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GRID VOLTAGE SYNCHRONIZATION FOR DISTRIBUTED GENERATION SYSTEMS UNDER GRID FAULT CONDITIONS

K.BHARGAVI [1] ***P.CHAITANYA*** [2]
[1] M.Tech Student, Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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ABSTRACT

The actual grid code requirements for the grid connection of distributed generation systems, mainly wind and photovoltaic (PV) systems are becoming very demanding. The transmission system operators (TSOs) are especially concerned about the low-voltage-ride-through requirements. Solutions based on the installation of STATCOMs and dynamic voltage regulators (DVRs), as well as on advanced control functionalities for the existing power converters of distributed generation plants, have contributed to enhance their response under faulty and distorted scenarios and, hence, to fulfill these requirements. In order to achieve satisfactory results with such systems, it is necessary to count on accurate and fast grid voltage synchronization algorithms, which are able to work under unbalanced and distorted conditions. This paper analyzes the synchronization capability of three advanced synchronization systems: the decoupled double synchronous reference frame phase-locked loop (PLL), the dual second order generalized integrator PLL, and the three-phase enhanced PLL, designed to work under such conditions. Although other systems based on frequency-locked loops have also been developed, PLLs have been chosen due to their link with *dq* 0 controllers. In the following, the different algorithms will be presented and discretized, and their performance will be tested in an experimental setup controlled in order to evaluate their accuracy and implementation features.

In this project decoupled double synchronous reference frame PLL (DDSRF PLL), the dual second order generalized integrator PLL (DSOGI PLL), and the three-phase enhanced PLL (3phEPLL).

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INTRODUCTION

Photovoltaic's is the field of technology and research related to the devices which directly convert sunlight into electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic effect involves the creation of voltage in a material upon exposure to electromagnetic radiation.

The photovoltaic effect was first noted by a French physicist, Edmund Becquerel, in 1839, who found that certain materials would produce small amounts of electric current when exposed to light. In 1905, Albert Einstein described the nature of light and the photoelectric effect on which photovoltaic technology is based, for which he later won a Nobel prize in physics. The first photovoltaic module was built by Bell Laboratories in 1954. It was billed as a solar battery and was mostly just a curiosity as it was too expensive to gain widespread use. In the 1960s, the space industry began to make the first serious use of the technology to provide power aboard spacecraft. Through the space programs, the technology advanced, its reliability was established, and the cost began to decline. During the energy crisis in the 1970s, photovoltaic technology gained recognition as a source of power for non-space applications.

Solar cell:

The photovoltaic effect was first reported by Edmund Becquerel in 1839 when he observed that the action of light on a silver coated platinum electrode immersed in electrolyte produced an electric current. Forty years later the first solid state photovoltaic devices were constructed by workers investigating the recently discovered photoconductivity of selenium. In 1876 William Adams and Richard Day found that a photocurrent could be produced in a sample of selenium when contacted by two heated platinum contacts. The photovoltaic action of the selenium differed from its photoconductive action in that a current was produced spontaneously by the action of light.

Electrical connection of the cells:

The electrical output of a single cell is dependent on the design of the device and the Semi-conductor material(s) chosen, but is usually insufficient for most applications. In order to provide the appropriate quantity of electrical power, a number of cells must be electrically connected. There are two basic connection methods: series connection, in which the top contact of each cell is connected to the back contact of the next cell in the sequence, and parallel

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connection, in which all the top contacts are connected together, as are all the bottom contacts. In both cases, this results in just two electrical connection points for the group of cells.

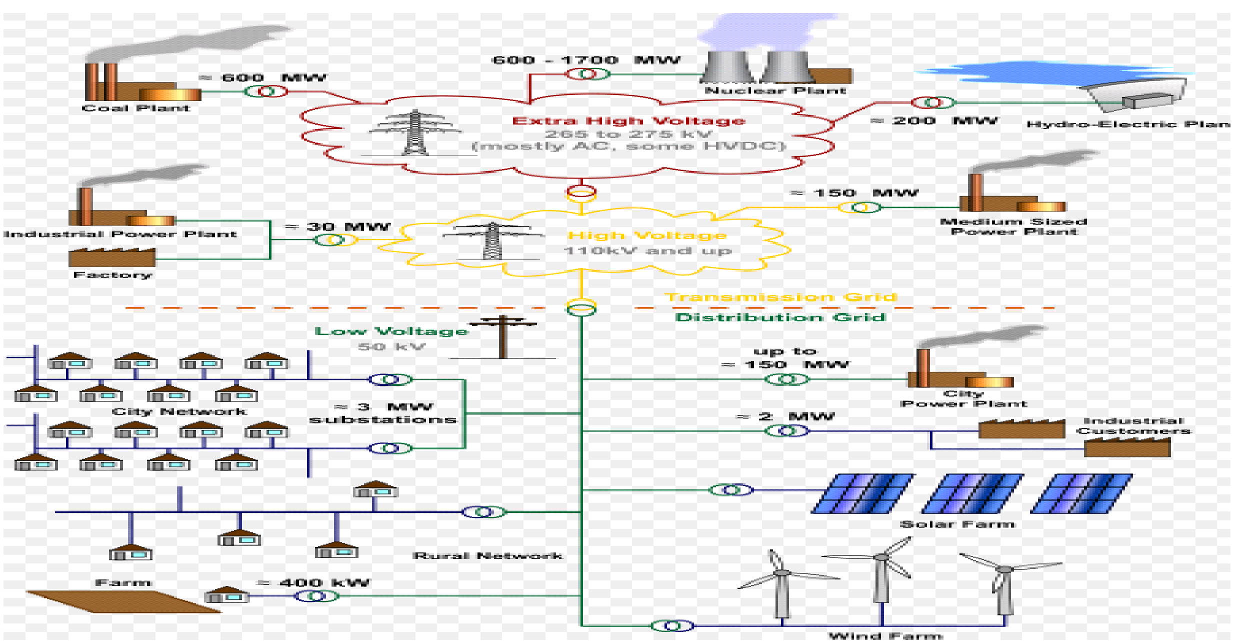
ELECTRICAL GRID:

An electrical grid is an interconnected network for delivering electricity from suppliers to consumers.

When referring to the power industry, grid is a term used for an electricity network which may support all or some of the following four distinct operations:

1. Electricity generation
2. Electric power transmission
3. Electricity distribution
4. Electricity control

The sense of grid is as a network, and should not be taken to imply a particular physical layout, or breadth. Grid may be used to refer to an entire continent's electrical network, a regional transmission network or may be used to describe a sub network such as a local utility's transmission grid or distribution grid.



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CONTROLLER

PI controller

The general block diagram of the PI speed controller is shown in Figure 2 [14].

