International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 08 Issue: 06| June 2021 www.irjet.net p-ISSN: 2395-0072

NOVEL POWER TRANSFER SCHEME FOR A GRID CONNECTED HYBRID SOLAR/WIND GENERATION

SUNDARARAJAN.S [1], MOHANKUMAR.G[2]

[1]*P.G Scholar, Department of EEE, PRIST UNIVERITY, Thanjavur, Tamil Nadu (Puducherry Campus)*

[2]*Assistant Professor& Head, Department of EEE, PRIST UNIVERITY, Thanjavur, Tamil Nadu (Puducherry Campus)*

Abstract – *In this paper an efficient power transfer scheme with minimum number of converters is designed for a grid connected wind/photovoltaic (PV) system. Permanent magnet synchronous generator (PMSG)-based wind energy conversion system and PV array system are considered at Distributed generation sources. A typical DC-link function wind side converter (WSC) and grid side converter (GSC) are two voltage source converters and PV array is directly tied to the DC link. MPPT controller extracts the utmost power from PV array and DC-link voltage is close to the utmost point voltage of the PV array and therefore the same are often varied by using fuzzy logic controller. The model is often simulated using software MATLAB/Simulink and result is often compared by conventional MPPT controller with fuzzy logic controller.*

Key Words: Permanent magnet synchronous generator *(PMSG),* Maximum power point tracking (MPPT), Fuzzy logic converter, wind energy conversion system (WECS)

1. INTRODUCTION

A grid connected system is an electricity generating system that's connected to the utility grid. The grid uses non- conventional energy to scale back the pollution and to perform with better efficiency. We entitle non- conventional energy like photovoltaic or wind energy for wind side and grid side converters. An electrical grid is an interconnected network for delivering electricity from producers to consumers. It consists of generating stations that produce electric power, high Voltage transmission lines that carry power from distant sources to demand centers, and distribution lines that connect individual customers. Power stations could also be located near a fuel source at a dam site or to require advantage of renewable energy sources and are often located faraway from heavily populated areas. They are usually quite large to require advantage of economies of scale. The electrical power which is generated is stepped up to a better voltage at which it connects to the electrical power transmission network.

In recent years, the renewable energy sources for electricity generation have suggests opportunities for utilizing both PV and wind power generation. Electrical generators ie variable-speed variable-frequency based system utilized in wind generation and has the pliability of operating under wide wind conditions, it can increase the energy production, reducing the strain on the mechanical subsystem and offering maximum efficiency in the least wind velocities

2. Proposed system description and configuration

Figure 1 shows the schematic diagram of the proposed hybrid DG system with wind and PV array. Power transfer from the DG sources to the grid as WSC is connected to the stator of PMSG and GSC. Both WSC and GSC are bidirectional voltage source converters connected in back-to-back configuration through a standard DC link. A variable DC-link voltage creating the DC bus tied to the PV array. To facilitate power extraction from both PV array and wind, GSC is act as a current controlled to deliver maximum power from both renewable. A PI voltage controller and Hysteresis loop takes care of servo changes within the voltage loop of WSC with reference to the PV voltage. In this proposed scheme, MPP voltage of the PV panel is about to the DC voltage reference for the WSC.

Effective power transfer from the wind/PV array using hysteresis current controller as shown in Figure 1. The MPP voltage of the PV array employing a PI controller objective of servo tracking of WSC output voltage to the control algorithm for WSC is comprised of two nested loops. The PV panel is directly tied to the DC link with none power converter providing variable DC-link voltage. The load line for the PV array during which the MPP voltage follows the WSC output voltage. The utmost PV power information is given to the GSC for extracting maximum current from the PV panel. For tracking the upmost power and for fixing the MPP voltage, P&O technique is adopted.

