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Power quality improvement using Grid Connected solar photovoltaic system with ANN based filters

Abstract— Grid-connected photovoltaic (PV) systems are gaining popularity in both the business and academic sectors as a clean energy alternative to fossil fuels. Using a shunt active power filter (APF) and an adaptive current management approach, this study intends to improve the power quality of a grid-connected PV distribution system. In this research, an artificial neural network-based controller is used to remove voltage and current harmonics from a photovoltaic (PV) system that is connected into the electrical grid. An strategy for producing a reference current is developed to lessen current harmonics by separating the fundamental components (FCs) of the nonlinear load currents. If the grid voltage is extremely distorted, MCCF may be utilised to protect the FC by isolating it from the distortion and eliminating the voltage harmonics. Power quality, dc offset rejection, FC and frequency extraction, and grid synchronisation are some of the metrics against which the proposed hybrid control technique is measured, as are comparisons to conventional and adaptive control methods.

I. INTRODUCTION

Most of the world's energy needs are now met by burning rapidly depleting fossil fuels including petroleum, coal, and natural gas. In particular, carbon dioxide, a byproduct of burning fossil fuels, is a significant contributor to global warming and a grave threat to all forms of life on Earth [1].

PV array systems are expected to play a substantial part in future energy generation, even more so than other forms of renewable energy. Solar photovoltaic (PV) systems convert light into electricity. Fuel cells, wind generation, and solar systems all provide low voltage output and need large step-up dc/dc converters to meet their various application requirements. With the rising demand for power and the decreasing availability and rising costs of nonrenewable sources, the photovoltaic (PV) energy conversion system has emerged as a viable option since it is abundant, produces no pollution, and is cheap to operate and maintain. Therefore, both independent and grid-connected PV systems should make more use of this energy source. As a renewable energy source, photovoltaic (PV) is subject to fluctuations in supply and demand based on factors such as latitude, longitude, time of day, and weather. Additionally, PV systems have a relatively high upfront cost and maintenance costs. Operating the system close to the maximum power point (MPP) so as to acquire roughly the maximum power of PV array is a crucial factor in improving the efficiency of PV systems. in order to get the most power from a solar array.

In the process of boosting the output of photovoltaic (PV) systems, it is standard practise to investigate the possibility of installing a high-efficiency power converter that was designed specifically for this objective. The Maximum Power Point, also known as the MPP, is the sole point on the V-I curve at which the PV system is producing the most amount of energy while also functioning at its highest level of efficiency. If the precise position of the MPP is unknown, then maybe we can make an educated guess as to where it will be found by using various search strategies or various computer models. It is possible to maintain the operating location of the PV array at the point where power production is maximised by using methods known as Maximum Power Location Tracking (MPPT). Numerous MPPT algorithms, such as "Perturb and Observe" (P&O) [2–5], "Incremental Conductance" (lC) [2–6], "Artificial Neural Network" (ANN) [7], and "Fuzzy Logic" (FL) [8, etc.], have been the focus of study. P&O and IC are the two ways that are used the most often. The Particle and Object method (P&O), the Incremental Conductance (lC) methodology [2-6], the Fuzzy Logic method [8], and the Particle Swarm Optimization strategy [l0] are the four different MPPT methodologies that are studied and contrasted in this article. These methods are gaining popularity since they are not very expensive and are simple to use. Approaches that are difficult to implement and not very practical, such as Sliding Mode [9], are beyond the focus of this study.In this study, we will work on a simulation model to determine how to best design and dimension the hybrid system across a wide range of stress and weather circumstances. The efficiency of the suggested system is confirmed by a simulation model run in Matlab and SimPower Systems, with the results reported. In Figure 1 we can see the hybrid energy generating system that is intended to be linked to the grid.

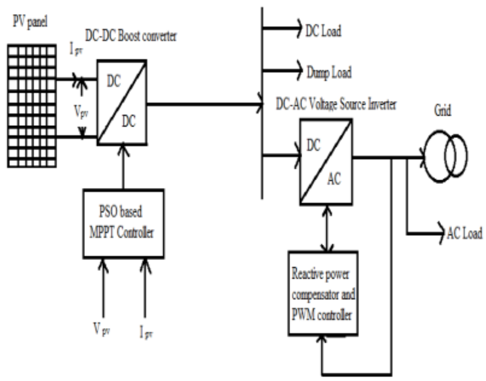

Figure 1: The configuration of the proposed hybrid system that is grid linked

II. Literature Survey

Ciobotaru et al. [15] looked at several ways to regulate a single-stage PV inverter. Two separate current controllers were built, and their respective performances were compared experimentally. Additionally, the whole control architecture of the single-phase PV system is described. Mahmud et al. [16] recommended a robust nonlinear distributed controller design for maintaining active and reactive power balance in isolated microgrid operation. Specifically, solar photovoltaic generators play the role of RESs and plug-in hybrid electric vehicles play the function of BESSs in this study's definition of microgrids as inverter-dominated networks with RESs and BESSs. Power electronics converters are essential to the development and improvement of the electrical power system. The rising popularity of DERs is driving the need for both more power sources and better quality power distribution. The purpose of a model predictive controller is to lessen deviations in capacitor voltage from their nominal values and common mode voltages. Bo and Yang [17] demonstrate the effectiveness of their proposed control mechanism and the usefulness of multilevel inverters by giving a simulation flowchart, parameters, and results using the PLECS software.

1. SOLAR SYSTEM

To put it simply, solar cells are the workhorse of any photovoltaic (PV) system. A PV array is simply a group of solar cells wired in series or parallel to produce the desired current, voltage, and high power. Each solar cell can be thought of as an individual diode with a semiconductor p-n junction [5]. When light is shone onto the junction, the photovoltaic effect causes currents to flow. The power output characteristics of the PV array at an insulation level are shown in Figure 3. Each output power characteristic curve displays a maximum power point. In Figure 3, we can see the (I-V) and (P-V) characteristics of the PV array at varying solar intensities. Solar cells have an equivalent circuit made up of a forward-biased diode connected in series with the current source. The terminals at the end of the output are used to link up the load. The solar cell's current equation is as follows:

$$I = I_{ph} - I_D - I_{sh}$$

$$I = I_{ph} - I_o [\exp (q\, V_D / nKT)] - (v_D / R_S)$$

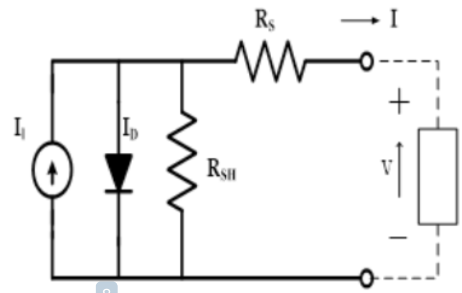

Figure 2: Equivalent circuit of PV Module

Power output of solar cell is P = V * I

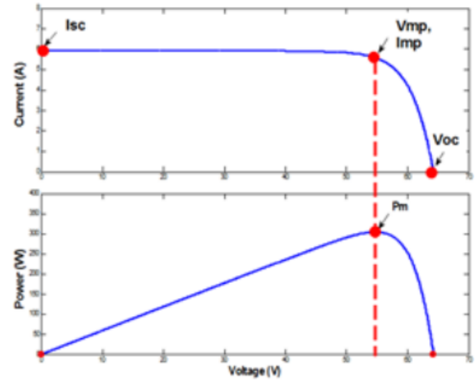

Figure 3: Output characteristics of PV Array

MAXIMUM POWER POINT TRACKING METHOD:

When it comes to the output power characteristics of a PV system, the irradiance and temperature curves play the most important roles. For the time being, solar radiation and temperature keep these two constant. Figure 1 depicts the dramatic fluctuations in solar radiation levels that have been described. Only around 30% to 40% of the solar irradiance that hits a typical solar panel is converted into usable electricity. The thevenin impedance (source impedance) of a circuit must coincide with the thevenin impedance (load impedance) of the circuit for maximum power transfer to occur. Therefore, it is essential to employ the Maximum power point tracking approach to maximise solar panel performance.

In response to rising input voltage or current, a PWM generator can increase the frequency of its switching to boost the solar array's output current. While doing this, more voltage is given to the inductor, which increases the charge current. Where sensor readings of current and voltage are used to determine a starting voltage and power output [9]. After determining the true power output, the Vref reference voltage is adjusted by comparing the current measurement to the previous one.

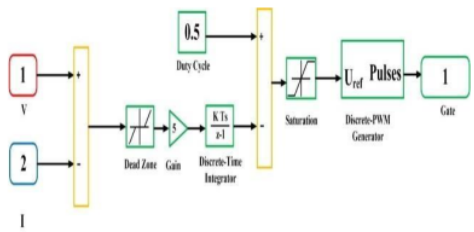

Figure 4: DC-DC converter MPPT Controller

3. PROPOSED SYSTEM

The amount of active electricity a solar inverter can put into the grid is dependent on the quantity of solar insolation. If the sun's rays are weaker than predicted, the solar inverter's output will be lower than its rated capability. The inverter ends up being underutilised as a result of this. If the inverter is set up to produce reactive power in addition to the active power, it may continue to operate at full capacity even when the solar resource is not producing as much energy as it might (based on the availability of solar irradiance). Network voltage regulation using reactive power injection and absorption is an attractive concept, and one possible option is reactive power compensation with a solar inverter.

