International Journal in Physical and Applied Sciences
Volume 07 Issue 07, July 2020 ISSN: 2394-5710 Impact Factor: 4.657
Journal Homepage: http://ijmr.net.in, Email: irjmss@gmail.com
Double-Blind Peer Reviewed Refereed Open Access International Journal

ENHANCE METHOD POWER POINT TRACKING WEAR METHOD DC-DC CONVERTER BASED ON FUZZY LOGIC OF BAYU POWER PLANT

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ABSTRACT

In increasing the electric power capacity of the Bayu Power Plant (PLTB) there are several ways among others by increasing the number of plants, but the weakness is that the costs are too expensive because they have to build a new generator. Another way is to improve the efficiency of the power output existing wind power plants. One way is to use technology Maximum Power Point Tracking (MPPT) which functions to increase power output electricity generator when there is a change in wind speed. In this paper, this technology in charge of regulating the output voltage of the generator through a DC-DC Converter type Cuk Converter, where the switching technique uses PWM (Pulse Width Modulation) with set the amount of the duty cycle. Change the value of the duty cycle depends on the size of the speed wind, so as to set the duty cycle value and speed up the PWM control switching response used a modern algorithm called Fuzzy Logic Controller (FLC). Research result shows that, with FLC-based MPPT technology can increase the percentage of efficiency PLTB output power from 45.5% to 87%.

Keywords: *Efficiency, PLTB, wind, MPPT, DC-DC converter, Fuzzy Logic Controller*

I. INTRODUCTION.

An issue is getting less supply oil and coal fuels and effects the negative for the environment, encouraging research into cheaper energy sources and environmentally friendly, known as renewable energy. One type of energy environmentally friendly is wind energy (S.Lubis et al., 2015). To make it easier to use, the wind energy needs to be changed into electrical energy by using generator. The most generators used is a type induction generator squirrel cage. Electricity generated need to be connected to the electricity network existing so that it can be utilized with wider (Yazidi & Sivert, 2016). Electricity is produced only can be connected to the net if it meets one of the quality standards set voltage and frequency quality standards that are stipulated in a ministerial decree. The process of channeling electrical energy to the network electricity is constrained due to the nature of energy the ever-changing wind (speed wind is not fixed). For this it is needed interface known as a converter power (P.Wibowo et al., 2017).

PLTB (Power Plant Bayu) is a source of energy renewable (renewable energy) a lot available in Indonesia. Based on data from ESDM Department 2006, Indonesia has wind energy potential of 9.29 GW and already installed at 0.0005 GW (Nugroho & Facta, 2014).

At present the government has issued roadmap for renewable energy utilization target the installed capacity of energyrenewable until 2025 reached 17%. This number is a picture of market potential, which is quite large in energy development renewable future (Malwiya & Rai, 2015).

Electric control for example electromagnetic torque control the generator by controlling turbine rotational speed (Waheedabeevi & Sukeshkumar, 2012). Method of increasing output power efficiency PLTB against changes in wind speed as above is usually called the Maximum method Power Point Tracking (MPPT). MPPT is widely used on solar power plants (PLTS) with various control methods. Control method constant voltage has been used for MPPT on traffic lights PLTS (Jadot et al., 2009) and Fuzzy logic control methods for MPPT solar cells via DC-DC Boost converter on electric vehicles (Hesari & Sistani, 2017).

This paper aims to design DC link voltage controller for the inverter side of the net. Control signal generated changed in the form of pulse width modulation by sinusoidal modulation. There are two the type of sinusoidal modulation used, that is, with and without additional signals zero order. In this paper, compared the response of the two types of modulation.

II. LITERATUR REVIEW.

Figure 1 shows a system diagram control the DC link voltage on the inverter 3 the side phase of the meshes that was designed on This paper. This system outline composed by the main elements as following:

a. 3 phase IGBT bridge.
b. Line connecting voltage IGBT with a net.
c. Inductance and element winding resistance.
d. Power transformer inverter and grid power.
e. Capacitors as compilers of DC links.
f. Voltage sensor that measures grid voltage (ST).
g. Current sensor that measures current electricity flowing between the bridge IGBT and Netting (SA).
h. DC link voltage sensor measure DC voltage (ST DC).
i. Grid inverter controller (IJJ).
j. A gate unit that amplifies power PWM from the controller to be able open the IGBT gate (UG).

By using notation (ae, be, ce) as the phase voltage of the grid, (ai, bi, ci) as the current flowing from the inverter to meshes, and (a v, b v, c v) as phase voltage on the legs of the inverter, then on the inverter side of the grid applies equation as follows (Deptt & Jabalpur, 2013).

