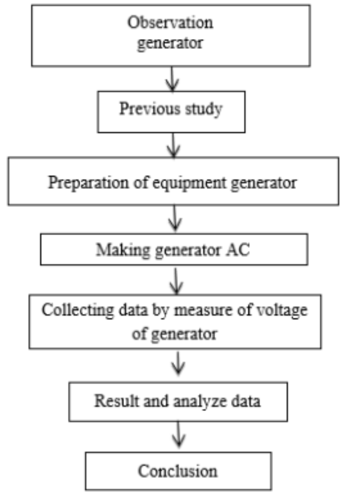
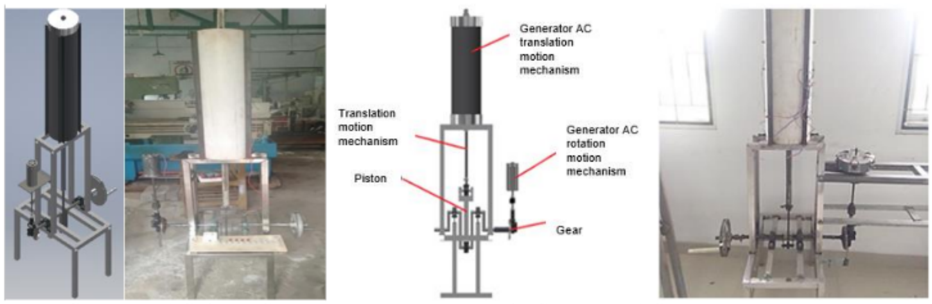


Fig 1. Flow chart of research



a. Generator AC dan DC b. Generator AC

Fig 2. Generator AC and DC with Translation and Rotation Mechanism

Figure 4 shows the design and outcome of creating a rotating motion AC generator. The rotational generator is made up of a stator body, a stator, a coil winding, and an iron core, as shown in Figure 4. The stator body is composed of PVC material with a 140 mm diameter and an 8.5 mm thickness. The iron core, which serves as a coil holder, has 600 turns and is positioned around the circle of the stator body. The stator is a neodymium magnet holder with 90 mm dimensions and a 25 mm trapezoidal magnet. Figure 3 shows the form of the rotor design.

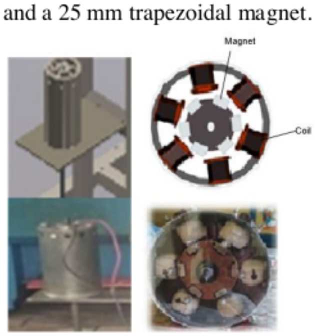


Fig. 3 Component Electric of generator AC and DC **Fig. 4** Component mechanic of generator AC and DC

Figure 4 shows the design and combined design of rotational motion AC generator components, where the work process is to rotate the AC generator rotor with rotational motion connected utilizing gears using the alternating motion of a translational generator. Figure 5 shows the form of the generator seat structure for translational and rotational motion at the time. The generator stand's movement mechanism and structure are shown in Figure 6.

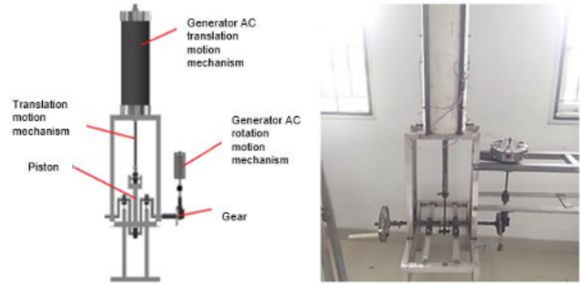


Fig 5. Generator AC with Translation and Rotation Mechanism

RESULT AND DISCUSSION

Results of Performance Tests Generators AC and DC for Translational Motion Mechanisms

Variable rotation and load are used to assess the performance of AC and DC generators for translational and rotational motion mechanisms. Tables 1 and 2 with variation load show the results of the performance test of the generator AC with translation motion mechanism. The output voltage of the generator AC with translation motion mechanism is 42.7 Volts at 200 rpm, as can be shown. The voltage is 31.14 V and the current is 0.38 an after utilizing a 12 watt light as a load. As indicated in Table 2, the output power of an AC generator with a translation motion mechanism is 11.83 w.