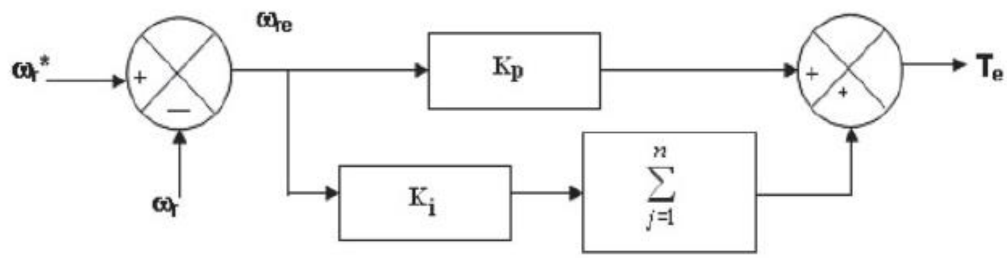

FIG. 2. Block diagram of PI speed controller.

The output

Of the speed controller (torque command) at n-th instant is expressed as follows:

Te (n)=Te(n−1)+Kp_ωre(n)+Kiωre(n) (10)

Where Te (n) is the torque output of the controller at the n-th instant, and Kp and Ki the proportional and integral gain constants, respectively.

A limit of the torque command is imposed as

$$T_{e(n+1)} = \begin{cases} T_{e\max} & \text{for} \quad T_{e(n+1)} \geq T_{e\max} \\ -T_{e\max} & \text{for} \quad T_{e(n+1)} \leq -T_{e\max} \end{cases}$$

The gains of PI controller shown in (10) can be selected by many methods such as trial and error method, Ziegler–Nichols method and evolutionary techniques-based searching. The numerical values of these controller gains depend on the ratings of the motor.

SIGNALS & DATA TRANSFER:

In complicated block diagrams, there may arise the need to transfer data from one portion to another portion of the block. They may be in different subsystems. That signal could be dumped into a goto block, which is used to send signals from one subsystem to another.

Multiplexing helps us remove clutter due to excessive connectors, and makes matrix(column/row) visualization easier.

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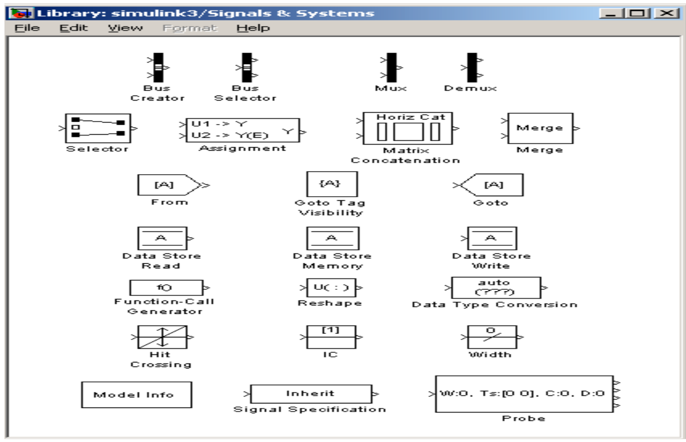

fig 4.7 signals and systems

Making subsystems

Drag a subsystem from the Simulink Library Browser and place it in the parent block where you would like to hide the code. The type of subsystem depends on the purpose of the block. In general one will use the standard subsystem but other subsystems can be chosen. For instance, the subsystem can be a triggered block, which is enabled only when a trigger signal is received.

Open (double click) the subsystem and create input / output PORTS, which transfer signals into and out of the subsystem. The input and output ports are created by dragging them from the Sources and Sinks directories respectively. When ports are created in the subsystem, they automatically create ports on the external (parent) block. This allows for connecting the appropriate signals from the parent block to the subsystem.

Setting simulation parameters:

Running a simulation in the computer always requires a numerical technique to solve a differential equation. The system can be simulated as a continuous system or a discrete system based on the blocks inside. The simulation start and stop time can be specified. In case of variable step size, the smallest and largest step size can be specified. A Fixed step size is recommended and it allows for indexing time to a precise number of points, thus controlling the size of the data vector. Simulation step size must be decided based on the dynamics of the system. A thermal process may warrant a step size of a few seconds, but a DC motor in the system may be quite fast and may require a step size of a few milliseconds.