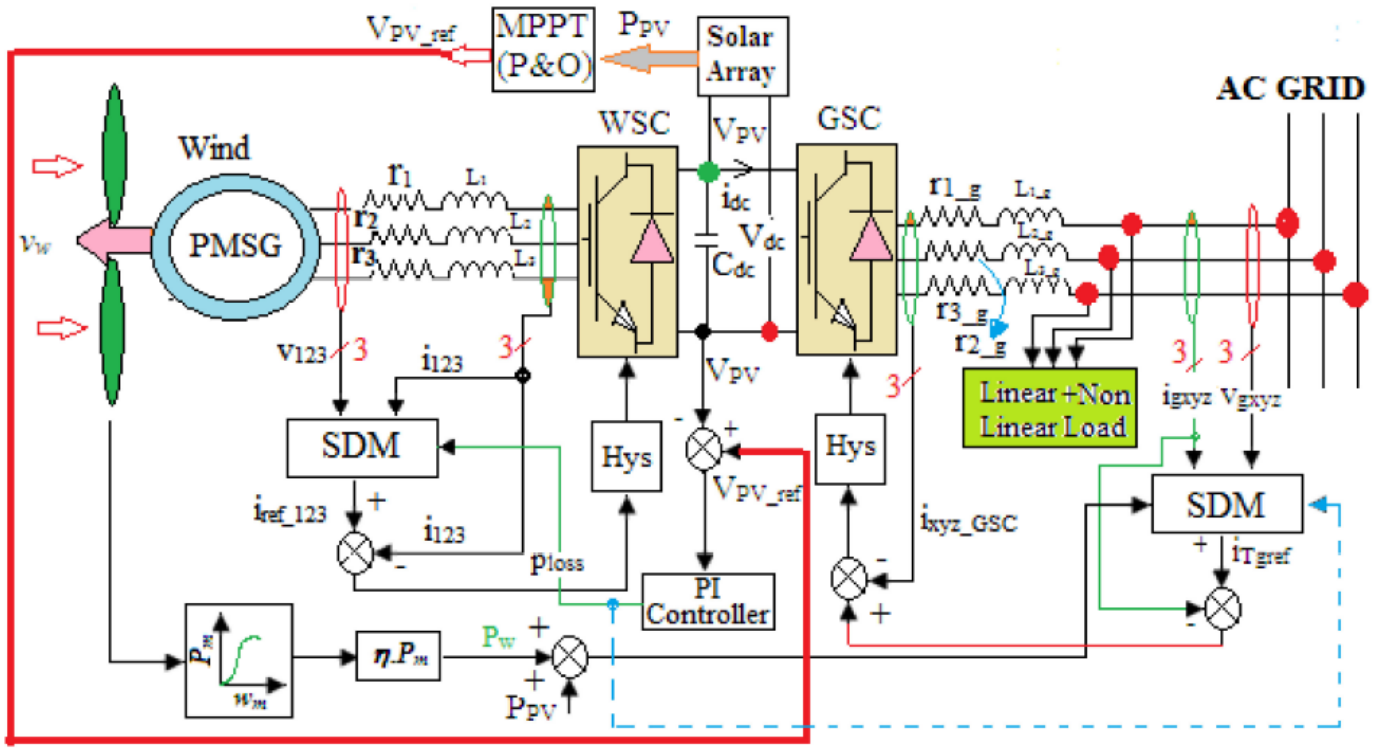

Figure 1 Schematic diagram of hybrid solar/wind system

3. FUZZY LOGIC CONTROLLER

The basic block diagram of fuzzy logic controller is shown in figure 2, which mainly contains three blocks which are Defuzzifier, Decision rules, Fuzzifier. Fuzzifier is one which measures inputs and are converted into fuzzy inputs. The decision rule block which enables the FLC to require intelligent decisions is predicated upon upon a group of if-then rules. The defuzzifier block converts the control output generated by the decision rule out to the numerical value. Fuzzy logic has been applied to several fields from control theory to artificial intelligence.

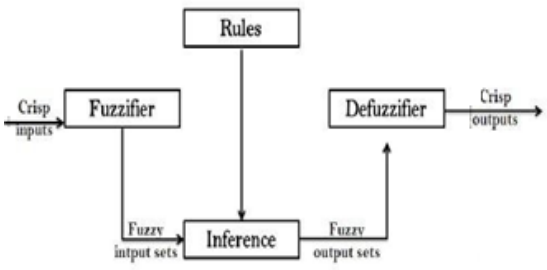

Figure 2 Fuzzy logic controller

Conventional MPPT controller doesn't give desirable performance for systems. Using fuzzy logic controller, the automated tuning of MPPT controller has been done. A linguistic control transforms into an automatic control strategy by means of fuzzy logic system. Figure 14 shows the block diagram of a fuzzy logic controller. The inputs to the fuzzy controller are the error (e) and therefore the rate of change of error (Δe) while the outputs are controller gains *KP & Ki.*

The fuzzy sets have been determined as: Negative Large (NL), Negative Medium (NM), Negative Small (NS), zero (ZE), Positive Small (PS), Positive Medium (PM), Positive Large (PL) respectively as shown in table 1 by fuzzy linguistic variables.