Table 1 Results of performance tests generators ac translation motion mechanism without load

Number of coils	Rotation [rpm]	Voltage of generator [V]
2 x 1260	100	36,12
	150	36,70
	200	42,7

Table 2 Results of performance tests generators ac translation motion mechanism without lamp 16.6 ohm (12 w)

Number of coils	Rotation [rpm]	The voltage of generator [V]	The current of the generator [mA]	Power [w]
2 x 1260	100	17,41	0,34	5,919
	150	27,26	0,40	10,904
	200	31,14	0,38	11,833

Results of Performance Tests Generators DC for Rotation Motion Mechanisms

Tables 3 and 4 show the results of testing the generator DC's performance with a rotational motion mechanism by varying the rotation speed. The output voltage of the generator DC with rotation motion mechanism is 77.4 Volts at 200 rpm, as shown in Table 3. The voltage is 36.82 V and the current is 0.4 an after utilizing a lamp load of 12 watts. Table 4 shows that the output power of the DC generator with rotation motion mechanism is 14.73 w at 200 rpm.

Table 3 Results of performance tests generators ac rotation motion mechanism without load

Rotation [rpm]	Voltage of generator [V]
100	39,33
150	39,94
200	77,4

Table 4 Results of performance tests generators ac rotation motion mechanism with load lamp 16.6 ohm (12 w)

Rotation [rpm]	The voltage of generator [V]	The current of the generator [mA]	Power [w]
100	14,82	0,38	5,632
150	24,00	0,40	9,6
200	36,82	0,40	14,728

Results of Performance Tests Generators AC for Rotation Motion Mechanisms

Variable rotation and load are used to test the performance of generators having rotation motion mechanisms. In an AC generator with a rotation motion mechanism stator, there are 600 x 6 coils. Generator testing is done individually and in conjunction with generator AC translation and rotation without load and with the load. As shown in Table 5, the results of generator AC with rotation motion mechanism by no-load and rotational speed variation from 100-200 rpm yielded a voltage range of 8.8 to 19.9 Volts. Table 6 shows the results of testing generator AC with a rotating motion by a lamp 65 k load, with voltage and current of 15.3 V and 0.17 mA, respectively.

Table 5. Results of Performance Tests Generators AC for Rotation Motion Mechanisms without load

Rotation [rpm]	Voltage of generator [V]
100	8.6
150	12.3
200	19.9

Table 6. Results of Performance Tests Generators AC for Rotation Motion Mechanisms with load 65 kΩ

Rotation [rpm]	The voltage of generator [V]	The current of the generator [mA]
100	9.31	0.15
150	12.53	0.09
200	15.3	0.17

Fig 5. Generator AC with Translation and Rotation Mechanism by using load LHE 5 w.

Figure 5 shows the results of a combined generator AC with translation and rotation motion mechanisms utilizing a 3 A transformer load and a 5 w LHE bulb. The voltage and current measurements with a 3 A transformer load and a 5 w LHE lamp rotated at 100-200 rpm yielded 70 V and 3.25 mA and 116.3 V and 8.35 mA, respectively.

CONCLUSION

The conclusion in this research is by experimental testing of generators yielded results of 42.7 volts at 200 rpm for the generator AC and 77.4 volts for the generator DC with rotation motion. The maximum value of the output voltage generator is 31.14 volts for generator translation and 36.82 volts for generator rotation when a load is added. A voltage and current of 8.8 to 19.9 volts are produced by an AC generator having a translation and rotation motion mechanism. The voltage and current are 15.3 V and 0.17 mA, respectively, as a result of testing generator AC with rotation motion by a lamp load of 65 kΩ.

ACKNOWLEDGMENTS

This research is supported by the Ministry of Education, Culture, Research, and Technology, Head of the National Research and Innovation Agency Republic of Indonesia through *Hibah Penelitian Dasar Unggulan Perguruan Tinggi* (PDUPT) 12 July 2021 2021 Number 022/E4.1/AK.04PT/2021 and Number 2182/YN30.15/PG/2021 13 July 2021, and Institution of Research and Community Service University of Bengkulu.