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SIMULATION RESULTS

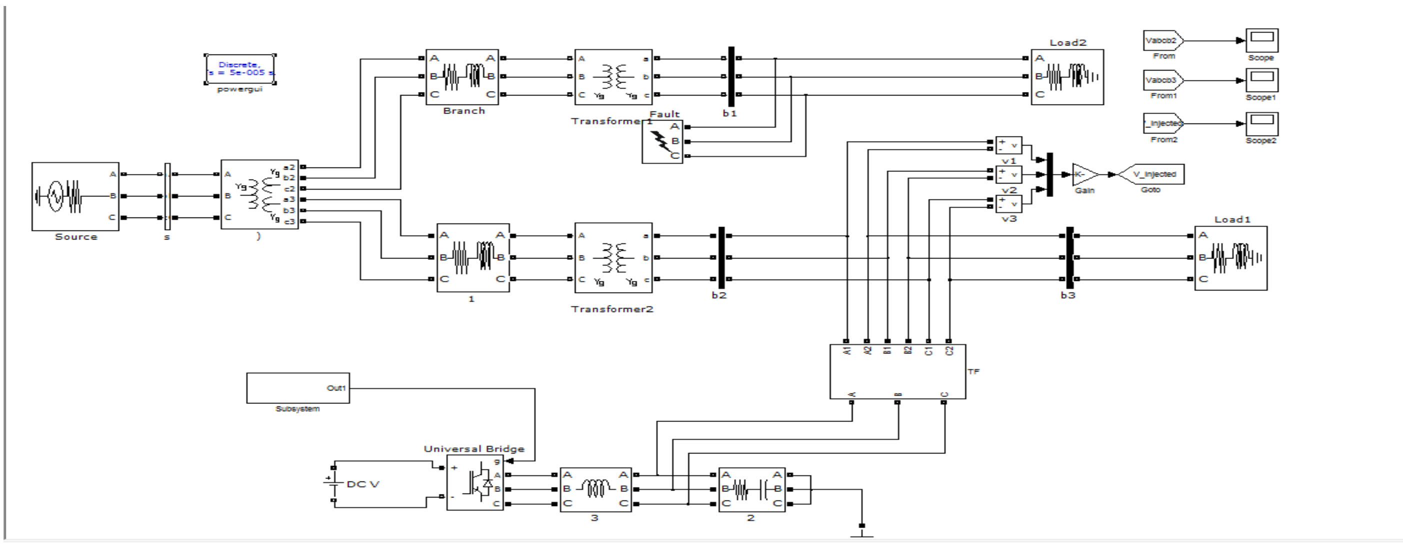

Fig. MATLB/SIMULINK diagram of proposed system single phase sag

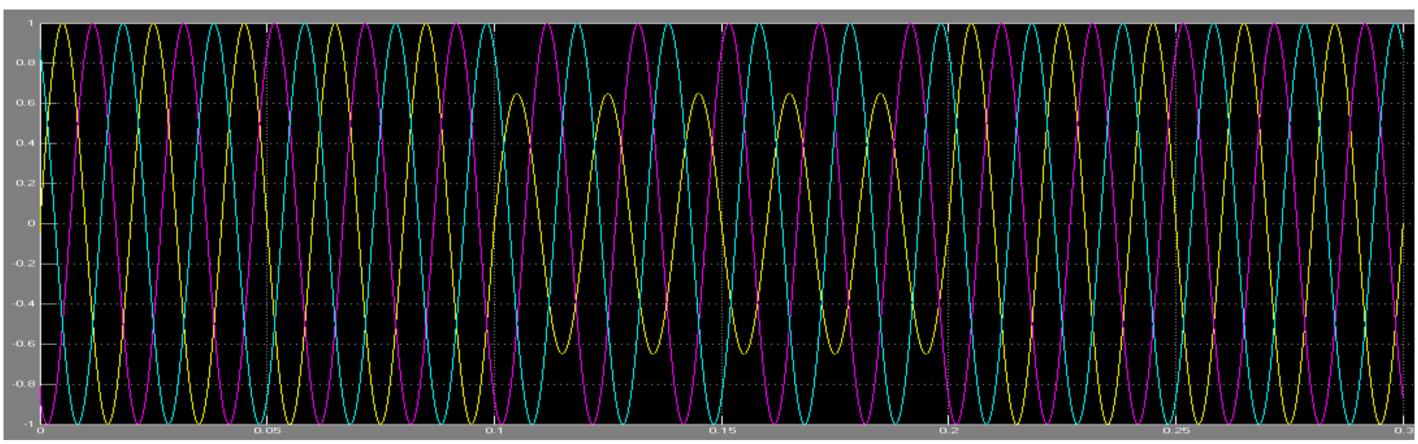

Fig. bus 2 voltage

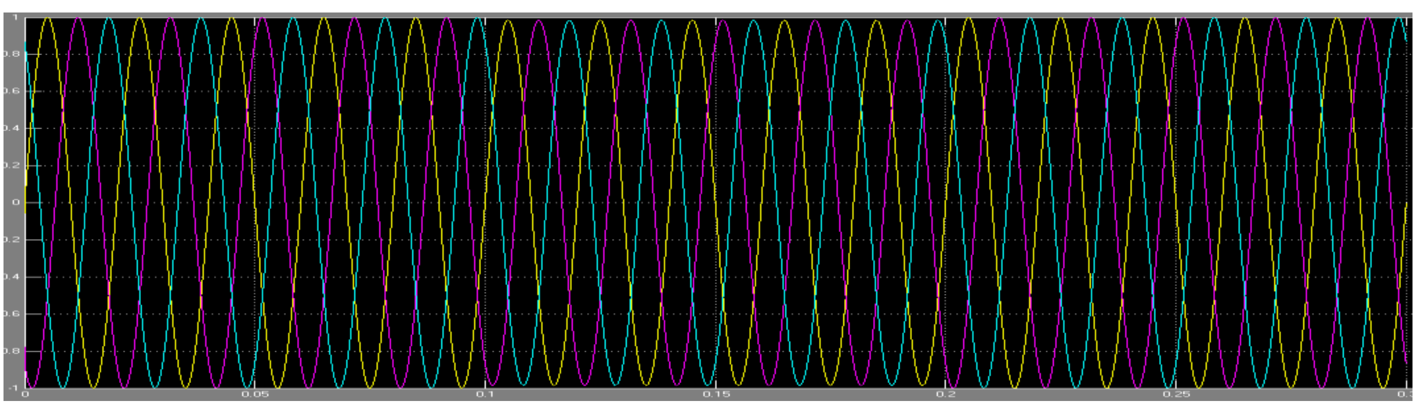

Fig.bus 3 voltage

CONCLUSION

This paper studied the behavior of three advanced grid synchronization systems. Their structures have been presented, and their discrete algorithms have been detailed. Moreover, their performances have been tested in an experimental setup, where these algorithms have been digitally implemented in a commercial DSP, allowing proof of their satisfactory response under balanced and distorted grid conditions. The DDSRF PLL and the DSOGI PLL allow estimating the ISCs of a three-phase system working in the $\alpha\beta$ reference frame, while the 3phEPLL uses the "*abc*" reference frame, thus working with three variables. As has been shown, this feature simplifies the structure of the DSOGI PLL and the DDSRF PLL, which allows reducing the computational burden, as compared to the 3phEPLL, without affecting its performance

REFERENCES

[1] A. Zervos and C. Kjaer, Pure Power: Wind Energy Scenarios for 2030. Brussels, Belgium: European Wind Energy Association (EWEA), Apr. 2008.

[2] e-on, "Grid code—High and extra high voltage," Bayreuth, Germany. Apr. 2006

[3] PO-12.3 Requisitos de Respuesta Frente a Huecos de Tension de las Instalaciones Eolicas, Comisión Nacional de Energía, Madrid, Spain, Oct. 2006.

[4] IEEE Standard for Interconnecting Distributed Resources With Electric Power Systems, IEEE Std. 1547-2003, 2003.

[5] The Grid Code: Revision 31, National Grid Electricity Transmission, Warwick, U.K., Oct. 2008, no. 3.

[6] Elkraft System og Eltra, "Vindmuller tilsluttet net med sprindinger under 100 kv," Fredericia, Denmark, TF3.2.6, 2004.

[7] M. Tsili and S. Papathanassiou, "A review of grid code technical requirements for wind farms," IET Renew. Power Gen., vol. 3, no. 3, pp. 308–332, Sep. 2009.

[8] F. Iov, A. Hansen, P. Sorensen, and N. Cutululis, "Mapping of Grid Faults and Grid Codes," Risø Nat. Lab., Roskilde, Denmark, Tech. Rep. Risoe- R-1617, 2007.

[9] A. Luna, P. Rodriguez, R. Teodorescu, and F. Blaabjerg, "Low voltage ride through strategies for SCIG wind turbines in distributed power generation systems," in Proc. IEEE PESC, Jun. 15–19, 2008, no. 1, pp. 2333–2339.

