RESEARCHERID
THOMSON REUTERS

[Nagaiah* 4(6): June, 2017] ISSN 2349-4506
Impact Factor: 2.785

Global Journal of Engineering Science and Research Management

LITERATURE SURVEY ON GRID INTEGRATION AND POWER MANAGEMENT OF SOLAR/WIND HYBRID MICRO-UNITS WITH BIDIRECTIONAL CONVERTERS BY USING SOFT COMPUTING TECHNIQUES

M. Nagaiah*, N. M. Girish Kumar, Shaik Rafi Kiran
* PhD Scholar, Acharya Nagarjuna University, Guntur
Assistant Professor, S.V.College of Engineering, Tirupati
Professor & Head, S.V. College of Engineering, Tirupati

DOI: 10.5281/zenodo.805443

KEYWORDS: Hybrid System, DC-DC Bidirectional Converter, DC to AC Bidirectional Converter, Battery Storage System.

ABSTRACT

The Proposed research is to explore the performance of Bidirectional Converters and Energy Administration system (EAS) of a Grid-connected crossover series of Solar and Wind Generation. The hybrid system comprises of wind turbine (WT) and solar photovoltaic (PV) panels as an essential energy sources. Inventive topologies for Renewable Energy (RE) change systems that incorporate with electric grids and energy storage systems are to be considered for different needs in smart grid applications. DC-DC bidirectional converter is to be connected between batteries bank and DC-connect bus voltage, is utilized to control the power through DC-link voltage. It is additionally to be utilized to make the batteries bank stores the overflow of solar energy and supplies this energy to the load during solar power lack. The complex Soft Computing Techniques are to be considered for the control of Bidirectional Converters. The proposed investigate work is additionally to recognize better Bidirectional Voltage Source Converter to bolster surplus power generation to the primary Grid. Grid combination of Photo Voltaic (PV)/Wind crossover energy change system is to be displayed with multi-functional features.

INTRODUCTION

To ensure productive Optimization of sources, Adaptive Neural Fuzzy Inference System (ANFIS) technique is to be utilized to accomplish the Maximum Power Point (MPP) in Photo Voltaic (PV) panels and the Fuzzy Logic Control (FLC) procedure is to be considered to achieve the MPP in Wind turbine. Also, the FLC control administration procedure is to be produced to deal with the Power current to the system. The ideal working method of power sources is to be chosen by FLC ensuring consistent supply of the load and keeping up the battery charge at satisfactory levels.

The corrected wind output and solar panel output is to be given to converter for lift up the DC voltage keeping in mind the end goal to connect them to a focal DC grid. At that point, the power must be taken from the DC system and it is given to the Main AC Grid system through Bidirectional Converter. Separating prerequisites are to be limited by decreasing the sounds with PWM strategy inside the Converter. The smart grid system is to fulfill its own load prerequisite and on the off chance that if the request is High it will draw the power from the primary grid and on the off chance that if the request is low it will send overabundance energy to the principle grid. The proposed research is to build up a setup that uses solar and wind energy system in a most ideal way so that the power can be created whenever, which fulfills the load necessity. The proposed investigate work is to be checked by utilizing Simulink in MATLAB condition

ISSN 2349-4506
Impact Factor: 2.785
Global Journal of Engineering Science and Research Management