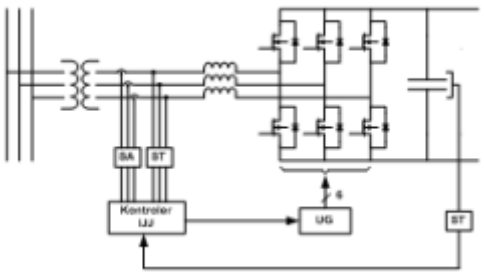


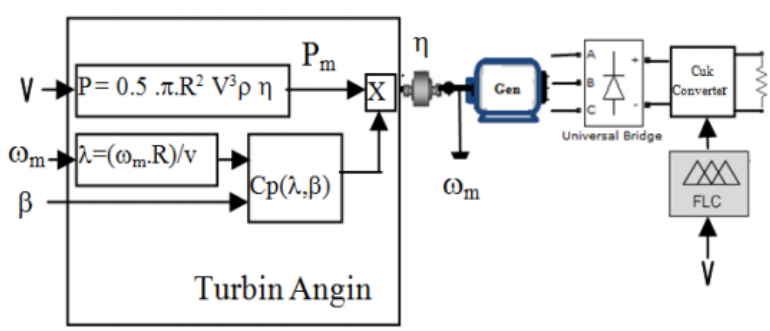
Figure 1. System Control Inverter

Where: dc v is the capacitor voltage DC link and dc i are the electric current flows out of the DC link to IGBT bridge. Equation (1) means the phase voltage at The inverter leg is the same

as the phase voltage the net is added to the voltage on the inductor which is denoted by R resistance and inductance L. Equation (2) means electric power flowing to the outside DC link capacitor C is equal to number electrical power flowing through IGBT bridge. Electric charge that is buried in the DC link capacitor is net amount of electric current flowing entry into the capacitor integrated against time to get the equation below this (Waheedabeevi & Sukeshkumar, 2012).

III. METHOD OF RESEARCH.

To complete this research, there are several stages carried out between others: make MPPT models on PLTB, calculation of the potential electric power generated by PLTB, Cuk component calculation Converter, making FLC algorithm, and MPPT testing. The MPPT model is based on Fuzzy Logic The controller on the PLTB is shown in Figures 2.

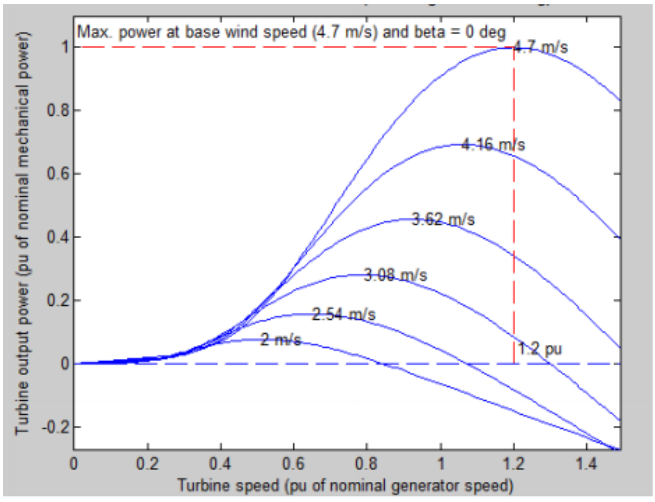


Figures 2. Model Of Enhance PLTB

Wind Turbines Potential electrical power that can be raised by wind turbines is:

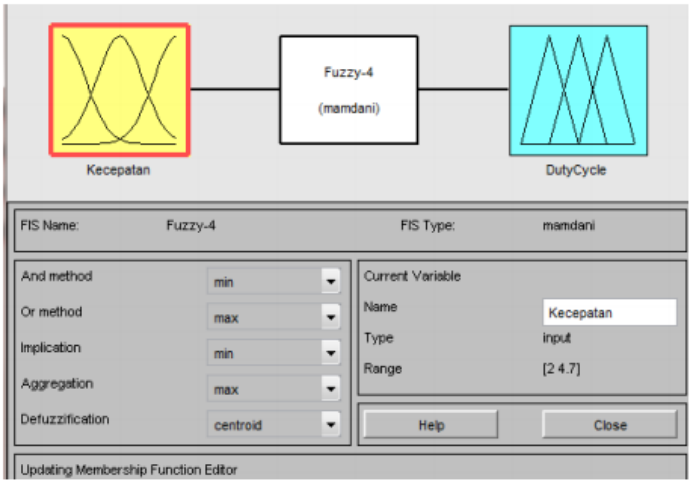
$$P = \eta_{total} \frac{1}{2} \rho A V^3 \ (W) \quad (1)$$