[10] D. Xiang, L. Ran, P. J. Tavner, and S. Yang, "Control of a doubly fed induction generator in a wind turbine during grid fault ride-through," IEEE Trans. Energy Convers., vol. 21, no. 3, pp. 652–662, Sep. 2006.

[11] J. Morren and S. W. H. de Haan, "Ridethrough of wind turbines with doubly-fed induction generator during a voltage dip," IEEE Trans. Energy Convers., vol. 20, no. 2, pp. 435–441, Jun. 2005.

[12] M. Molinas, J. A. Suul, and T. Undeland, "Low voltage ride through of wind farms with cage generators: STATCOM versus SVC," IEEE Trans. Power Electron., vol. 23, no. 3, pp. 1104–1117, May 2008.

[13] K. Li, J. Liu, Z. Wang, and B. Wei, "Strategies and operating point optimization of STATCOM control for voltage unbalance mitigation in

three-phase three-wire systems," IEEE Trans. Power Del., vol. 22, no. 1, pp. 413–422, Jan. 2007.

[14] J. A. Barrena, L. Marroyo, M. A. R. Vidal, and J. R. T. Apraiz, "Individual voltage balancing strategy for PWM cascaded H-bridge converterbased STATCOM," IEEE Trans. Ind. Electron., vol. 55, no. 1, pp. 21–29, Jan. 2008.

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ANTI-ISLANDING PROTECTION OF DISTRIBUTED GENERATION : A REVIEW

D.Neelima Rani [1] M.Uday Kiran [2]
[1] M.Tech Student, Dept of EEE, RK College of Engineering and Technology,Kethanakonda,Amaravathi, A.P., India
[2] Associate Professor, Dept of EEE, RK College of Engineering and Technology,Kethanakonda,Amaravathi, A.P., India

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ABSTRACT

Due to the variety of distribution generation (DG) sizes and technologies connecting to distribution networks, and the concerns associated with out-of phase reclosing, anti-islanding continues to be an issue where no clear solution exists. This paper presents an auto ground approach that was proposed in the context of an IEEE working group on best practices for DG protection. A prototype system was constructed using standard distribution apparatus and a recloser controller, and it was tested on the utility's distribution test line. Results show that the anti-islanding detection time is approximately a cycle longer than the delay associated with application of the auto ground. Once the auto ground was applied, the DG was disconnected within 1 cycle on over current protection. The solution is inherently scalable, applicable to all DG types, is configurable to various reclosing practices and does not require additional equipment or settings changes at the producer's site.

INTRODUCTION

THE integration of distributed generator has grown over the past decade and some utilities have reached very high penetration levels. Despite this experience the debate between utilities and private producers still rages on a number of technical issues. Possibly the most contentious is that of anti-islanding protection [1]–[3], where a reliable high speed communication based transfer-trip scheme and a local passive approach that relies only on the measurements of the voltage waveform represent, respectively, the most conservative and most liberal approaches. The anti-islanding and line protection are the two fundamental protection requirements that need to be met by all distributed generation (DG) installations, as detailed in the DG interconnection standards [1], [2]. Line protection consists of being able to detect all faults on the distribution feeder to which the DG is connected, while not disconnecting for faults on an adjacent feeder. Generally over current relaying is sufficient to meet this requirement, although in power electronic based generators, other strategies may be necessary due to the limited contribution to short circuits by these installations. Anti-islanding has been the subject of a number of studies [3]–[9]. These approaches can be typically divided into the following two classifications: passive approaches (using the local measurements of voltage and current, and variables derived from using these quantities, to delineate between islanding and grid connected operation) and active approaches (whereby the DG perturbs either the grid voltage or frequency, an approach intended to be benign while the grid is present, and to destabilize the system when the substation is open. A third approach is in fact a variant on communication based approaches, whereby using thyristor valves connected to ground, a disturbance is periodically injected at the substation- its presence at the DG's location indicates a normal condition, whereas its absence is indicative of an islanded grid [10], [11]. Wang et al. have also suggested these thyristor based devices for fault identification in [12]. Similar to active islanding techniques, this approach could be criticized alone on the impact on power quality. Additionally, in noisy grids or feeders that are particularly long, the issue of nuisance tripping is an issue. This paper proposes an approach to anti-islanding protection that is based on applying a three-phase short circuit to the islanded distribution system just prior to reclosing or re-energization. Section II provides the theory and methodology for construction of this utility-owned equipment. Section III presents the experimental set-up and results, and we conclude with a summary of various practical considerations.

ISLANDING

Islanding is the situation in which a distribution system becomes electrically isolated from the remainder of the power system, yet continues to be energized by DG connected to it. As shown in the figure. Traditionally, a distribution system doesn't have any active power generating source in it and it doesn't get power in case of a fault in transmission line upstream but with DG, this presumption is no longer valid. Current practice is that almost all utilities require DG to be disconnected from the grid as soon as possible in case of islanding. IEEE 929-1988 standard requires the disconnection of DG once it is islanded .Islanding can be intentional or Non intentional. During maintenance service on the utility grid, the shut down of the utility grid may cause islanding of generators. As the loss of the grid is voluntary the islanding is known. Non-intentional islanding, caused by accidental shut down of the grid is of more interest. As there are various issues with unintentional islanding. IEEE 1547-2003 standard stipulates a maximum delay of 2 seconds for detection of an unintentional island and all DGs ceasing to energize the distribution system,

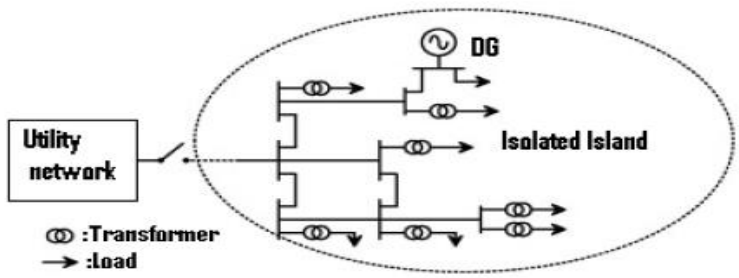


Figure 1.4: Scenario of Islanding operation

ISSUES WITH ISLANDING:

Although there are some benefits of islanding operation there are some drawbacks as well. Some of them are as follows:

- Line worker safety can be threatened by DG sources feeding a system after primary sources have been opened and tagged out.
- The voltage and frequency may not be maintained within a standard permissible level. Islanded system may be inadequately grounded by the DG interconnection.
- Instantaneous reclosing could result in out of phase reclosing of DG. As a result of which large mechanical torques and currents are created that can damage the generators or prime movers [26] Also, transients are created, which are potentially damaging to utility and other customer equipment. Out of phase reclosing, if occurs at a voltage peak, will generate a very severe capacitive switching transient and in a lightly damped system, the crest over-voltage can approach three times rated voltage.
- Various risks resulting from this include the degradation of the electric components as a consequence of voltage& frequency drifts.