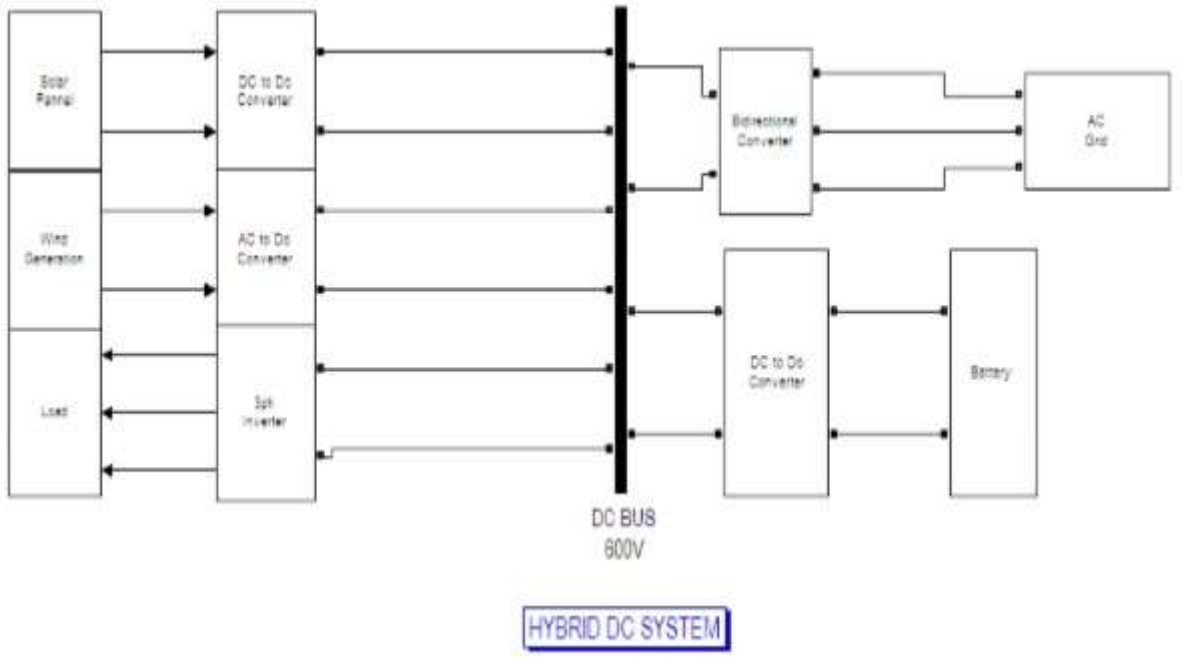

Fig 1: Block diagram of proposed hybrid system.

DC-DC BIDIRECTIONAL CONVERTER BETWEEN DC BUS TO THE BATTERY STORAGE SYSTEM

Bidirectional DC-DC converters are utilized as a part of uses where bidirectional power flow might be required. In half breed electric vehicles (HEVs) and electric vehicles (EVs), these bidirectional converters charge a low voltage (12 V) battery during ordinary operation (buck mode) and charge or help the high-voltage (400 V/600 V) battery or bus in crisis circumstances like when a high-voltage battery has released to a low energy or limit level (lift mode). A normal system comprises of a full-bridge control arrange on the high-voltage (HV) side, which is disconnected from a full-bridge or a present encouraged push-pull organize on the low voltage (LV) side. In this execution, shut circle control for both bearings of power current are actualized utilizing TI 32-bit microcontroller TMS320F28035, which is put on the LV side. Generally, microcontrollers have been limited to performing just supervisory or interchanges errands in these systems. With the availability of high-performing microcontroller devices, microcontrollers can close control circles in these systems and handle the customary microcontroller capacities. The move to advanced power control demonstrates that capacities beforehand executed in equipment are currently actualized in programming. Notwithstanding the adaptability, this capacity adds to and disentangles the system. These systems can execute propelled control procedures to ideally control the power arrange under various conditions and furthermore give system level insight to make protected and consistent moves between operation modes and pulse width modulation (PWM) switching designs.

All the examined converters for the seaward wind homestead are uni-directional power current, which is lucid with wind energy creation. In any case, a specific measure of force must be conveyed to preload the diverse DC buses (medium voltage and low voltage) and twist turbines for providing the sensors and estimation hardware. The issue can be understood by presenting extra helper energy storage hardware or voltage venture down converters, bringing about diminished power thickness and expanded system cost. BDC is a Great option series. By the by, it ought to be noticed that little measure of force is required to preload the DC buss (approx. 0.5% of the ostensible power), consequently, the utilization of traditional BDC is monetarily wasteful. The proposed BDC with awry power transmission is exceptionally appropriate for this application.

BIDIRECTIONAL CONVERTER BETWEEN DC-AC GRIDS

The hybrid grid consists of both ac and dc systems associated together by bidirectional converters. The cross breed ac/dc small scale grid is utilized to lessen the procedures of dc–ac–dc or ac–dc–ac changes in an individual ac or dc grid.AC sources and loads are connected with the ac organize though dc sources and loads are attached to the dc series. Energy storage systems can be connected with dc or ac links. The coordination control procedures are proposed for smooth power switch amongst ac and dc links and for stable system operation under different generation and load conditions.

A hybrid micro grid system setup where different ac and dc sources and loads are connected with the relating dc and ac systems. A renewable cross breed system, made out of PV panels and twist turbines as renewable energy sources, batteries as an electrical energy storage device, is considered. The AC and DC buses are coupled through a three phase transformer and a principle bidirectional power stream converter to trade control amongst DC and AC sides. The transformer helps up the AC voltage of the primary converter to utility voltage level and to confine AC and DC grids.