$$P_m = 0.5\pi\rho C_p(\lambda, \beta) R^2 v^3 \quad (2)$$



Figures 3. Mechanical Power Characteristics of Wind Turbines

To increase or decrease AC generator output voltage already rectified, then a DC to is needed DC Converter. The type of converter used is Cuk Converter, because it has current input and output that continue ,, so the average current is greater compared to the type of converter that is the other. To determine the component value inductors and capacitors, it needs to be determined first the value of duty cyle. If desired input voltage is the same as voltage output, then the duty cycle value (D) = 0.5. The switching frequency (f) used at 25kHz. Generator output voltage at 53V (Vs). Maximum output current (Iomax) of 5.3A. (M.Rashid, 2007). In designing the FLC uses 1 input, i.e. changes in wind speed and 1 ie output changes in duty cycle, as is shown in the picture below.



Figures 4. Modelling Of FLC

The method used in this FLC is Mamdani method, which consists of 3 parts namely Fuzzification, Fuzzy Rule, and Defuzzificati

Table 1. Fuzzy Set Point

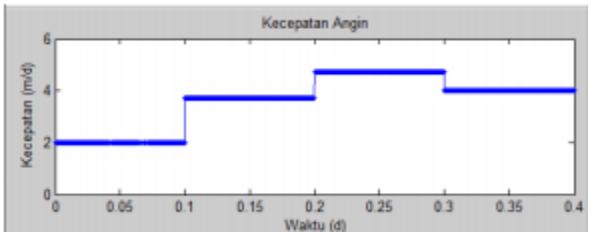
DC (%)	SK	K	CK	S	CB	B	SB
20	Y*	Y	N	N	N	N	N
26	Y	Y*	Y	N	N	N	N
30	N	Y	Y*	Y	N	N	N
35	N	N	Y	Y*	Y	N	N
39	N	N	N	Y	Y*	Y	N
45	N	N	N	N	Y	Y*	N
52	N	N	N	N	N	N	Y*

Tables 2. Duty Cycle Fuzzy

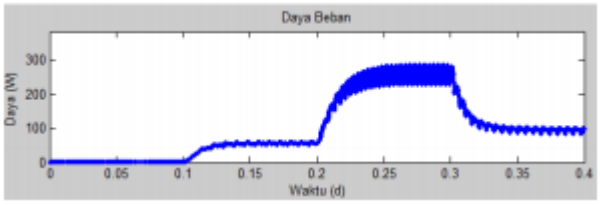
Kec (m/det)	SR	R	CR	S	CT	T	ST
2.0	Y*	Y	N	N	N	N	N
2.5	Y	Y*	Y	N	N	N	N
3.1	N	Y	Y*	Y	N	N	N
3.7	N	N	Y	Y*	Y	N	N
4.0	N	N	N	Y	Y*	Y	N
4.3	N	N	N	N	Y	Y*	N
4.7	N	N	N	N	N	Y	Y*

IV. ANALYZE AND RESULT.

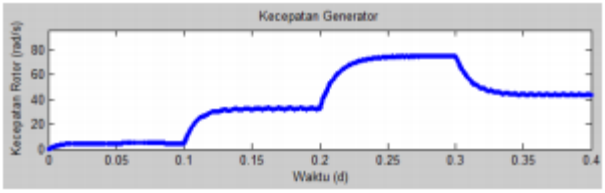
To check the performance of a DC controller grid link inverter designed on this paper, has been made a program for computer simulation. Computer simulation carried out for the purpose of testing DC link voltage controller performance when power on electricity from the direction of the generator converter changes. This is to check whether the controller DC link grid inverter is capable control the flow of electricity to the grid in accordance with the incoming electrical power from the direction of the generator while maintaining value Fixed link DC voltage.



Figures 5. Speed Of Air



Figures 6. Load Power



Fugures 7. Speed Of Generator

From the picture above shows that, at when there is a change in wind speed, power electricity absorbed by the load and speed The generator experiences sufficient fluctuation high with an average power rating of 130 Watt. (measured in seconds 0.2 to 0.4), if the power potential of the PLTB of 287 Watts, then the percentage of PLTB efficiency is 45.3%.

V. CONCLUSION

Based on the results of research that has been done, conclusions can be drawn as following:

1. The proposed MPPT method is capable increase the percentage of power efficiency PLTB electricity that has been proven through computer simulation.
2. Fuzzy Logic Controller Algorithm applied to the MPPT method on this research can improve percentage of PLTB efficiency of 45.3% to 87%.

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