REFERENCES

1. Indriani, A., Suhartini, Y., Hendra, Hernadewita, and Rispandi, Performance of Generator Translation and Rotation Motion on Vertical Direction for Sea Wave Power Plant, OP Conf. Series: Materials Science and Engineering 1007 (2020) 012044 doi:10.1088/1757-899X/1007/1/012044.
2. Anand, S., Turbines for Wave Energy Plants, Proceedings of the 8th International Symposium on Experimental and Computational Aerothermodynamics of Internal Flows, Lyon, 2007.
3. Amundarain, M., Alberdi, M., Garrido, J., and Garido, I., Modeling and Simulation of Wave Energy Generation Plants: Output Power Control, IEEE Transactions on Industrial Electronics, Vol. 58, and No.1, 2011.
4. Falcao, A. F., Wave Energy Utilization: A Review of the Technologies, Renewable and Sustainable Energy Reviews, 14, pp. 899-918, 2010.
5. Casman, D. P., Sullivan, D. L., Egan, M., and Hayes, J. G., Modeling and Analysis of an Offshore Oscillating Water Column Wave Energy Converter, Proceedings of the 8th European Wave and Tidal Energy Conference, 2009, pp. 924-933, Sweden.
6. Hendra, Indriani, A., Hernadewita, Applying of Piston Mechanism Design In The Wavelength Electrical Generating of Ocean For Fishing Community, Advanced Materials Research, Vol. 918, 2014-01-01.
7. Indriani, A., Dimas, S., Hendra, Effect of Dimension and Shape of Magnet on the Performance AC Generator with Translation Motion, IOP Conference Series: Materials Science and Engineering, Vol. 307, issue: 1, 2018-02-19.
8. Indriani, A., Hendra, Suhartini, Y., Tanjung, A., Performance of Ocean Wave Power Plant Using Pneumatic System With Variety Of Position Of Exhaust Valves Tube Piston And The Number Of Buoys, Proceeding of International Symposium on Materials Science and Engineering, Kuala Lumpur, Malaysia, 2017.
9. Indriani, A, Jonianto, H., Hendra, Optimasi Desain Piston Pembangkit Listrik Tenaga Gelombang Laut Sistem Pneumatik Untuk Output Daya Listrik, Prosiding Seminar Nasional Teknik Mesin XV, ITB Bandung, 2016
10. Indriani, A., Hendra, Suhartini, Y., Tanjung, A., Performance of Generator Pneumatic for Power Plant of Ocean Wave, IOP Conference Series: Materials Science and Engineering, Vol. 505, issue: 1, 2019-07-04.
11. Nugroho W.B., Kusuma, I.R., dan Sarwitto, S., Kajian Teknis Gejala Magnetisasi pada Linear Generator untuk Alternatif Pembangkit Listrik, Jurnal Teknik POMITS Vol. 3, No. 1, (2014) ISSN: 2337-3539 (2301-9271 Print).
12. Indriani, A., Darmana, I., Hernadewita, Setiawan, A., Hendra, Control Output of Generator Translation and Rotation Using Buck-Boost Converter for Sea Wave Power Plant, International Journal of Mechanical Engineering and Technology, Volume 11, Issue 5, May 2020, pp. 61-74.
13. Higuchi, K., Guan Y., Yokomizu Y., and Matsumura T., Observation of Transient Behavior of Magnetic Flux in Inductive-type Fault Current Limiter with YBCO Thin Film Disc, Physics Procedia 36 (2012) 1254 – 1257.

14. Eka Putri R. L., Sarwoko, M., Rusdinar, A., Adam, K. B., Perancangan Dan Implementasi Pembangkit Listrik Tenaga Ombak Laut Menggunakan Sistem Generator DC Untuk Pengisian Baterai Di Perahu Nelayan, e-Proceeding of Engineering : Vol.3 , No.1 April 2016.

B361

ORIGINALITY REPORT

16%	12%	12%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Universitas Sultan Ageng Tirtayasa Student Paper	5%
2	journal.uad.ac.id Internet Source	2%
3	A. Indriani, Hendra, S. Yenni, W. Aswata, Rispandi, Hernadewita, A. Tanjung. "Stress analysis on the frame holder of generator translation motion on horizontal direction for sea wave power plant using finite element method (fem)", IOP Conference Series: Materials Science and Engineering, 2020 Publication	1%
4	Submitted to SDM Universitas Gadjah Mada Student Paper	1%
5	Submitted to itera Student Paper	1%
6	repository.untar.ac.id Internet Source	1%

7	Hendra, Pudi Virama, Hernadewita, Dhimas Satria, Hermiyetti, Frengki Hardian. "Analyze of Geometric Characteristic of Powder Reinforced Composite Material from Liquid Waste for Part of Motor Vehicle", Materials Science Forum, 2022 Publication	1 %
8	COMPEL: The International Journal for Computation and Mathematics in Electrical and Electronic Engineering, Volume 33, Issue 5 (2014-09-16) Publication	<1 %
9	sportdocbox.com Internet Source	<1 %
10	www.hindawi.com Internet Source	<1 %
11	www.ijert.org Internet Source	<1 %
12	publica.fraunhofer.de Internet Source	<1 %
13	repository.unmul.ac.id Internet Source	<1 %
14	www.coursehero.com Internet Source	<1 %
15	www.journal.uad.ac.id Internet Source	<1 %

16	vdocuments.site Internet Source		<1%
17	www.science.gov Internet Source		<1%
18	Toshiro Matsumura. "Increase of inductance ratio of flat type fault current limiter with high-Tc superconducting disk", IEEJ Transactions on Electrical and Electronic Engineering, 09/2006 Publication		<1%

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	Off		