WIND TURBINE

A wind turbine is a device that changes over the wind's motor energy into electrical power.
Wind turbines are fabricated in an extensive variety of vertical and level hub sorts. The littlest turbines are utilized for applications, for example, battery charging for helper control for vessels or convoys or to power activity cautioning signs. Somewhat bigger turbines can be utilized for making commitments to a local power supply while offering unused power back to the utility provider by means of the electrical grid. Varieties of extensive turbines, known as wind homesteads, are turning into an undeniably imperative wellspring of discontinuous renewable energy and are utilized by numerous nations as a major aspect of a methodology to lessen their dependence on fossil energizes.

SOLAR PHOTOVOLTAIC SYSTEM

A photovoltaic system, additionally sun oriented PV control system, or PV system, is a power system intended to supply usable solar power by method for photovoltaic. It comprises of a game plan of a few parts, including solar panels to retain and change over daylight into power, a solar inverter to change the electric current from DC to AC, and in addition mounting, cabling and other electrical assistants to set up a working system. It might likewise utilize a solar following system to enhance the system's general execution and incorporate a coordinated battery series, as costs for capacity devices are required to decay. Entirely, a solar exhibit just envelops the gathering of solar panels, the noticeable piece of the PV system, and does exclude the various equipment, regularly compressed as battery of system (BOS). Besides, PV systems change over light specifically into power and shouldn't be mistaken for different advances, for example, concentrated solar power or solar warm, utilized for warming and cooling.

PV systems run from little, housetop mounted or constructing coordinated systems with limits from a couple to a few many kilowatts, to vast utility-scale control stations of several megawatts. These days, most PV systems are grid connected, while off-grid or remain solitary systems represent a little part of the market.

HYBRID PV-WIND GENERATION

Hybrid PV-wind based generation of power and its interface with the power grid are the essential research regions. Have proposed a multi-input half and half PV-wind control generation system which has a buck/buck support melded multi-input dc-dc converter and a full-bridge dc ac inverter. This system is basically centered on enhancing the dc-interface voltage control. The yields of a PV exhibit and wind generators are sustained to a lift converter to coordinate the dc-bus voltage. The enduring state execution of a grid connected half and half PV and twist system with battery storage. This paper concentrates on system building, for example, energy generation, system unwavering quality, unit estimating, and cost examination. A hybrid PV system alongside a battery is exhibited, in which both sources are connected with a typical dc-bus through individual power converters. What's more, the dc-bus is connected with the utility grid through an inverter.

PI CONTROLLER

At present, the PI controller is most widely adopted in industrial application due to its simple structure, easy to design and low cost. Despite these advantages, the PI controller fails when the controlled object is highly nonlinear and uncertain. PI controller will eliminate forced oscillations and steady state error resulting in operation of on-off controller and P controller respectively. However, introducing integral mode has a negative effect on speed of the response and overall stability of the system. Thus, PI controller will not increase the speed of response. It can be expected since PI controller does not have means to predict what will happen with the error in near future. This problem can be solved by introducing derivative mode which has ability to predict what will happen with the error in near future and thus to decrease a reaction time of the controller. PI controllers are very often used in industry, especially when speed of the response is not an issue. A control without D mode is used when

1) Fast response of the system is not required
2) Large disturbances and noise are present during operation of the process
3) There is only one energy storage in process (capacitive or inductive)
4) There are large bus delays in the system.

FUZZY LOGIC

Fuzzy logic is a form of many-valued logic in which the truth values of variables may be any real number between 0 and 1. By contrast, in Boolean logic, the truth values of variables may only be 0 or 1. Fuzzy logic has been extended to handle the concept of partial truth, where the truth value may range between completely true and completely false. Furthermore, when linguistic variables are used, these degrees may be managed by specific functions.

Usually fuzzy logic control system is created from four major elements presented on Figure fuzzification interface, fuzzy inference engine, fuzzy rule grid and defuzzification interface. Each part along with basic fuzzy logic operations will be described in more detail below.