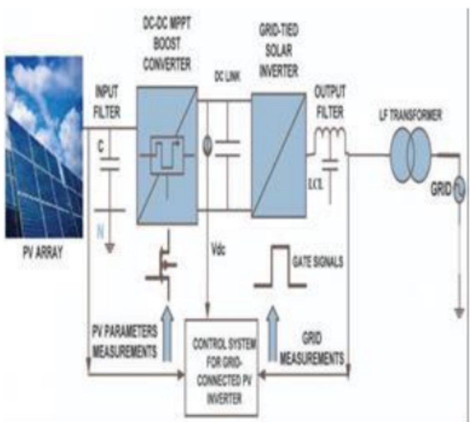

Figure 5: Structure of Grid Connected PV system for Reactive Power Control

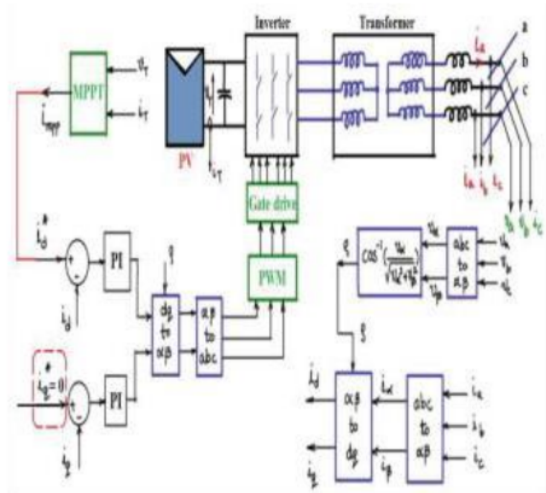

Figure 6: Control of VSI

Artificial Neural Network:

Figure 7 depicts the fundamental structure of an artificial neural network, with a circle representing a hidden layer and a square representing an adaptable node. Nodes serving as membership functions are provided between the input and output levels of this architecture, and the rules established by if-then statements are obliterated. We assume the analysed ANN [14] has two inputs and a single output to keep things simple. Each neuron in this network is linked to each component of the input vector p through a weight matrix W.

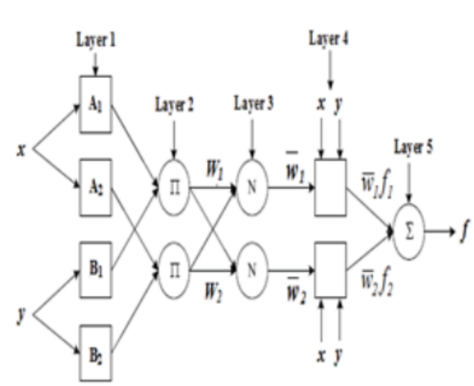

Figure 7: A two-input multi-layer ANN structure

RESULTS AND DISCUSSION:

Modeling the intended control situation was done in MATLAB/Simulink. The suggested system is tested under a variety of scenarios, including steady state, dynamic load, load removal, grid voltage imbalance, varying solar irradiance, and distorted grid voltage.

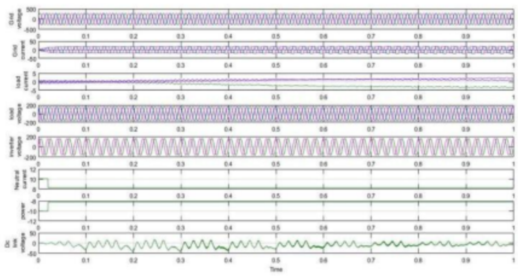

Figure 8: Simulation features under contaminated grid voltage

In Figure 8, we can see that the system is operating with a balanced supply voltage, no load, and a dynamic load. The voltage supply from the grid is balanced from 0 to 0.08 seconds. For the purpose of analysing the controller's dynamic performance, the load on phase "a" is temporarily removed (from 0.08 to 0.15 s in Figure 5.6). In a period of 0.15–0.2 s, the suggested system operates under a dynamic load condition.

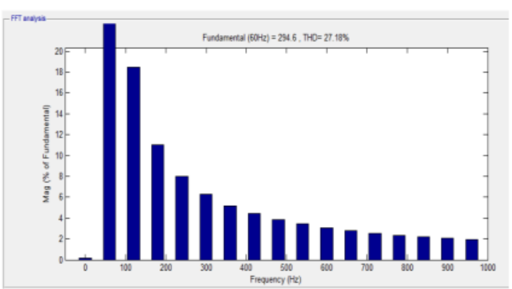

Figure 9: THD Source Voltage

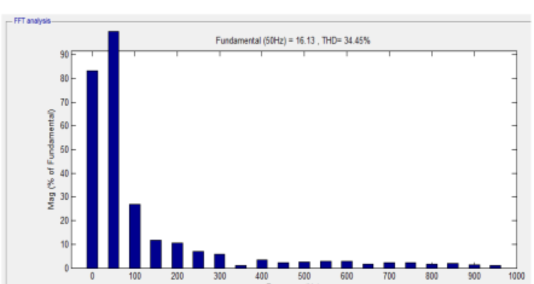

Figure 10: THD for Compensated voltage

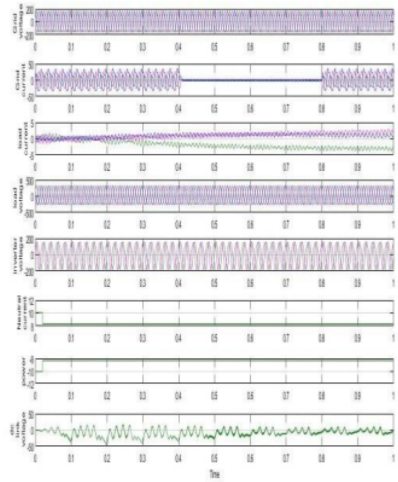

Figure 11: The results of running a simulation using ANN while in Steady State, with the Load Removed, and under Dynamic Load Conditions

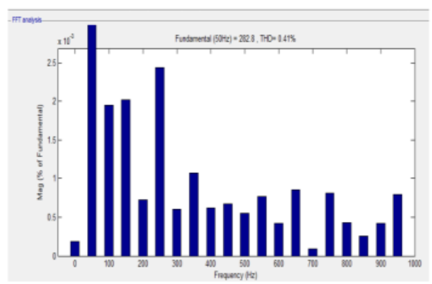

Figure 12: THD for Source voltage

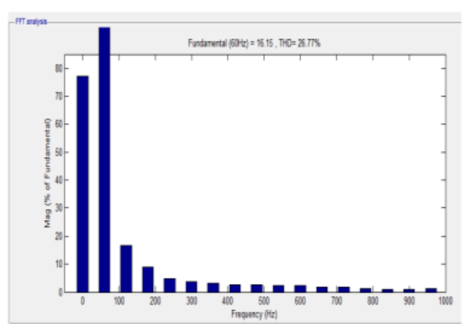

Figure 13: THD for Compensated voltage

CONCLUSION:

In this research, a three-stage grid-connected Photovoltaic inverter with an ANN-based seamless transfer controller between grid and islanding operations is suggested. For both grid-connected and islanding modes of operation, the stage edges of the corresponding current and voltage controls remained constant. Even when the voltage dropped or the mode of operation switched, the PLL's synchronisation point grew without any jarring jumps. At the beginning of the synchronisation procedure, the output voltage and current exhibited a few bendings in accordance with the stage and amount of the heap voltage being altered simultaneously in accordance with the grid voltage before switching to thegrid-associated operation. The suggested working sequencefor constant transfer caused the heap voltage to quickly approach its desired voltage upon switching to the islanding operation mode, spikes and surge streams notwithstanding.

REFERENCES:

[1] R. Datta and V. T. Ranganathan, "Variable-speed wind power generation using doubly fed wound rotor induction machine—A comparison with alternative schemes," IEEE Trans. Energy Convers., vol. 17, no. 3, pp. 414–421, Sep. 2002.

[2] J. Arbi, M. J.-B. Ghorbal, I. Slama-Belkhodja, and L. Charaabi, "Direct virtual torque control for doubly fed induction generator grid connection," IEEE Trans. Ind. Appl., vol. 47, no. 1, pp. 4163–4173, Jan./Feb. 2011.

[3] A. Luna, K. Lima, D. Santos, P. Paul, and S. Arnaltes, "Simplified modeling of a DFIG for transient studies in wind power applications," IEEE Trans. Ind. Electron., vol. 58, no. 1, pp. 9–19, Jan 2011.

[4] M. J. Hossain, H. P. Pota, V. A. Ugrinovskii, and R. A. Ramos, "Simultaneous STATCOM and pitch angle control for improved LVRT capability of fixed-speed wind turbines," IEEE Trans. Sustainable Energy, vol. 1, no. 3, pp. 142–151, Oct. 2010.

[5] A. Causebrook, D. J. Atkinson, and A. G. Jack, "Fault ride-through of large wind farms using series dynamic braking resistors," IEEE Trans. Power Syst., vol. 22, no. 3, pp. 966–975, Aug. 2007.

[6] M. E. Haque, M. Negnevitsky, and K. M. Muttaqi, "A novel control strategy for a variable-speed wind turbine with a permanent-magnet synchronous generator," IEEE Trans. Ind. Appl., vol. 46, no. 1, pp. 331–339,Jan./Feb 2010.