Due to these reasons, it is very important to detect the islanding quickly and accurately.

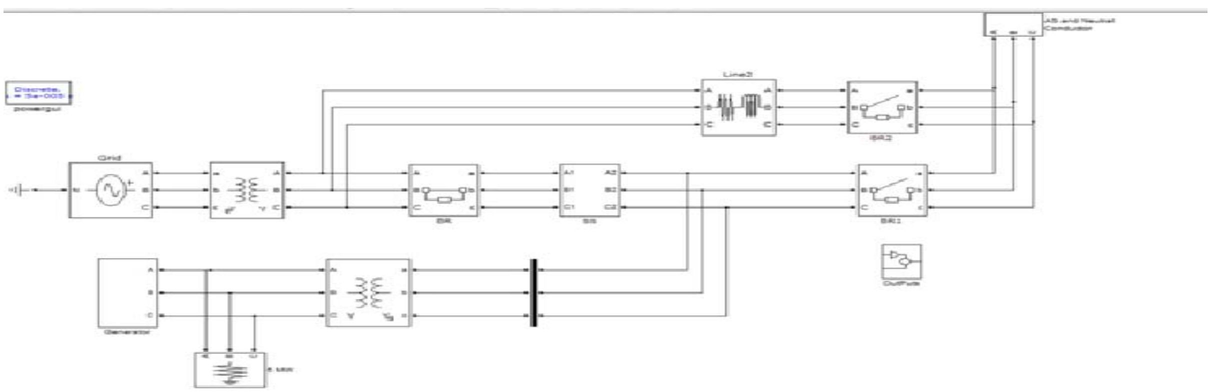
OBJECTIVES:

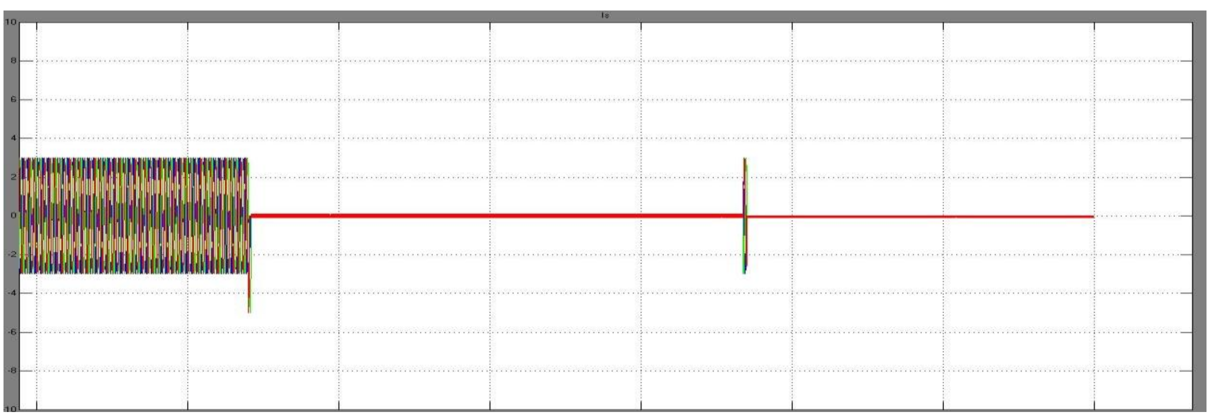
The objective of this thesis is to develop an islanding detection technique which works effectively in Power distribution network with multiple DG interface.

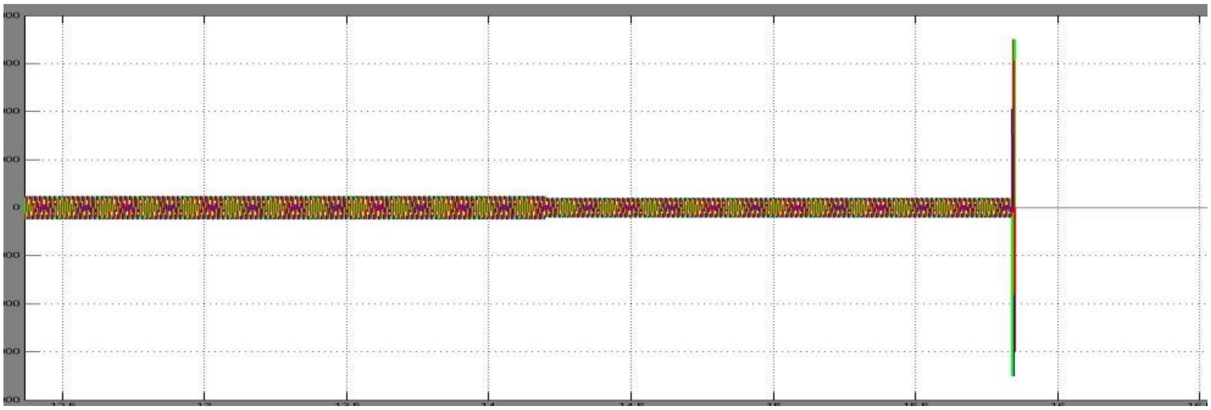
The proposed research investigates the performance of the negative sequence voltage components for islanding detection.

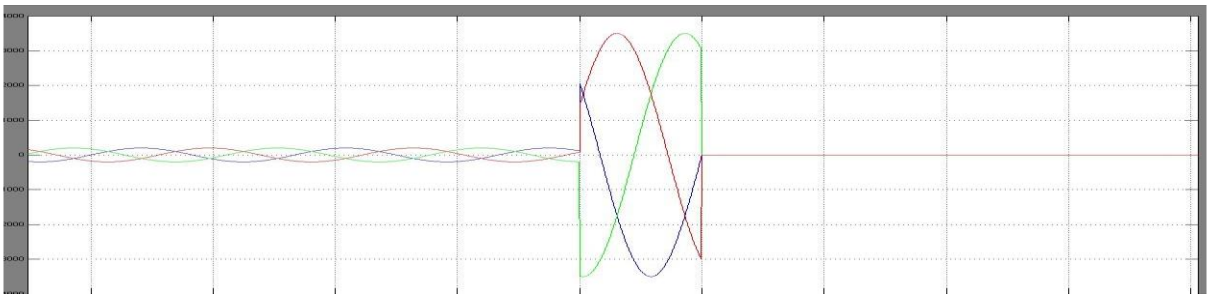
As negative sequence components are the key parameters for detecting unbalanced conditions in the power systems, the same has been considered for islanding detection during the islanding process. The Change in energy and standard deviations of the d1 Wavelet coefficients of the negative sequence voltage and current detects the islanding conditions accurately. Another important parameter such as negative sequence impedance has been measured at the target DG location for islanding detection. Thus this thesis aims to derive a new technique for islanding detection which has edge over the existing conventional techniques.