Δe \ e	NB	NS	EZ	PS	PB
NB	NB	NB	NS	NS	EZ
NS	NB	NS	NS	EZ	PS
EZ	NB	NS	EZ	PS	PS
PS	NS	EZ	PS	PS	PB
PB	EZ	PS	PS	PB	PB

Table1 Fuzzy linguistic variables

The following advantages of fuzzy logic controller are

a) It is cheap compared to other conventional controllers and it does not require a previous mathematical model.

b) It reduces the entire harmonic distortion compared to others controller.

4. SIMULATION AND DISCUSSION

Figure 3 shows a hybrid wind/solar PV supported on Permanent Magnet Synchronous Motor (PMSM) with connected to grid system using MPPT controller is simulated using MATLAB/SIMULINK software.

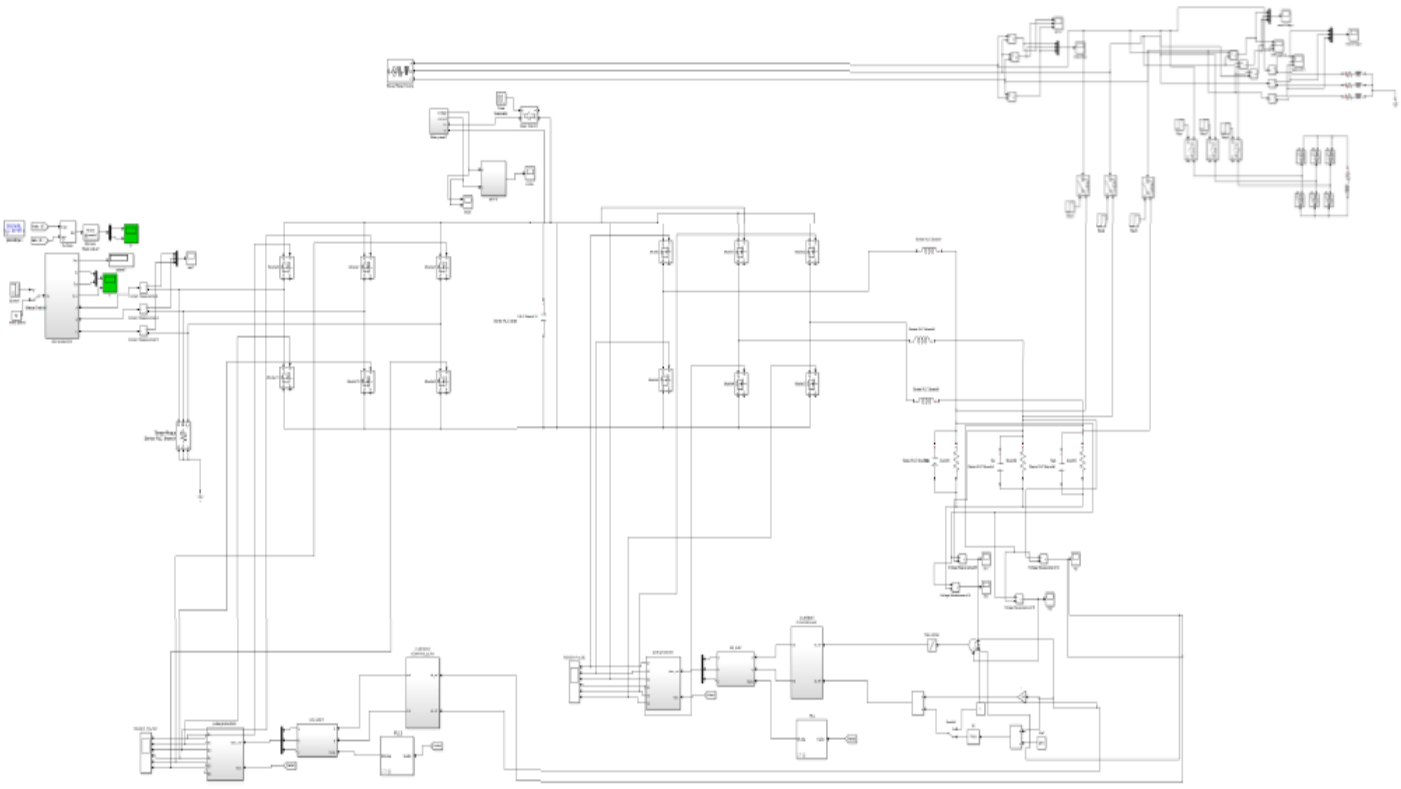

Figure 3 Proposed circuit diagram with conventional MPPTcontroller

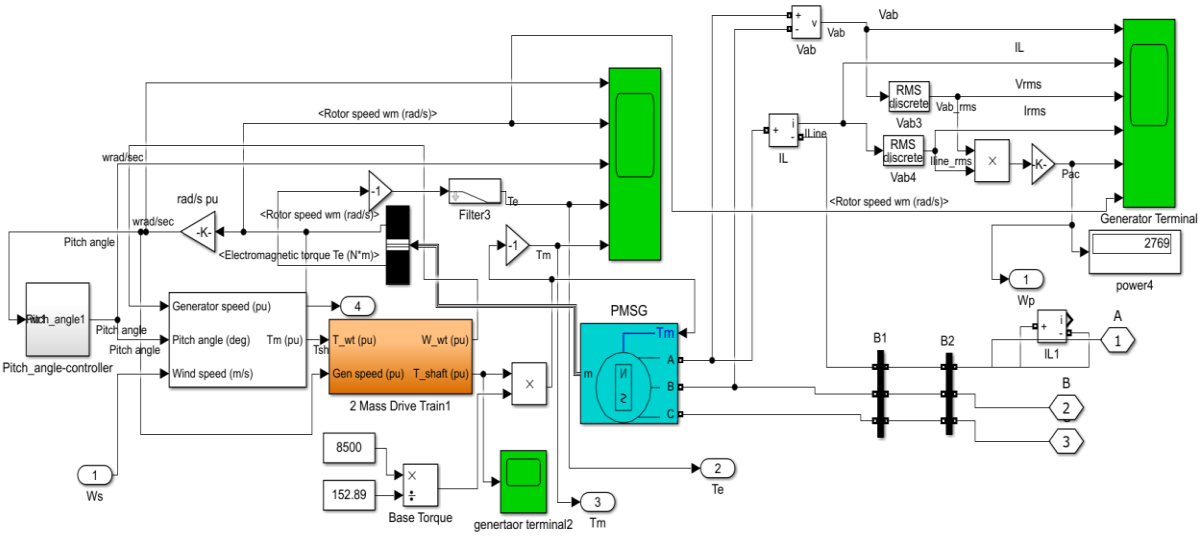

Figure 4 Wind generation with PMSG

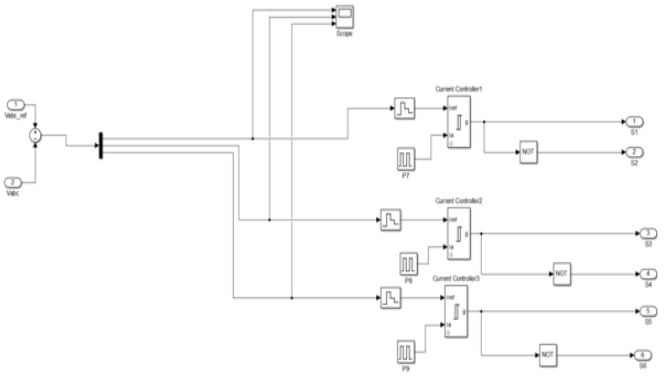

Figure 5 Pulse generation

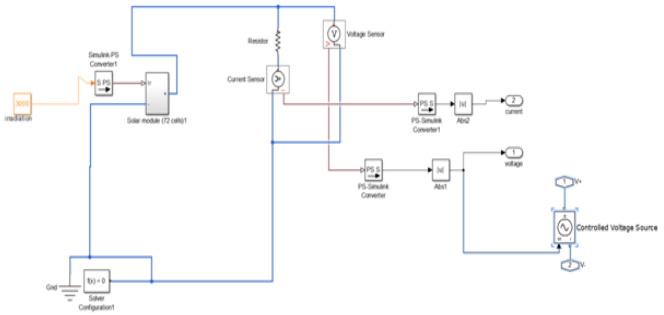

Figure 6 Solar panel

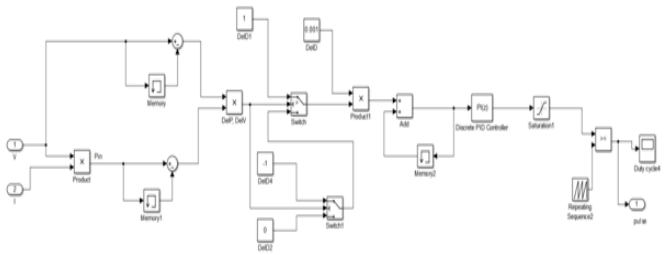

Figure 7 MPPT Controller

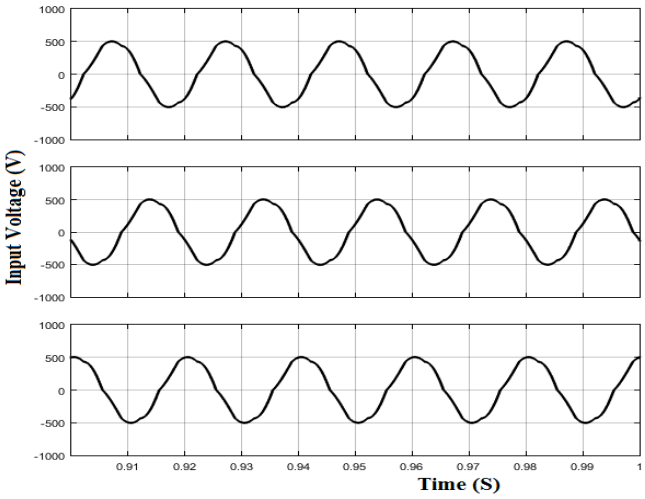