[7] W. Oiao, L. Qu, and R. G. Harley, "Control of IPM synchronous generator for maximum wind power generation considering magnetic saturation," IEEE Trans. Ind. Appl., vol. 45, no. 3, pp. 1095–1105, May/Jun. 2009.

[8] C. S. Brune, R. Spee, and K. Wallace, "Experimental evaluation of a variable-speed doubly-fed wind-power generation system," IEEE Trans. Ind. Appl., vol. 30, no. 3, pp. 648–655, May/Jun. 1994.

[9] S. Bhowmik, R. Spee, and J. H. R. Enslin, "Performance optimization ´ for doubly fed wind power generation systems," IEEE Trans. Ind. Appl., vol. 35, no. 4, pp. 949–958, Jul/Aug. 1999.

[10] C.-H. Liu and Y.-Y. Hsu, "Effect of rotor excitation voltage on steady-state stability and maximum output power of a doubly fed induction generator," IEEE Trans. Ind. Electron., vol. 58, no. 4, pp. 1096–1109, Apr. 2011.

[11] A. Petersson and S. Lundberg, "Energy efficiency comparison of electrical systems for wind turbines," in Proc. IEEE Nordic Workshop Power Ind. Electron. (NORPIE), Stockholm, Sweden, Aug. 2002, pp. 12–14.

[12] A. C. Smith, R. Todd, M. Barnes, and P. J. Tavner, "Improved energy conversion for doubly fed wind generators," IEEE Trans. Ind. Appl., vol. 42, no. 6, pp. 1421–1428, Nov./Dec. 2006.

[13] S. Muller, M. Deicke, and R. W. De Doncker, "Doubly fed induction ¨ generator systems for wind turbines," IEEE Ind. Appl. Mag., vol. 8, no. 3, pp. 26–33, May/Jun. 2002.

[14] Mihai Ciobotaru-Macquarie University and F.Blaabjerg-Aalborg University, "Control of Single-Stage Single-Phase PV Inverter," Sep 2006, Epe journal 16(3):20-26, DOI:10.1080/0939368.2006.11463624, Source: IEEE Xplore.

[15] Md.Apel Mahmud, M.J.Hossain, "Robust Nonlinear Distributed Controller Design for Active and Reactive Power Sharing in Islanded Micro grids," Dec 2014, IEEE Transactions on Energy Conversion 29(4):893-903.

[16] Ganga Bhavani, Chaladi & Kishore, D.Ravi. (2020). Battery Protection Scheme Integrated with Demand Side Management in Stand Alone Hybrid Microgrid. 1-6. 10.1109/iSSSC50941.2020.9358847.

[17] Vimmigari Karthik, T. Santhosh Kumar, Vendoti Suresh, B. Kavya Santhoshi, M. Raja Nayak, Performan0ce of DFIG fed wind turbine under fault conditions, Materials Today: Proceedings, 2021, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2021.06.380.

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Analysis of DC to DC Converters using SVM Technique for ElectricVehicle Applications

Abstract. This paper suggests a method for switching between different operating modes by making use of a bidirectional DC/DC converter, which is a component that is often used in battery-powered electric vehicles (EVs). In the suggested design, when the DC-link voltage is at an unacceptable level, the converter will transition from the boost mode to the buck mode. This method is intended to lower pollutants while simultaneously increasing the efficiency of the electric vehicle's energy storage system (ESS). During operation, a buck-boost DC/DC converter is utilized to increase the voltage of the DC connection, and during deceleration, the battery is recharged using the extra power. When the system is running in boost mode, the steady maintenance of the DC-link voltage is accomplished by driving operations using PI control of the DC-link voltage. The buck mode minimizes the effects of voltage ripples by controlling the battery voltage using the PI algorithm. Current control mechanisms are used in both modes of operation. This is done to ensure that the converter modules are sharing the battery current in anequitable manner. The recommended method is assessed by simulating it with the help of the propulsion system of an electric car.

1. Introduction

Many causes, such as air pollution, climate change, and the ever-increasing demand for fossil fuels, have contributed to the EV industry's meteoric rise over the last few years. There are now a number of research projects being carried out to increase the density and efficiency of the converters, which are two of the most important parts of electric cars alongside the power electronic converters and drive systems. Many other types of electric cars, including PEVs, HEVs, and FCEVs (fuel cell electric vehicles), will soon be available to buyers (FCEVs). Electric motors, linked to the vehicle's batteries through voltage inverters, will power every one of these automobiles (VSIs). Electric vehicles (EVs) have arisen as a possible alternative to traditional cars driven by gas- powered engines in light of rising concern about the usage of fossil fuels and the amount of pollution they produce. For the electric car industry to continue growing, charging stations must proliferate throughout the nation to make up for the batteries' low storage capacity. It is possible for the electrical grid to become overloaded, the voltage to drop, and power outages to occur when a high number of charging stations are directly linked to the system. Although several studies have looked at the feasibility of incorporating solar (PV) power production with electric vehicle (EV) charging infrastructure, this is usually viewed as giving just a modest amount of energy to EV charging stations at now. As PV manufacturing technology has advanced quickly, peak-load electricity usage has been optimized. With the increasing need for rapid charging around the clock, this is of crucial importance. Managing DC bus or load voltage, balancing power gaps, and smoothing PV power may all benefit from the use of battery energy storage (BES) due to the intermittent nature of solarelectricity.

2. Electric Vehicles

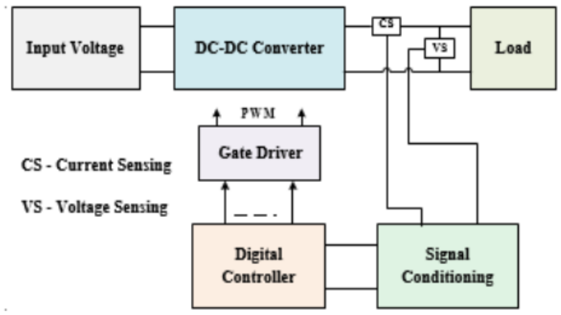
The traction power in a standard EV comes from a battery pack wired to an electric motor through a transmission. An external source, like a wall outlet, is used to power a battery charger, which in turn charges the batteries. When the vehicle's speed is reduced by using regenerative braking, the motor doubles as a generator, feeding energy back into the batteries. The primary benefit of an EV is its simple design and low number of components. The main drawback of EVs is that their driving range is capped by the capacity of their batteries, and recharging them can take anywhere from 15 minutes to 8 hours, depending on how far the vehicle was driven before being recharged, the type of battery used, and the charging method.

3. Proposed Circuit Configuration

Direct current (DC) to direct current (DC) converters with digital control are often used to provide electricity for charging and refilling the EV's batteries. It uses power switching devices based on semiconductors to change the voltage at different points in a circuit. In a non-linear system, the switching action of semiconductor devices manifests as a delay. Different methods of control may be used to stabilize the system's output voltage and boost its overall performance [1-5]. The DC-DC converters often employ a standard control method, such as a Proportional-Integral-Deferential (PID) based approach, because of the simplicity of its design and implementation. Traditional PID controllers rely on mathematical models with constants that have already been defined and adjusted. PID controllers rely on fixed parameters to ensure steady operation. Commonly utilized to boost system performance in a wide variety of industrial applications, PID controllers are a staple of the field. It is demonstrated in Fig. 1 how the DC-DC converter is used in conjunction with the most typical form of control structure. It has a digital control and gate driver in addition to a DC-DC converter and a signal conditioning device.

Fig. 1. Conventional control approach of DC-DC converter

The multiphase interleaved converter is often studied because of its straightforward design and straightforward control setup. It's put to work in situations calling for non-isolation, a step-down conversion ratio, a large output current with minimal ripple, and so on. An essential consideration for tiny form factor applications is the flexibility provided by a multi-phase design's output inductor



selection. In order to guarantee the best possible converter performance, a multiphase operation offers a number of advantages, such as flexible phase combinations and phase shedding.

4. Operation Modes of the Proposed Converter

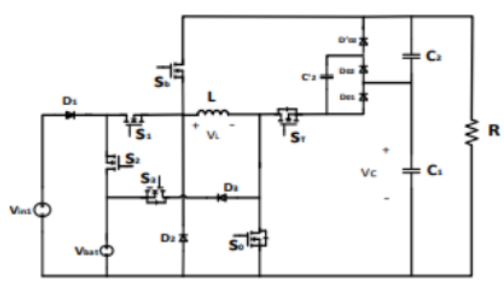
The suggested converter is not only multidirectional, but also uses multiple inputs and outputs as described in [5-10]. The suggested structure improves the converter's efficiency by allowing for many charging modes, such as the battery discharge mode, battery charging via the inputs, and battery charge mode in the braking mode. In the sections that follow, each of the aforementioned modes is further developed and mathematically evaluated separately. The utilization of the multi-stage m-level multiplier circuit causes a minimal voltage stress on the S0 of the suggested converter.

4.1 Power supply mode with battery discharge

In this configuration, the converter uses power from the battery and any other connected input sources to power the linked load. There are two inputs (the battery and one primary source) and two outputs (the two possible outcomes) in the mathematical analysis. In this configuration, the brake switch (S3 and Sb) is always off, the transfer switch (ST) is always on, and all the other switches are likewise on. With the help of switches S0, S1, and S2, the output voltage (VO) may be adjusted in this setting. The primary waveforms of the converter in this mode are shown in Fig. 2 and the converter in its operational state is depicted in Fig. 3. In this mode, the converter's switching orders are stated as follows (see Fig. 4)

4.1.1. Time interval 0<t<D1T

In this configuration, the battery and the other sources are both used to power the load connected to the converter. As a result, it is possible to use all linked resources at once. There are two inputs and two outputs in the mathematical analysis. In this setup, all switches except for S3 and Sb are active. In this mode, the output voltage (VO) is managed by a series of switches whose on/off sequence



is determined by the values of S0, S1, and S2.