MATLAB/SIMULINK CIRCUIT WITH RESULTS









CONCLUSION

This paper has presented a scalable, low cost approach for Anti-islanding protection of distributed generation, using a Utility owned and operated system referred to as an autoground. The design of the system and its control were presented and a prototype system was constructed using standard distribution utility equipment. Testing results were presented for symmetrical and asymmetrical operation of the system. In all cases, the DG's over current protection isolated the generator from the system in less than two cycles. The peak torque observed exceeded momentarily around 4 times the pre-fault value. Using this anti-islanding protection scheme, a renewable Application is presented for better distributed generation. And the entire system is observed with renewable application also. The results validated the concept for a single generator based on a synchronous machine, while future work will study its applicability to systems with large numbers of DG, including those with power electronic interfaces. The solution shows promise due to its relatively low cost and inherent scalability.

REFERENCES

[1] Requirements for the Interconnection of Distributed Generati
on to the Hydro-Québec Medium-Voltage Distribution System [Online]. Available:http://www.hydroquebec.com/transenergie/fr/commerce/racco
rdement_distribution.html

[2] "IEEE application guide for IEEE std 1547, IEEE standard for interconnecting distributed resources with electric power systems," *IEEE*

Std. 1547.2–2008, pp. 1–207, Apr. 2009.

[3] J.Mulhausen, J.Schaefer, M.Mynam, A. Guzman, and M. Donolo, “Anti-islanding today, successful islanding in the future,” in *Proc. Protective Relay Engineers*, , Mar. 29–Apr. 1, 2010, pp. 1–8.

[4] R.J.Best, D.J.Morrow, D.M.Laverty, andP.A.Crossley,“Synchrophasor Broadcast over internet protocol for distributed generator synchronization,” *IEEE Trans. Power Del.*,vol. 25, no. 4, pp.2835–2841, Oct. 2010.

[5] F. Katiraei, A. Foss, C. Abbey, and B. Strehler, “Dynamic analysis and field verification of an innovative anti -islanding protection scheme based on directional reactive power detection,” in *Proc. 2007 IEEE Elect. Power Conf.*, Canada, Oct. 25–26, 2007, pp. 183–188.

[6] C.AbbeyandP.Venne,“Field validation of a reverse reactive powerrelay for anti-islanding protection of a synchronous generator,” in *Proc.CIGRE Canada Conf. Power Syst.*,Sep.2011.

[7] Vieira, J. C. M. Vieira, W. Freitas, W. Xu, and A. Morelato, “Efficient Coordination of ROCOF and frequency relays for distributed generation Protection by using the application region,” *IEEE Trans. Power Del.*, vol. 21, no. 4, pp. 1878–1884, Oct. 2006.

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POWER QUALITY IMPROVEMENT BY USING FUZZY BASED GRID-CONNECTED DUAL VOLTAGE SOURCE INVERTER

K.PRAKASH [1] ***B.R.NARENDRA*** [2]
[1] M.Tech Student, Dept of EEE, RK College of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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ABSTRACT

This paper presents a dual voltage source inverter (DVSI) scheme to enhance the power quality and reliability of the microgrid system. The proposed scheme is comprised of two inverters, which enables the microgrid to exchange power generated by the distributed energy resources (DERs) and also to compensate the local unbalanced and nonlinear load. The control algorithms are developed based on instantaneous symmetrical component theory (ISCT) to operate DVSI in grid sharing and grid injecting modes. The proposed scheme has increased reliability, lower bandwidth requirement of the main inverter, lower cost due to reduction in filter size, and better utilization of microgrid power while using reduced dc-link voltage rating for the main inverter. These features make the DVSI scheme a promising option for microgrid supplying sensitive loads. The topology and control algorithm are validated through extensive simulation and experimental results.

INTRODUCTION

Technological progress and environmental concerns drive the power system to a paradigm shift with more renewable energy sources integrated to the network by means of distributed generation (DG). These DG units with coordinated control of local generation and storage facilities form a microgrid. In a microgrid, power from different renewable energy sources such as fuel cells, photovoltaic (PV) systems, and wind energy systems are interfaced to grid and loads using power electronic converters. A grid interactive inverter plays an important role in exchanging power from the microgrid to the grid and the connected load. This microgrid inverter can either work in a grid sharing mode while supplying a part of local load or in grid injecting mode, by injecting power to the main grid.

Maintaining power quality is another important aspect which has to be addressed while the microgrid system is connected to the main grid. The proliferation of power electronics devices and electrical loads with unbalanced nonlinear currents has degraded the power quality in the power distribution network. Moreover, if there is a considerable amount of feeder impedance in the distribution systems, the propagation of these harmonic currents distorts the voltage at the point of common coupling (PCC). At the same instant, industry automation has reached to a very high level of sophistication, where plants like automobile manufacturing units, chemical factories, and semiconductor industries require clean power. For these applications, it is essential to compensate nonlinear and unbalanced load currents .

Power Quality Problems

This IEEE defined power quality disturbances shown in this paper have been organized into seven categories based on wave shape:

1. Transients.
2. Interruptions.
3. Sag / under voltage.
4. Swell / Overvoltage.
5. Waveform distortion.
6. Voltage fluctuations.
7. Frequency variations.

Transients:

Potentially the most damaging type of power disturbance, transients fall into two subcategories:

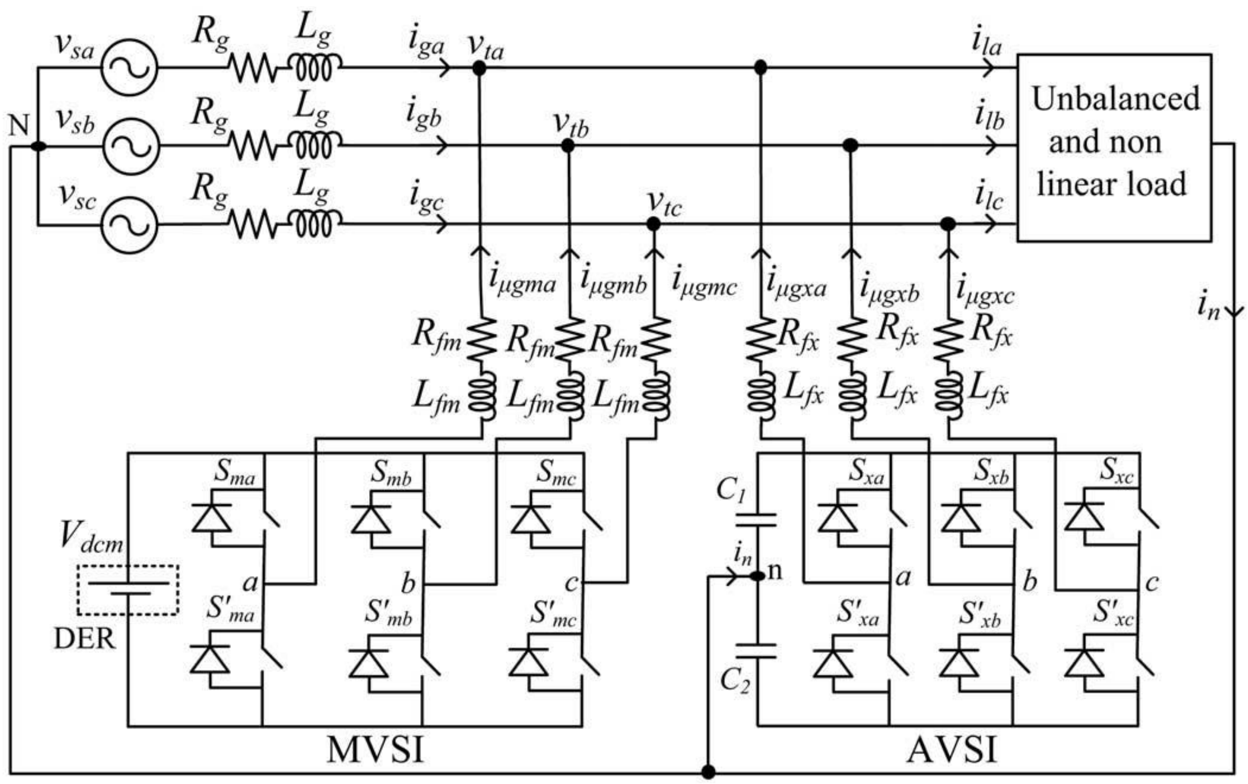
1. Impulsive
2. Oscillatory

PROPOSED SYSTEM

DUAL VOLTAGE SOURCE INVERTER

System Topology

The proposed DVSI topology is shown in Fig. It consists of a neutral point clamped (NPC) inverter to realize AVSI and a three-leg inverter for MVSI [18]. These are connected to grid at the PCC and supplying a nonlinear and unbalanced load. The function of the AVSI is to compensate the reactive, harmonics, and unbalance components in load currents. Here, load currents in three phases are represented by *ila*, *ilb*, and *ilc*, respectively. Also, *ig*(*abc*), *iμgm*(*abc*), and *iμgx*(*abc*) show grid currents, MVSI currents, and AVSI currents in three phases, respectively. The dc link of the AVSI utilizes a split capacitor topology, with two capacitors *C*1 and *C*2. The MVSI delivers the available power at distributed energy resource (DER) to grid. The DER can be a dc source or an ac source with rectifier coupled to dc link. Usually, renewable energy sources like fuel cell and PV generate power at variable low dc voltage, while the variable speed wind turbines generate power at variable ac voltage. Therefore, the power generated from these sources use a power conditioning stage before it is connected to the input of MVSI. In this study, DER is being represented as a dc source. An inductor filter is used to eliminate the high-frequency switching components generated due to the switching of power electronic switches in the inverters.The system considered in this study is assumed to have some amount of feeder resistance *Rg* and inductance *Lg*. Due to the presence of this feeder impedance, PCC voltage is affected with harmonics. Section III describes the extraction of fundamental positive sequence of PCC voltages and control strategy for the reference current generation of two inverters in DVSI scheme.



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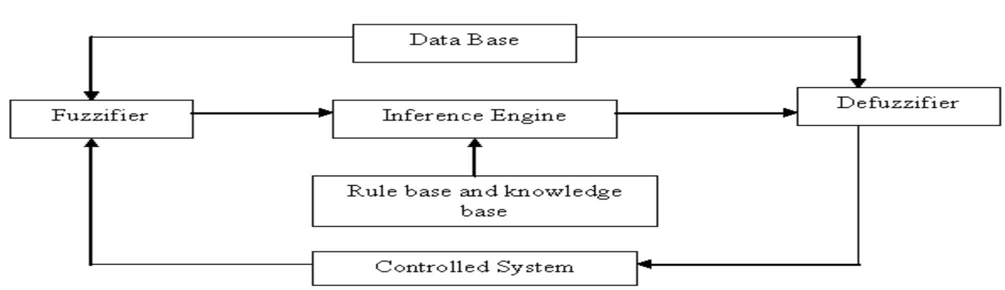
FUZZY LOGIC CONTROLLER

Introduction

Most of the real-world processes that require automatic control are non-linear in nature. That is, their parameter values alter as the operating point changes over time or both. In case of conventional control schemes, as they are linear, a controller can only be tuned to give good performance at a particular operating point or for a limited period of time. The controller needs to be retuned if the operating point changes with time. This necessity to retune has driven the need for adaptive controllers that can automatically retune themselves to match the current process characteristics. Analytical techniques may fail to give a precise solution in a controlling process. Where as an expert or a skilled human operator, without the knowledge of their underlying dynamics of a system can control a system more successfully. So it is worth simulating the controlling strategy based upon intuition and experience can be considered a heuristic decision or rule of thumb decision. This can be possible through the Fuzzy controller.

Fuzzy Controller Model

Fuzzy modeling is the method of describing the characteristics of a system using fuzzy inference rules. The method has a distinguishing feature in that it can express linguistically complex non-linear system. It is however, very hand to identify the rules and tune the membership functions of the reasoning. Fuzzy Controllers are normally built with fuzzy rules. These fuzzy rules are obtained either from domain experts or by observing the people who are currently doing the control. The membership functions for the fuzzy sets will be derive from the information available from the domain experts and/or observed control actions. The building of such rules and membership functions require tuning. That is, performance of the controller must be measured and the membership functions and rules adjusted based upon the performance. This process will be time consuming. The basic configuration of Fuzzy logic control based as shown in Fig. 4.1 consists of four main parts i.e. (i) Fuzzification, (ii) knowledge base, (iii) Inference Engine and (iv) Defuzzification.