Figure 8 Three phase grid input voltage

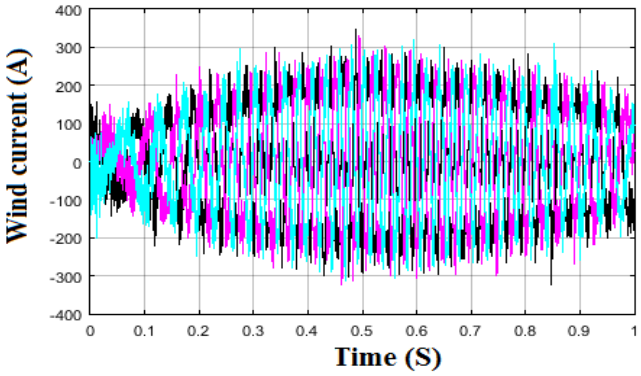

Figure 9 Wind power

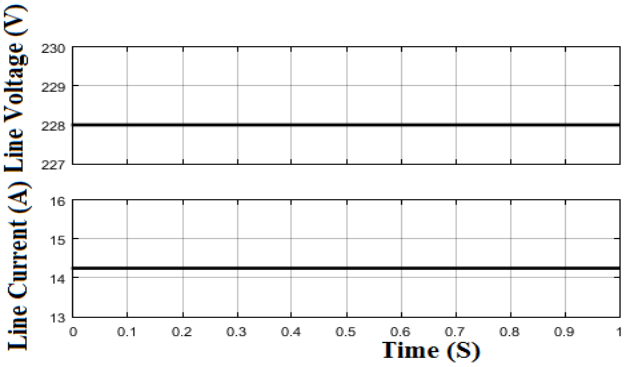

Figure 10 Line Voltage and Current

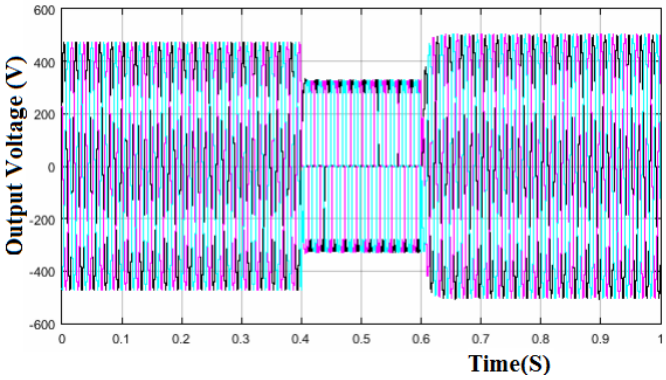

Figure 11 Sag output Voltage

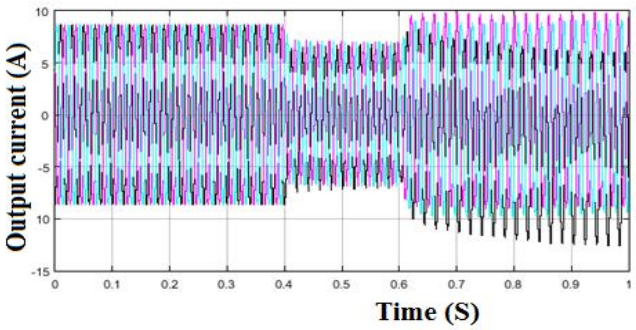

Figure 12 Sag output Current

Figure 13 shows a hybrid wind/solar PV based on Permanent Magnet Synchronous Motor (PMSM) with connected to grid system using Fuzzy Logic controller is simulated using MATLAB/SIMULINK software

.