Fig. 2. Two-input, two-output converter is proposed.

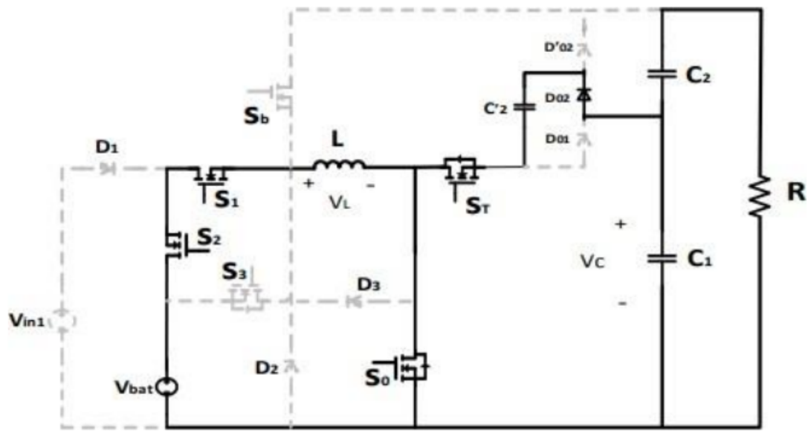


Fig. 3. converter comparable circuits in mode A at time interval 0<t<D1T

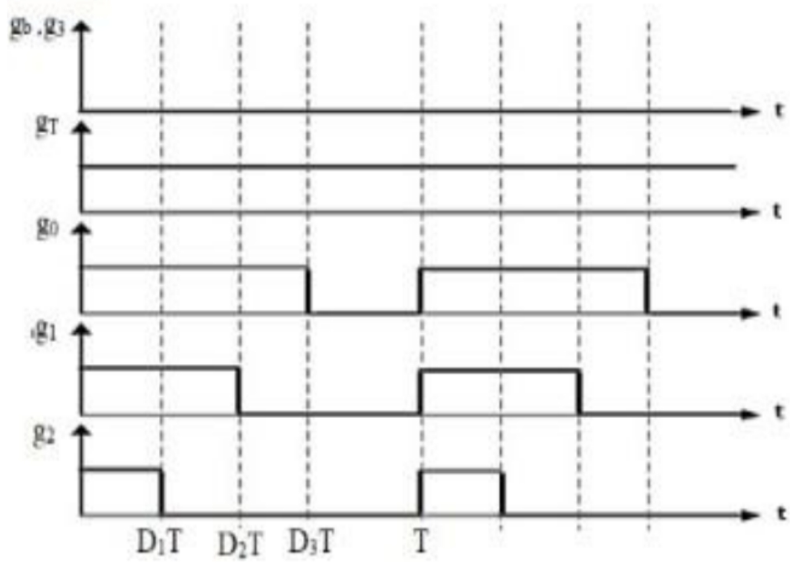


Fig. 4. Alternation of power sources when batteries are depleted

4.1.2 Time interval D1T <t<D2T

The S0 is active, while the S1 is inactive, and the rest of the circuit looks like Fig. 4. The inductor is charged by the primary power source (fuel cell, for instance). The inductor's voltage is the same as the mains voltage, and the inductor current rises in a straight line with a shallower slope (Vbat > Vin1). Its inductor current looks like this while operating in this mode:

4.1.3.Time interval D2T <t<D3T:

Here, we have S0 turned on and S2 and S1 turned off. The inductor acts as a current path, activating diode D2. Using KVL with a circuit consisting of a diode, an inductor, and S0:

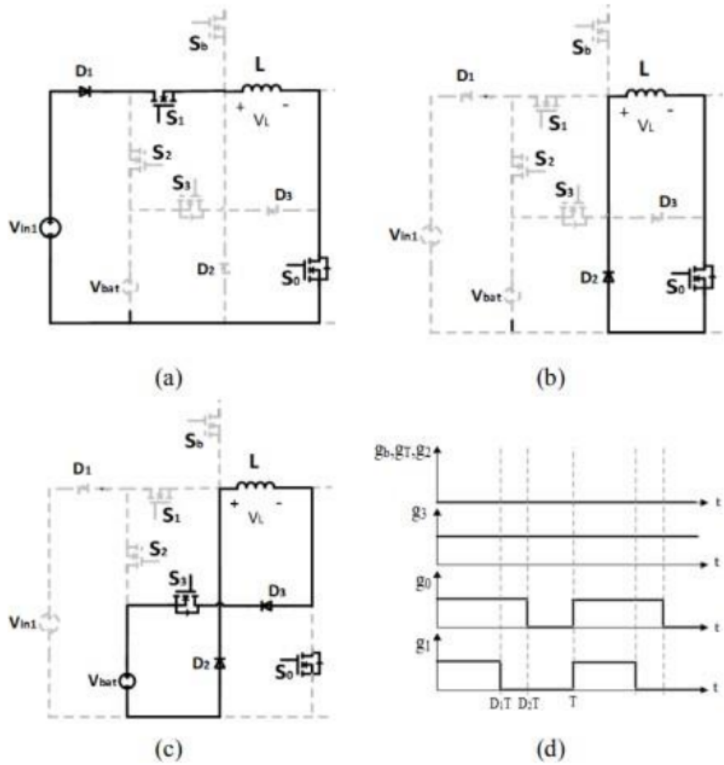


Fig. 5. (a) Switching State 1, (b) Switching State 2, (c) Switching State 3, and (d) Switching Sequence while charging a battery from external sources.

4.2. Battery charge mode via input sources

The battery is being charged by the input sources while in this mode. This state is reached by the battery whenever there is no load being carried and the battery must be recharged. As shown in Fig. 2.10, all but switch S1 are always ON, while switches S2, ST, and Sb are always OFF. Three different converter switching states are studied in this mode.

4.2.1. Time interval $0 < t < D1T$

Both S0 and S1 switches are active in this switching state. As a result, there is no current flowing through the D3 and S3 diodes since they are reverse biased. Charge is applied to inductor L from the input source (Vin1), and the current flows steadily upwards. This leads us to the following equation for the current in an inductor

4.3. Battery Charging Mode in Braking Operation

The motor vehicle may function as a generator and store energy in the battery when braking or travelling downhill. Transducer performance is optimized in this mode of operation. To achieve thisresult, a switch is installed in the reverse circuit to convert the high voltage to the lower voltage of the battery, so conserving power. All other switches are on and functioning normally, whereas S0, S1, and ST are constantly turned off. In this mode, Sb regulates the battery's output voltage (Vbat. The converteris a standard buck converter while in the braking mode. There are a few of different ways that the switchmay be thrown.

4.3.1Time interval 0 <t<D1T

The Sb mode is activated here. What this means is that the inductor's voltage is defined as the difference between Vo and Vbat. So, here is a linear progression of the inductor current:

$$i_{L3}=I_{LV3}+\frac{1}{L}\int_0^t V_L dt$$

5. Space Vector Modulation Technique

Instead of using a standard pulse width modulation method, this system takes use of the two phase vector components—d and q—to provide gate triggering signals. Figure 6 depicts the 8 space vector switching pattern locations of the inverter, each of which represents a different space vector representation of the neighboring vectors V1 and V2.

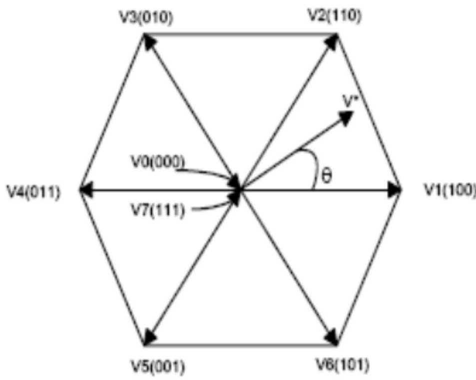


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Fig. 6. Space Vector Modulation Technique

By using the Space Vector Modulation Technique, one of the most used pulse width modulation techniques for three-phase voltage source inverters, we are able to reduce harmonic distortion in the voltage and current delivered to the applied ac motors. Figure 6 shows how we construct reference vectors using a space vector modulation approach by modifying the switching time sequence of space vectors over six distinct locations. It can be seen in Figure 6 that inversion makes use of six switching sectors, two of which function similarly to null vectors. The following methods may be used to carry out space vector modulation:

To convert three-phase values to two-phase ones.

2) Calculate T1, T2, and T0.

The following phrase creates the voltage reference signals, the V0–V7 switching time sequences, and the switching times themselves.

$$V^* Tz = V1 *T1 + V2 *T2 + V0 *(T0/2) +V7 *(T0/2)$$

6. Simulation Diagrams and Results

The suggested converter is shown via simulation, and its performance across all three modes of operation is validated. The MATLAB/Simulink environment is used for the simulations, and the settings for those simulations are shown.