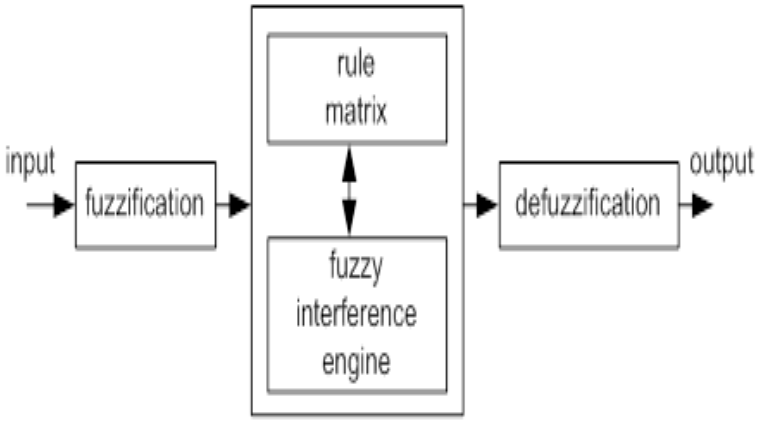

Fig 2: Block Diagram of fuzzy Controller

The fuzzy logic analysis and control methods shown in Figure 1 can be described as:

1. Receiving one or large number of measurements or other assessment of conditions existing in some system that will be analyzed or controlled.
2. Processing all received inputs according to human based, fuzzy ”if-then” rules, which can be expressed in simple language words, and combined with traditional non-fuzzy processing.
3. Averaging and weighting the results from all the individual rules into one single output decision or signal which decides what to do or tells a controlled system what to do. The result output signal is a precise defuzzified value.

ADAPTIVE NEURO-FUZZY CONTROLLER

A fuzzy inference system and a back propagation algorithm. For an ordinary fuzzy inference, the parameters in the membership functions are usually determined by experience or the trial-and-error method. However, the adaptive neuro-fuzzy inference system can overcome this disadvantage through the process of learning to tailor the membership functions to the input/output data in order to account for these types of variations in the data values, rather than arbitrarily choosing parameters connected with a given membership function. This learning method works similarly to that of neural grids.

Adaptive Neural Fuzzy Inference System (ANFIS) is fuzzy Sugeno model put in the system to facilitate learning and adaptation procedure. Such grid makes fuzzy logic more systematic and less relying on expert knowledge. The objective of ANFIS is to adjust the parameters of a fuzzy system by applying a learning procedure using input–output training data. Basic architecture of ANFIS that has two inputs x and y and one output f.

In matlab the main difference between fuzzy controller and adaptive neuro fuzzy controller is only we have in matlab two types fuzzy controllers one is mamdani and second one is Sugeno.

Mamdani is ordinary fuzzy controller in this we provide input and output by using some assumptions but in Sugeno type we provide inputs only they automatically train outputs this is the main difference between two fuzzy controllers in matlab.

So mamdani type fuzzy controller used as ordinary fuzzy controller and Sugeno type fuzzy controller used as adaptive neuro fuzzy controller in matlab.

CONCLUSION

The proposed project describes the hybrid dc system consist of solar and wind power generation with dc- dc Bidirectional converter between DC Bus and Battery Storage system to ensure efficient utilization of energy. And also Bidirectional Converter between DC grid to the main AC grid with the motto of achieving bidirectional power flow from DC grid to AC grid and vice versa is implemented and tested hybrid System in Matlab Simulink .

REFERENCE

1. R. T. Naayagi, A. J. Forsyth, and R. Shuttle worth, ‘‘High-power bidirectional DC--DC converter for aerospace applications,’’ IEEE Trans. Power Electron., vol. 27, no. 11, pp. 4366-4379, 2012.
2. W. Li, H. Wu, and X. He, “Isolated winding-coupled bidirectional ZVS converter with PWM plus phase-shift (PPS) control strategy,” IEEE Trans. Power Electron., vol. 26, no. 12, pp. 3560-3570, 2011.
3. G. G. Oggier, G. O. Garcýa, and A. R. Oliva, ‘‘Modulation strategy to operate the dual active bridge dc-dc converter under soft switching in the whole operating range,’’ IEEE Trans. Power Electron., vol. 26, no. 4, pp. 1228--1236, Apr. 2011.
4. F. Valenciaga and P. F. Puleston,“Supervisor control for a stand-alone hybrid generation system using wind and photovoltaic energy,” IEEE Trans. Energy Convers., vol. 20, no. 2, pp. 398-405, Jun. 2005.
5. C. Liu, K. T. Chau and X. Zhang,“An efficient wind-photovoltaic hybrid generation system using doubly excited permanent-magnet brushless machine,”IEEE Trans. Ind. Electron., vol. 57, no. 3, pp. 831-839, Mar. 2010.
6. W. Qi, J. Liu, X. Chen, and P. D. Christofides,“Supervisory predictive control of standalone wind/solar energy generation systems,” IEEE Trans. Control Sys. Tech., vol. 19, no. 1, pp. 199-207, Jan. 2011.
7. Wind/Diesel Systems Architecture Guidebook. American Wind Energy Association; 1991.