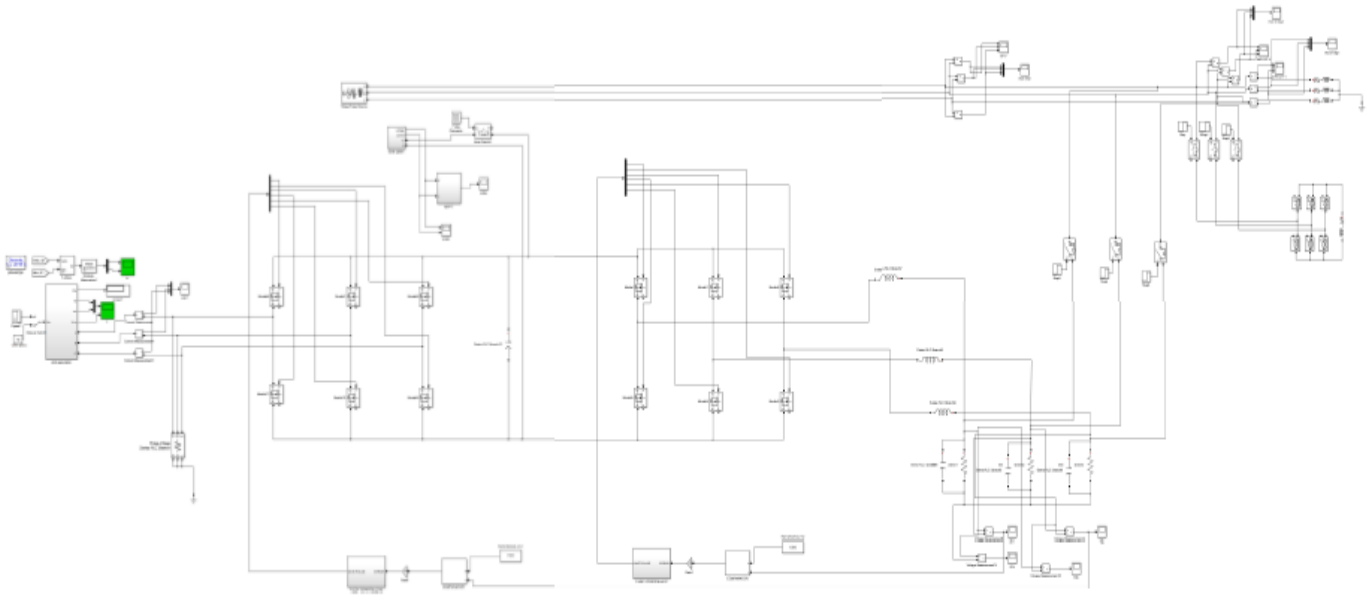

Figure 13 Proposed circuit diagram with Fuzzy Logic Controller

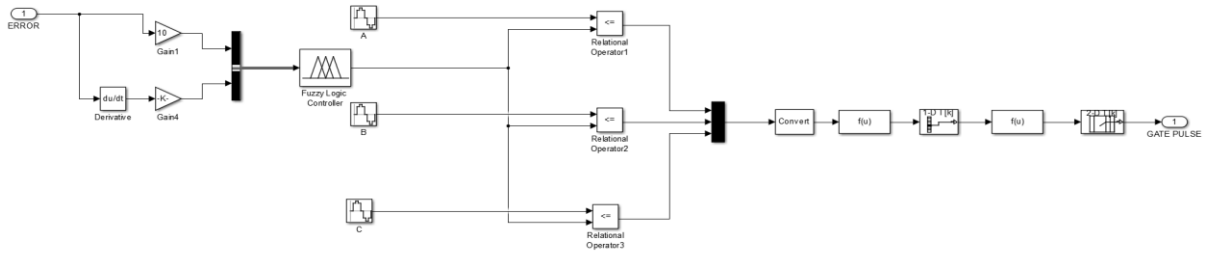

Figure 14 Fuzzy Logic Controller

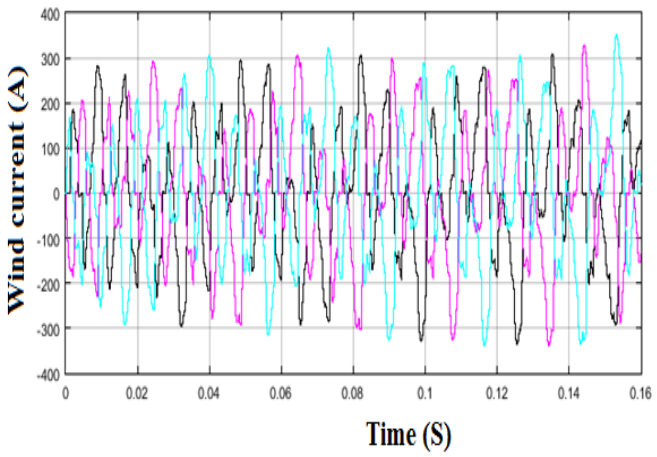

Figure 15 Wind power with fuzzy controller

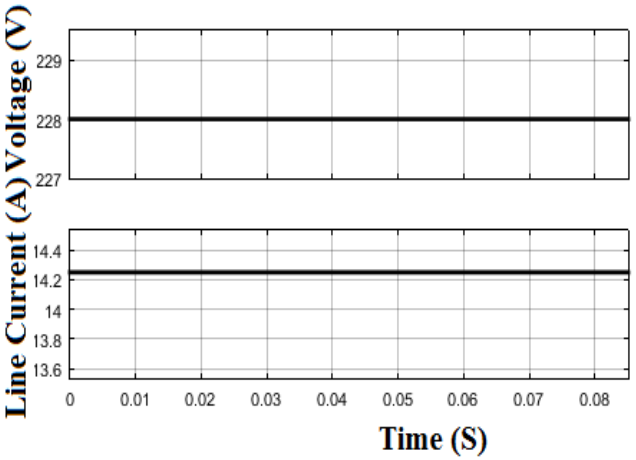

Figure 16 Line Voltage and Current with fuzzy

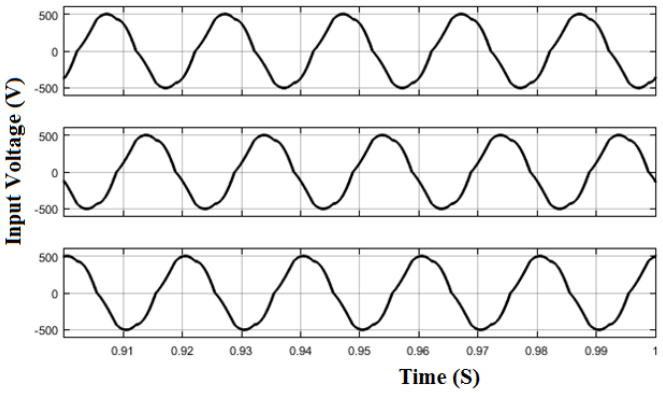

Figure 17 Three phase grid input voltage with fuzzy

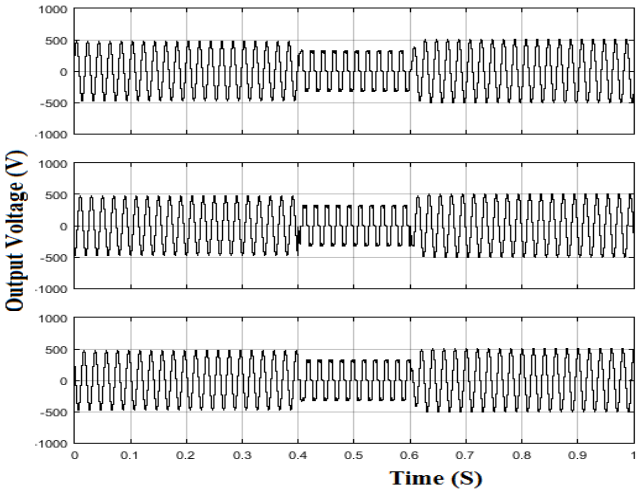

Figure 18 Sag output Voltage (each phase) with fuzzy

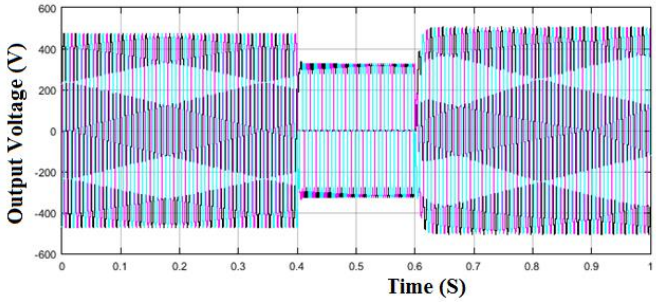

Figure 19 Sag output Voltage with fuzzy

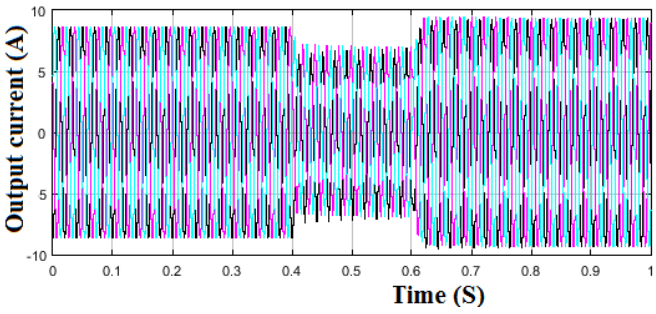

Figure 20 Sag output Current with fuzzy

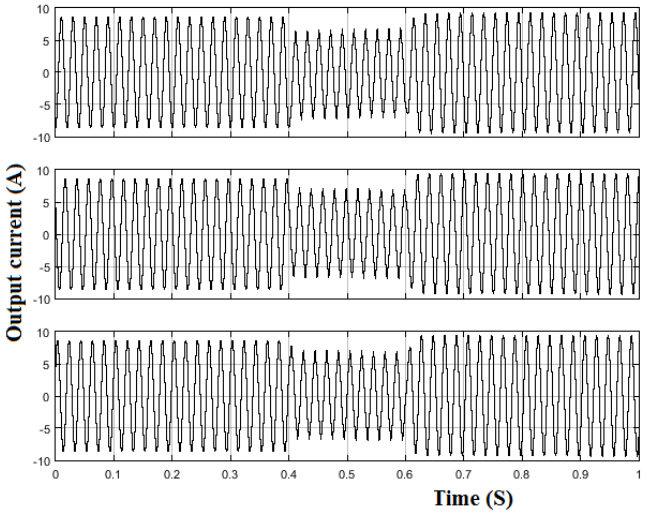

Figure 21 Sag output Current(each phase) with fuzzy

5. CONCLUSION

In this paper an efficient power transfer scheme with minimum number of converters ismeant for a grid connected wind/photovoltaic (PV) system. MPPT controller extracts