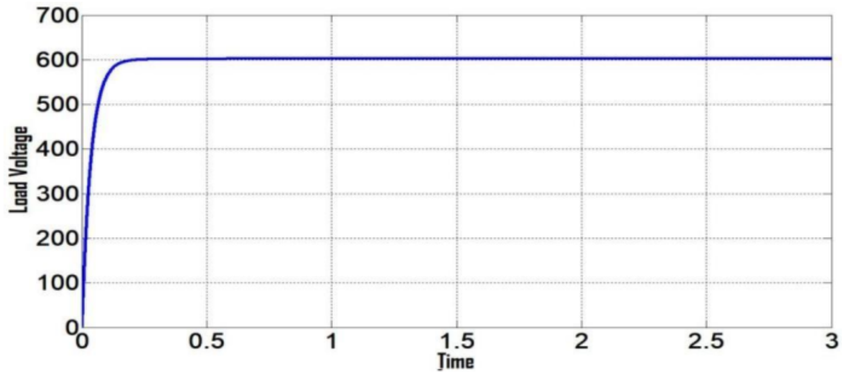

Fig. 7. Load voltage of converter(V0) during battery discharge mode using PWM

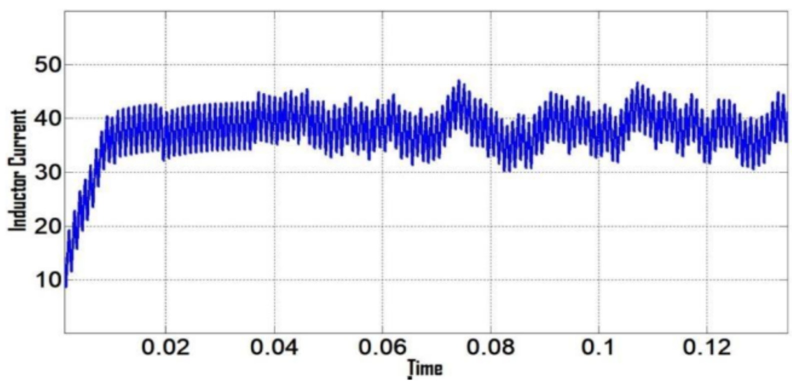

Fig. 8. Inductor current (i1) during battery discharge mode using PWM

6.1. Simulation Results during battery charge in braking mode using PWM

As the battery is charged by the regenerative energy, the load's voltage is sent back into the system as an input. When the brakes are applied, a current flows via switch Sb and into the battery to charge it. The load voltage is directly employed as the charging power source in this kind of converter, which is known as a buck converter.

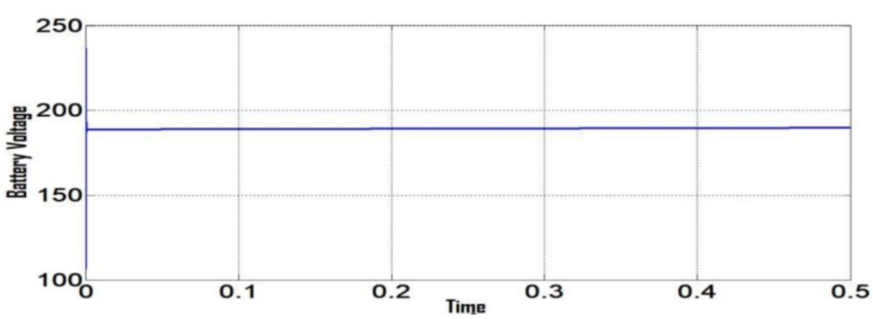

Fig. 9. Voltage of battery (Vbat) during battery charge in braking mode using PWM

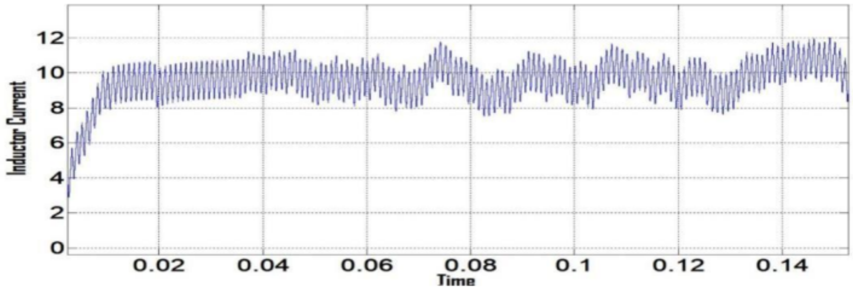

Fig. 10. Inductor current(il)during battery charge in braking mode using PWM

6.2. Simulation results during battery discharge using SVM:

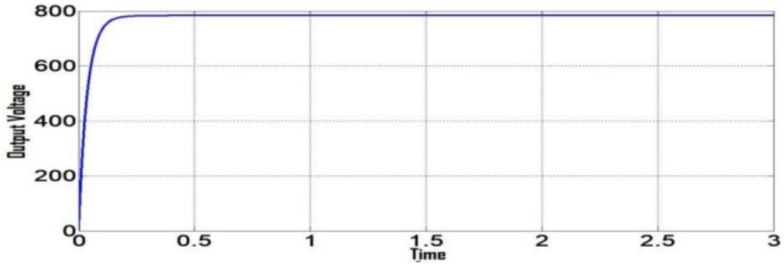

Fig. 11. Load voltage of converter (V0) during battery discharge mode using SVM

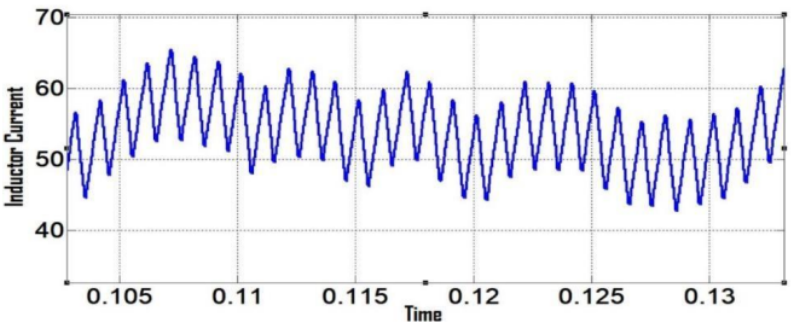

Fig. 12. Inductor Current of converter during battery discharge mode using SVM

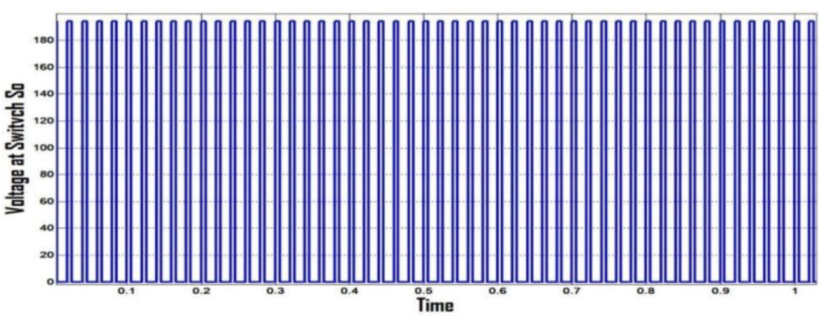

Fig. 13. Voltage across switch (So) during battery discharge mode using SVM

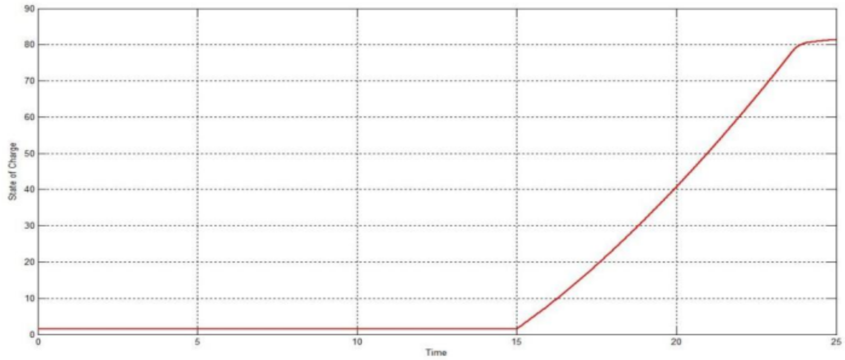

Fig. 14. EV Battery Charging Conditions using PWM Controller

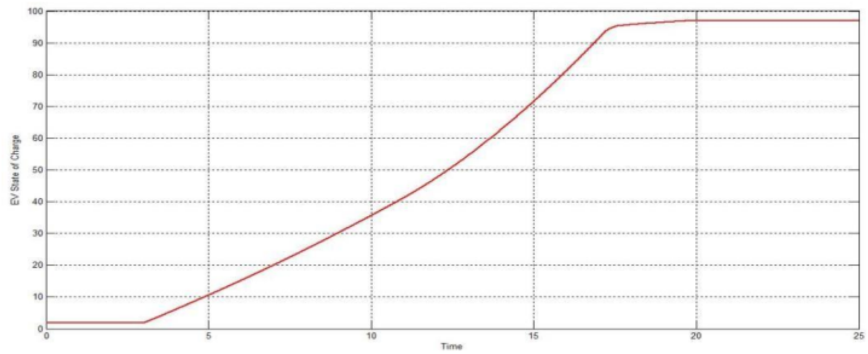

Fig. 15. EV Battery Charging Conditions using SVM Controller

7. Conclusion

In order to boost the efficiency of dc-dc converters, this research suggests a novel design for bidirectional non-isolated converters using Space vector modulation. The flexibility of the proposed converter to transfer energy across resources with varied voltage and current profiles and the high voltage gain it provides without resorting to high duty cycle and high-frequency switching are the most significant benefits it provides. The voltage multiplier inverter included in the output also reduces the voltage stress on the primary switch. The suggested converter is capable of both buck and boost operation. The various converter modes were shown in this project. Validation of a two-input, two-output converter's simulation results was performed to ensure the suggested design would work as intended. Comparatively, the switching action of a space-vector-modulation-based converter is less taxing on the voltage supply, allowing for more freedom in structuring the switching sequence to meet specific needs.