the utmost power from PV array and DC-link voltage is close to the utmost point voltage of the PV array and therefore the same are often varied by using fuzzy logic controller. The model is often simulated using software MATLAB/Simulink and result can be compared by conventional MPPT controller with fuzzy logic controller. The proposed system may facilitate the mixing process of DC power technologies into the prevailing AC system.

REFERENCES

[1]Saheb-Koussa, D., Haddadi, M., Belhamel, M.: 'Economic and technical study of a hybrid system (wind–photovoltaic–diesel) for rural electrification in Algeria', *Appl. Energy*, 2009, **86**, pp. 1024–1030

[2] Liu, G., Rasul, M.G., Amanullah, M.T.O., *et al.*: 'Feasibility study and energy conversion analysis of stand-alone hybrid renewable energy system', *Energy Convers. Manage.*, 2015, **105**, pp. 471–479.

[3] Anayochukwu, A.V.: 'Simulation of photovoltaic/diesel hybrid power generation system with energy storage and supervisory control', *Int. J. Renew. Energy Res.*, 2013, **3**, (3), pp. 605–614

[4] Nehrir, M.H., Lameres, B.J., Venkataramanan, G., *et al.*: 'An approach to evaluate the general performance of stand-alone wind/photovoltaic generating systems', *IEEE Trans. Energy Convers.*, 2000, **15**, (4), pp. 433–439.

[5] Wang, L., Lin, T.J.: 'Stability and performance of an autonomous hybrid wind-PV-battery system'. Int. Conf. Intelligent Systems Applications to Power System (ISAP), 2007, pp. 1–6

[6] Valenciaga, F., Puleston, P.F.: 'Supervisor control for a stand-alone hybrid generation system using wind and photovoltaic energy', *IEEE Trans. Energy Convers.*, 2005, **20**, pp. 398–405

BIOGRAPHIES

SUNDARARAJAN.S received the Engineering degree in 2011 from Annamalai University, Chidambaram. He is currently working as an Assistant Engineer/ O&M/ TANGEDCO (Tamilnadu Electricity Board)/V Parangani section/Tindvanam division/ Villupuram circle. His current research is power system operation and control.