References

[1] S. Vendoti, K. A. Swami, S. K. Govindaraju and D. V. S. S. Varma, "Microgrid Design For EV Fast Charging Station Using Interleaved DC-DC Converter," 2023 International Conference for Advancement in Technology (ICONAT), Goa, India, 2023, pp. 1-5, doi: 10.1109/ICONAT57137.2023.10080139.

[2] S. Vendoti, R. Manikanta Swamy, T. Sai Saran Jyothi and B. Varun, "ANN based Bridgeless Landsman Converter Design for Electric Vehicle Power Factor Correction," 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS), Coimbatore, India, 2023, pp. 1257-1262, doi: 10.1109/ICAIS56108.2023.10073855.

[3] T. sharifi, A. Haji Biglo, M. Mirsalim, S. Farzamkia and J. S. Moghani, "An asymmetrical cascaded single-phasequasi Z-source multi-level inverter with reduced number of switches and lower THD, " Tehran, Iran,2020.

[4] A. B. Kancherla and D. R. Kishore, "Design of Solar-PV Operated Formal DC-DC Converter Fed PMBLDC Motor Drive For Real-time Applications," 2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC), Gunupur Odisha, India, 2020, pp. 1-6, doi: 10.1109/iSSSC50941.2020.9358813..

[5] A. Haji Biglo, S. Farzamkia, S. Farhangi and H. Iman Eini, "Utilization of Soft-Switched Boost Converter for MPPT Application in Photovoltaic Single-Phase Grid-Connected Inverter," in Proc.,New York,2020.

[6] S. H. Hosseini, R. Ghazi, S. Farzamkia and M. Bahari, "A Novel High Gain Extendable DC-DC Bidirectional Boost-Buck Converter,"in Proc.,Iran,2020.

[7] F. Sedaghati, S. Mohammadsalehian, H. Shayeghi, and E. S. Asl, " A configuration of double input Z-source DC-DC converter for standalone PV/battery system application," Journal of Energy Management and Technology, 2(3), pp.60-69.

[8] C. S. G. Bhavani and D. R. Kishore, "Battery Protection Scheme Integrated with Demand Side Management in Stand Alone Hybrid Microgrid," 2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC), Gunupur Odisha, India, 2020, pp. 1-6, doi: 10.1109/iSSSC50941.2020.9358847.

[9] A. Ansari, P. Cheng, and H.-J. Kim, "A 3 kW Bidirectional DC-DC Converter for Electric Vehicles", Journal of Electrical Engineering Technology, vol. 11, no. 4, pp. 860-868, 2016.

[10] A. K. Rathore and U. R. Prasanna, "Analysis, Design, and Experimental Results of Novel Snubberless Bidirectional Naturally Clamped Converter for Fuel Cell Vehicles", IEEE Trans. Ind. Electron., vol. 60, no. 10, pp. 4482–4491, 2013

[11] T. Mishima, E. Hiraki, "A dual voltage power system by battery/supercapacitors hybrid configuration", in Proc. Power Electronic Specialists Conf., pp.1845-1852,June 2005.

[12] S. Rezayi, H. Iman-Eini, M. Hamzeh, S. Bacha, S. Farzamkia, "Dual output DC/DC boost converter for bipolar DC microgrids", IET Renewable Power Generation,vol.13, pp.1402-1410, 2019.

[13] E. Sanchis-Kilders et al., "Bidirectional high-power high-efficiency non-isolated step-up dc-dc converter", PESC'26, in Power Electronics Specialists Conference, 2006. 37th IEEE, pp. 1-7.

[14] B. V. Kumar, R. K. Singh, and R. Mahanty, "A modified non-isolated bidirectional DC-DC converter for EV/HEV's traction drive systems," in 2016 IEEE International Conference on Power Electronics, Drives and Energy Systems (PEDES), 2016, pp. 1-6.

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ANN based energy management strategy in microgrids

Abstract—***In order to mitigate the power fluctuations caused by PV panel characteristics and solar radiation, it is usual practise to include battery storage into PV systems. The bus voltages in photovoltaic battery systems must be stabilised while allowing for a high degree of discretion in the management of power flows. This paper's goal is to propose a comprehensive control and power management system (CAPMS) for AC and DC bus-based PV-battery hybrid microgrids operating in both grid-connected and islanded modes. The proposed investigation contrasts PI controllers with artificial neural networks (ANN). Regulators keep an eye on both the power supply and the waves. The task was completed using the Matlabsimulink application.***

KEYWORDS:Battery storage, Artificial Neural Network, PV-battery systems, PI Controller.

I. Introduction

Microgrids are small, decentralised energy networks that may operate autonomously from both the larger power grid and other microgrids. According to the Microgrid Exchange Group of the US Department of Energy, the following skills are necessary: A microgrid is a small electrical grid that operates within clearly defined geographic boundaries, connecting and containing loads and distributed energy resources. A microgrid is essentially an independent grid inside a bigger grid. Microgrids may switch between grid-connected and island modes, depending on their needs.

In order for a microgrid to meet the electrical power demands of its consumers, it must have access to a producing source. Due to the microgrid's age, it has often received its power from fossil fuel sources located "beyond the metre," such as gas-powered plants. However, many of the microgrids that are now being developed obtain their electrical supply from a mix of solar energy and battery storage because of the dropping cost of solar energy and the environmental advantages of transitioning away from the production of electricity using fossil fuels. To begin, it's important to note that this is a kind of local energy, meaning that it serves local customers. This is one of the main differences between microgrids and the enormous centralised grids that have provided the bulk of our nation's electricity for the previous century. Power plants can transmit electricity across long distances thanks to transmission and distribution lines that link to major grids. Long-distance power transmission is inefficient due to the fact that some of the energy is wasted along the way. This loss may be as high as 15% of the total. A microgrid sidesteps this inefficiency by generating power in close proximity to the people it serves. Microgrids often have their power sources close by or within the structure itself, with the instance of solar panels placing them on the rooftop.

II. Solar Energy

2.1 Introduction

One method of generating energy is by the use of solar cells, which are photovoltaic semiconductors that convert solar radiation into DC power. Photovoltaic energy is generated using solar panels comprised of many individual cells, each of which contains a photovoltaic material. Monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium selenide/sulfide are only some of the types of silicon that may be used in photovoltaics [1]. However, amorphous silicon, another form of silicon, is also useful. Other forms of silicon, such as amorphous silicon, may also be put to use. Rising demand for solar and other renewable energy sources has led to significant improvements in solar cell and photovoltaic array production over the last several years.

Solar photovoltaic generates electricity in over 100 nations as of 2010, and is the world's fastest growing power-generation technology, but accounting for only a small portion of the 4800 GW total global power-generating capacity from all sources. Grid-connected PV System capacity expanded by 60% of annually average of 2004 to 2009 is 21GW. Building Combined Photovoltaics or BIPV for short are installations that are either ground-mounted or sometimes integrated with farming and grazing embedded into the roof or walls of a building. An extra 3–4 GW comes from off-grid PV.

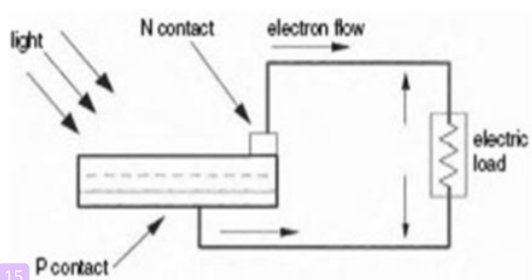

Fig 2.1: PV converts the photon energy into voltage across the p-n junction

Since the invention of the first solar cells, advances in technology and greater efficiency in production have led to a steady decline in the price of photovoltaics. Positive feed-in rates for solar-generated power and other financial incentives have helped spread the use of solar photovoltaics around the globe.

Light causes a material to produce a voltage via what is called the photovoltaic effect (or a corresponding electric current). It is important to distinguish between the photovoltaic effect and the photoelectric effect, despite their close relationship. In the photoelectric effect, electrons are emitted from the surface of a substance when it is subjected to radiation of a high enough energy. What sets the photovoltaic effect apart is that the created electrons are transferred across bands inside the material (from the valence to the conduction bands), resulting in a voltage increase between two electrodes. These cells were given their name since the sun is the most common source of radiation employed in photovoltaic applications. P-n junction solar cells generate current when exposed to light because the electric field present in the depletion region sweeps the excited electrons and residual holes in opposite directions. In Figure 2 we can observe this behaviour clearly. In 1839, Alexandre-Edmond Becquerel is credited with being the first to notice the photovoltaic effect. In October of 2010, Canada's 80 MW Sarnia Photovoltaic Power Plant was the biggest PV power plant in the world. There are several more major PV power plants, such as Spain's 60 MW Olmedilla Photovoltaic Park, Germany's 54 MW Strasskirchen Solar Park, Germany's 53 MW Lieberose Photovoltaic Park, Spain's 50 MW Puertollano Photovoltaic Park, Portugal's 50 MW Moura Photovoltaic Park, and so on (Germany, 40 MW).

2.1.1 In Buildings:

Photovoltaic arrays are often linked with buildings, either because they are installed on or next to the ground, or because they are incorporated into the design of the building itself. Arrays are often installed as an afterthought in preexisting buildings, often affixed to the existing roof or the existing walls. Alternatively, a cable may be run from an array located elsewhere and linked to the building in order to provide energy to the building. The vast majority of Germany's solar PV capacity, over 8,500 MW, was added to roofs that year.

2.1.2 InTransport:

Solar photovoltaics (PV) have been utilised for quite some time to generate electricity in space. Motive power generation from PV is uncommon in transportation applications, but its use as an auxiliary power source in vehicles like boats and automobiles is on the rise. While the power and usefulness of a standalone solar car are questionable, solar-charged vehicles can get you where you need to go. Solar-powered cars have already been shown out.

2.1.3 StandaloneDevices:

Before approximately a decade ago, PV was often employed to power calculators and other novelty gadgets. These devices can now run for years without needing new batteries because to advancements in integrated circuits and low-power LCD screens, which has reduced the need for PV. However, in regions where grid energy is unaffordable owing to high connection prices, solar-powered remote fixed devices have lately gained appeal. There are a wide variety of applications for this technology, including water pumps, parking metres, emergency phones, garbage compactors, temporary traffic signs, and remote guard posts and signals.

2.1.4 RuralElectrification:

Since many rural villages in developing nations are more than five kilometres away from the nearest electricity line, photovoltaics have become more popular. Solar-powered LED lights have been distributed by an Indian government scheme to replace kerosene lamps in rural areas. The cost of a few months' supply of kerosene was compared to the cost of the solar lights. Cuba plans to provide solar electricity to remote areas that now lack access to the grid. While there is a clear justification for going solar in these areas due to the social costs and benefits, the lack of profitability may restrict such initiatives to purely altruistic ones.

2.1.5 Solar Roadways:

Since roadways are often unobstructed to the sun and represent nearly the proportion of land area required to replace other energy sources with solarpower, a 45 mile (72 km) length of roadway in Idaho is being used to investigate the idea of embedding solar panels into the road surface. As a result of its low environmental impact and low maintenance requirements, solar energy has recently emerged as the dominant technological platform. To improve energy efficiency, solar systems have recently been installed in highways.

2.1.6 Solar PowerSatellites:

Spacecraft that harvest solar energy on a massive scale have been the focus of design studies for decades. Peter Glaser, formerly of Arthur D. Little Inc, initially proposed the idea in the 1960s; NASA conducted a lengthy series of technical and economic feasibility studies beginning in the 1970s; and the notion has lately seen renewed attention in the early 2000s. For such satellites, the problem of launch cost seems to be the most relevant issue from a practical economic aspect. Space-based assembly procedures still need to be developed, although this seems like a lesser hurdle than the initial investment. As the price of solar panels drops or their efficiency increases, these will go down.

2.2 Solar cell:

One way that sunlight may be converted into energy is via the use of a solar cell, which is a semiconductor device that exploits the photovoltaic effect. In the solar industry, solar modules are more usually referred to as solar panels, however they are really composed of cell assemblies. These solar modules generate solar electricity, which is one kind of renewable energy.

The PV potential originates from the disparity in the Fermi levels (chemical potentials) of the electrons in the two separated materials. When they're connected, a new thermodynamic equilibrium is established at the junction. Such a balance is possible only when the Fermi levels of the two substances are equivalent. The electrons flow from one material to another until the voltage difference between them is equal to the difference at the Fermi level. This potential is what powers the photocurrent in the PV system. Although the word is usually solely used to describe the process of harnessing solar electricity, photovoltaics is really the scientific study of how photovoltaic cells may be utilised to convert light into usable energy. Photovoltaic cells are those used when the light source isn't always the sun. These are used to either detect or quantify the intensity of light or other forms of electromagnetic radiation in the visible spectrum.

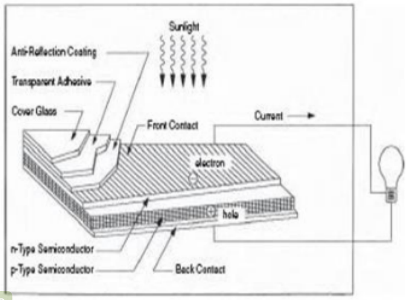

Fig 2.2: Basic construction of PV cell

Equvivalent electrical circuit of a Battery:

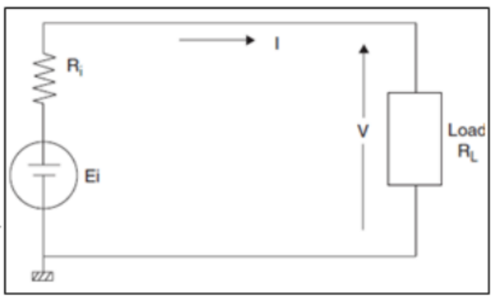

Fig 2.3:Equvivalent electrical circuit of a Battery

III. PI CONTROLLER

PI controllers, or proportional-integral controllers, are a form of feedback controller used in control engineering to identify the optimal driving strategy for a plant. This kind of controller incorporates both the error, or the difference between the actual output and the goal value, and its integral into its calculations. One subset of PID controllers does not take into account the derivative (D) of the error signal.

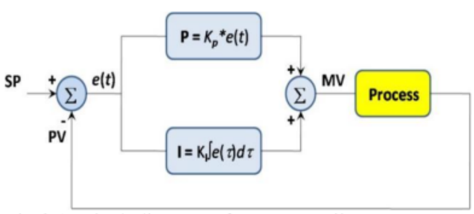

Fig.3.1: Block diagram of a PI controller

Integration of integral control action transforms the proportional controller into a high-order system. If Kp is very large, the control system may become unstable because the roots of the characteristic equation may have a positive real component. This is because it's possible that the roots of the characteristic equation will include a real-valued positive integer. When applied to a system subject to a wide range of inputs, proportional control tends to stabilise it, but integral control has the ability to significantly decrease or even eliminate steady-state error. There is a general trend toward less overshoot and faster reaction times as Ti increases.

IV. ARTIFICIAL NEURAL NETWORKS

To put it simply, Artificial Neuronal Networks are simplified digital representations of the brain's neural architecture. The brain is primarily an experiential learner. The results show that problems that are too difficult for today's computers to tackle may be solved by compact, low-power devices. The use of brain models holds up hope for a less complex approach to creating technological answers. It is expected that these computer approaches influenced by biology will be the next big thing. Simple animal brains can do tasks that computers can't even begin to mimic just now. Computers excel at routine tasks like maintaining an accounting system or calculating complicated formulas. However, computers struggle to recognise even the most basic patterns, much less generalise previous actions into future actions. Developments in biological study have recently offered hope for a first glimpse into the workings of the mind in its natural state. This study demonstrates that the brain organises information into patterns. Some of these patterns are quite intricate, allowing us to identify certain faces from a variety of perspectives. A new area of computer science has developed around the concept of storing data as patterns, applying those patterns to problems, and finally achieving a solution. Instead of using standard programming, researchers in this discipline build massively parallel networks and teach them to solve problems. Words like "behave", "respond", "self-organize", "learn", "generalise", and "forget" are used in this discipline that are considerably different from the language of "conventional computing". The term "neural network" (NN) refers to the mathematical model or computer model that is based on biological brain networks; this is what distinguishes it from "artificial neural network" (ANN). It uses a connectionist method of computing and is composed of a network of artificial neurons. The learning phase of an ANN often involves the system adapting its structure in response to incoming data from the outside or from inside the network itself. In a nutshell, neural networks are used to describe statistical data in a way that is not linear. They are useful for discovering patterns in data and modelling intricate connections between inputs and outcomes. Like the huge network of neurons in the human brain, a neural network is made up of a collection of nodes that communicate with one another.

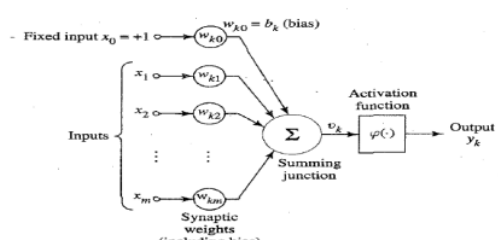

Fig 4.1: Artificial Neural Networks

V. SIMULATION RESULTS

Project Background

- A DC/DC boost converter is used in this project to connect the PV array to the DC bus.
- A bidirectional DC/DC converter regulates the charging and discharging of the batteries in the battery bank.
- For the purpose of linking the DC and AC systems, a central inverter has been set up.
- The DC load block often stands in for the many loads that connect to the DC bus.
- CAPMS chooses the operating modes of PV array & battery (charging, discharge mode) & delivers correct reference values to controllers based on PV output power, battery state of charge, battery power limit, and AC loads. In order to maintain a stable power supply, CAPMS will use one of many possible control strategies for the converters.

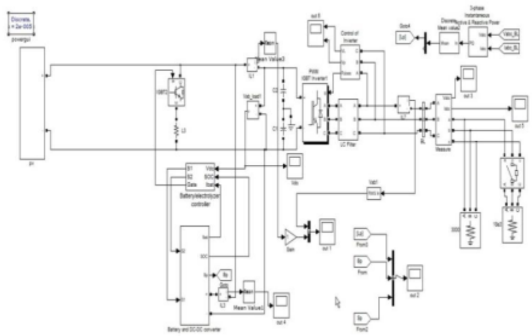

Fig.5.1Proposed Model

a) Case1:
Initialload -10000watt
Extraload - 4000watt
Battery Specifications:
1. 200volts,
2. 6.5AH
3. Nickel-Metal Hydrate Battery

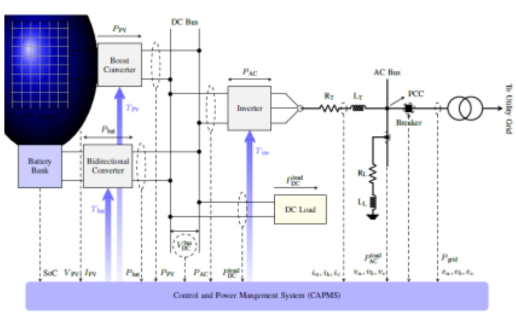

Fig 5.2 Simulation Model of CAPMS

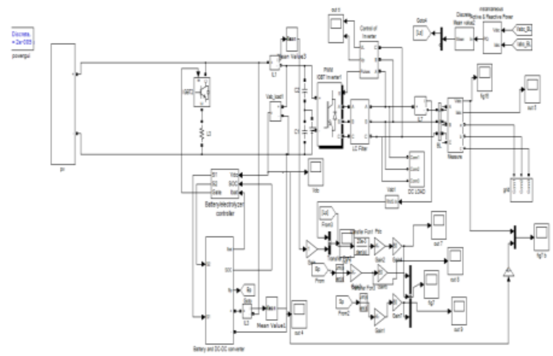

Fig 5.3 Simulation Model of Proposed System with ANN

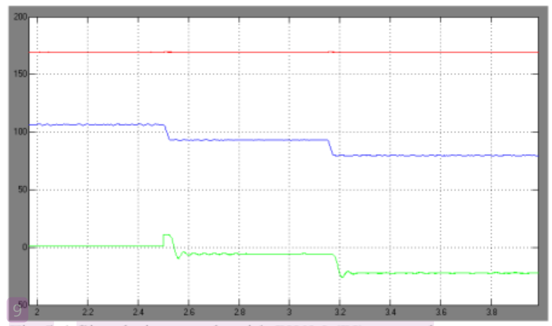

Fig 5.4 Simulation result with PWM (PI) control

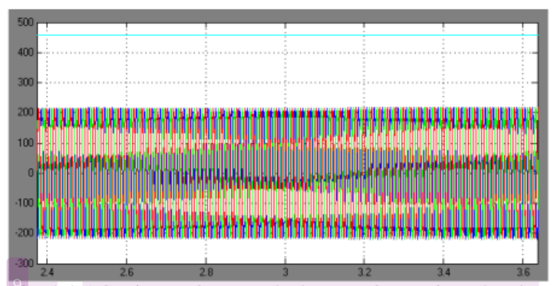

Fig 5.5 AC Line Voltage and Phase Voltage given by the inverter

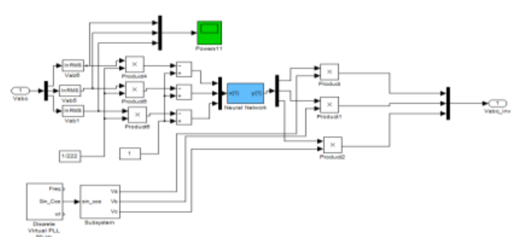

Fig 5.6 Inverter control with ANN control

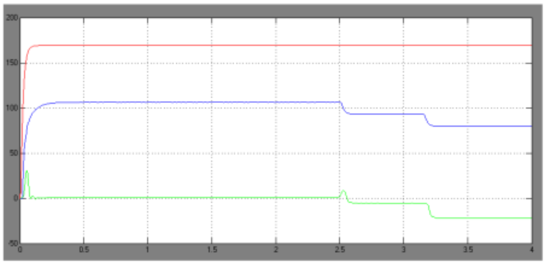

Fig 5.7 Simulation result with ANN control

VI. Conclusion

In this study, we offer a control and power management system for a PV battery system operating in isolated mode, using both DC and AC buses. The CAPMS, thus, has complete command over both the DC and AC buses while operating in islanded mode. The described CAPMS can efficiently and flexibly regulate power flows in converters of any size. As an added bonus, CAPMS keeps the system running smoothly even if the PV array goes down due to a defect or if the power fluctuates because to erratic irradiance. To regulate the hybrid system's power flow and the DC and AC bus voltages, the CAPMS optimises the reference values for each unit and transmits PWM (pulse width modulation) signals to the inverter and converter. Using PI and ANN controllers, the proposed CAPMS uses a tried-and-true technique. When compared to more traditional approaches, the outcomes produced by ANN controllers are superior.

References

[1] Omar, R. Rahim, N.A. "New Control Technique Applied in Dynamic Voltage Restorer for Voltage Sag Mitigation" Industrial Electronics and Applications, 2009. ICIEA 2009.4th IEEE Conference.

[2] Faisal, M.F. "Power Quality Management Program: TNB's Experience", Distribution Engineering, TNB 2005.

[3] Dinesh, Lakhinana, Harish Sesham, and Vasupalli Manoj. "Simulation of D-Statcom with hysteresis current controller for harmonic reduction." Emerging Trends in Electrical Engineering and Energy Management (ICETEEEM), 2012 International Conference on. IEEE, 2012.

[4] Wahab, S.W. Yusof, A.M. "Voltage Sag Mitigation Using Dynamic Voltage Restorer (DVR) System, ELEKTRIKA, 8(2),2006, 32-37. IEEE Standard Board (1995), "IEEE Std. 1159-1995", IEEE Recommended Practice for Monitoring Electric Power Quality". IEEE Inc. New York.

[5] Santhoshi, B.K., Mohanasundaram, K. & Kumar, L.A. ANN-based dynamic control and energy management of inverter and battery in a grid-tied hybrid renewable power system fed through switched Z-source converter. Electr Eng 103, 2285–2301 (2021).

[6] P. Boonchiam and N. Mithulananthan, "Understanding of Dynamic Voltage Restorers through MATLAB Simulation," Thammasat Int. J. Sc. Tech., Vol. 11, No. 3, July-Sept 2006.

[7] V. B. Venkateswaran and V. Manoj, "State estimation of power system containing FACTS Controller and PMU," 2015 IEEE 9th International Conference on Intelligent Systems and Control (ISCO), 2015, pp. 1-6, doi: 10.1109/ISCO.2015.7282281.

[8] Manohar, K., Durga, B., Manoj, V., & Chaitanya, D. K. (2011). Design Of Fuzzy Logic Controller In DC Link To Reduce Switching Losses In VSC Using MATLAB-SIMULINK. Journal Of Research in Recent Trends.

[9] Manoj, V., Manohar, K., & Prasad, B. D. (2012). Reduction of switching losses in VSC using DC link fuzzy logic controller Innovative Systems Design and Engineering ISSN, 2222-1727.

[10] Nise, N. S. "Control Systems Engineering" 5th Edition, John Wiley &Son, Inc. 2008

[11] Mattavelli, P. Rossetto, L. Spiazzi, G. Tenti, P. "General-Purpose Fuzzy Controller for DC-DC Converter" IEEE Transactions on Power Electronics, Vol. 12, No. 1, January 1997.

[12] Nemati, M. Yousefian, H. A. Afshari, R. "Recognize The Role of A DVR in Power Systems" International Journal of Recent Trends in Engineering, Vol 2, No. 7, November 2009.

[13] Benachaiba, C. Ferdi, B. "Voltage Quality Improvement Using DVR", Electrical Power Quality and Utilization, Journal Vol. XIV, No. 1, 2008.

[14] Dinesh, L., Harish, S., & Manoj, V. (2015). Simulation of UPQC-IG with adaptive neuro fuzzy controller (ANFIS) for power quality improvement. Int J Electr Eng, 10, 249-268.

[15] Moulali, S., Vijay Muni, T., Bala Subrahmanyam, Y., & Kesav, S. (2018). A flying capacitor multilevel topology for pv system with apod and pod pulse width modulation. Journal of Advanced Research in Dynamical and Control Systems, 10(2), 96–101.

[16] Srikanth, M., Vijay Muni, T., VishnuVardhan, M., & Somesh, D. (2018). Design and simulation of PV-wind hybrid energy system. Journal of Advanced Research in Dynamical and Control Systems, 10(4), 999–1005.

[17] Vijay Muni, T., Sai Sri Vidya, G., & Rini Susan, N. (2017). Dynamic modeling of hybrid power system with mppt under fast varying of solar radiation. International Journal of Applied Engineering Research, 12(Special Issue 1), 530–537.

[18] Sudharshan Reddy, K., Sai Priyanka, A., Dusarlapudi, K., & Vijay Muni, T. (2019). Fuzzy logic based iUPQC for grid voltage regulation at critical load bus. International Journal of Innovative Technology and Exploring Engineering, 8(5), 721–725.

[19] Ilahi, S., Ramaiah, M. S., Muni, T. V., & Naidu, K. G. (2018). Study the performance of solar PV array under partial shadow using DC-DC converter. Journal of Advanced Research in Dynamical and Control Systems, 10(4 Special Issue), 1006–1014.

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