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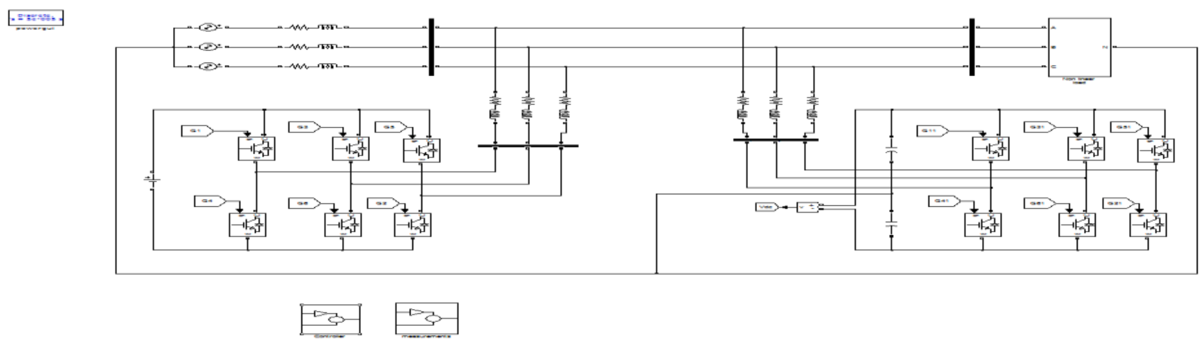
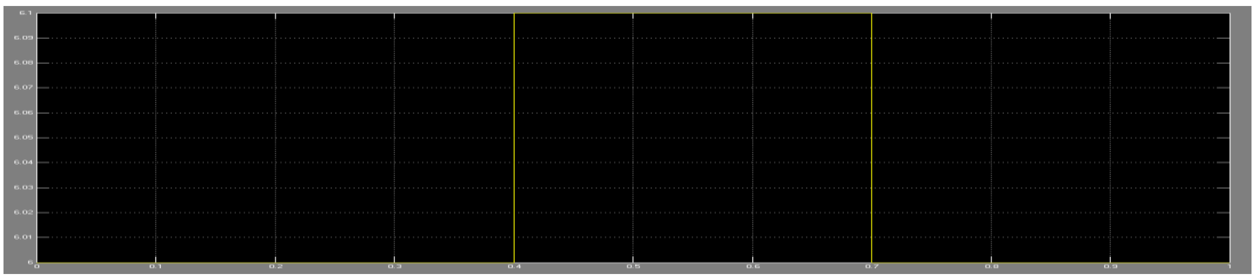
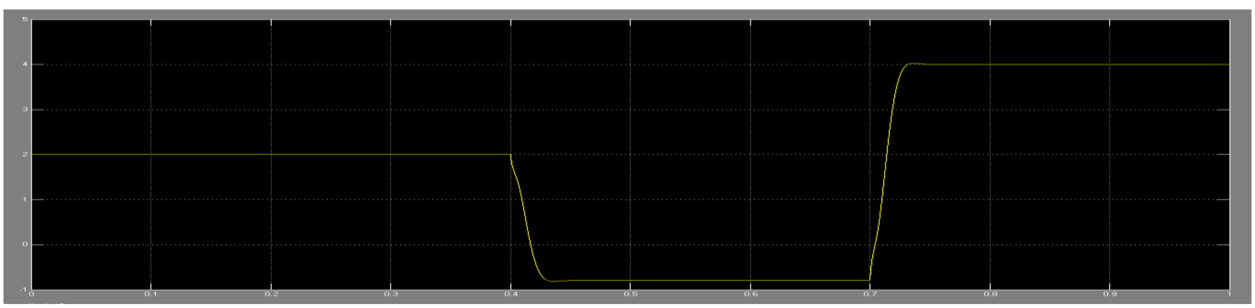
MATLAB/SIMULATION RESULTS



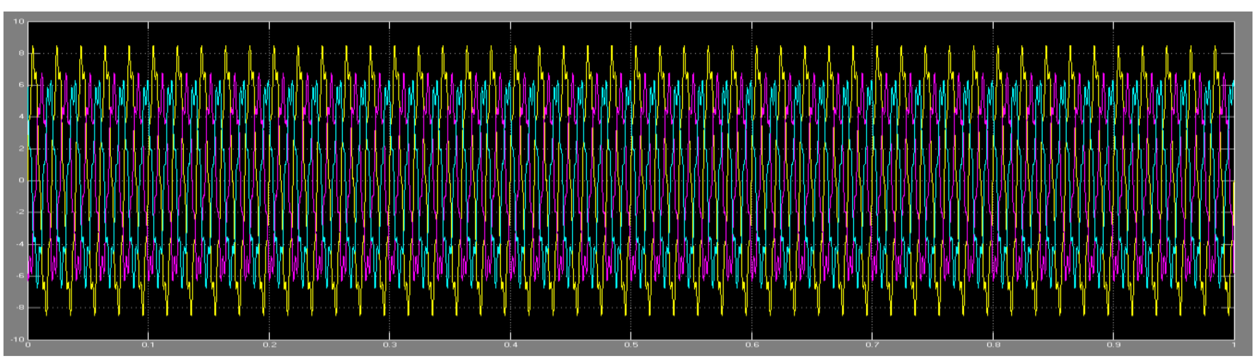
Matlab/simulink diagram of proposed DVSI system



load active power



Active power supplied by grid



11AVSI currents

CONCLUSION

A DVSI scheme is proposed for microgrid systems with enhanced power quality. Control algorithms are developed to generate reference currents for DVSI using ISCT. The proposed scheme has the capability to exchange power from distributed generators (DGs) and also to compensate the local unbalanced and nonlinear load. The performance of the proposed scheme has been validated through simulation and experimental studies. As compared to a single inverter with multifunctional capabilities, a DVSI has many advantages such as, increased reliability, lower cost due to the reduction in filter size, and more utilization of inverter capacity to inject real power from DGs to microgrid. Moreover, the use of three-phase, threewire topology for the main inverter reduces the dc-link voltage requirement. Thus, a DVSI scheme is a suitable interfacing option for microgrid supplying sensitive loads.

REFERENCES

[1] A. Kahrobaeian and Y.-R. Mohamed, “Interactive distributed generation interface for flexible micro-grid operation in smart distribution systems,” IEEE Trans. Sustain. Energy, vol. 3, no. 2, pp. 295–305, Apr. 2012.

[2] N. R. Tummuru, M. K. Mishra, and S. Srinivas, “Multifunctional VSC controlled microgrid using instantaneous symmetrical components theory,” IEEE Trans. Sustain. Energy, vol. 5, no. 1, pp. 313–322, Jan.2014.

[3] Y. Zhang, N. Gatsis, and G. Giannakis, “Robust energy management for microgrids with high-penetration renewables,” IEEE Trans. Sustain.Energy, vol. 4, no. 4, pp. 944–953, Oct. 2013.

[4] R. Majumder, A. Ghosh, G. Ledwich, and F. Zare, “Load sharing and power quality enhanced operation of a distributed microgrid,” IET Renewable Power Gener., vol. 3, no. 2, pp. 109–119, Jun. 2009.

[5] J. Guerrero, P. C. Loh, T.-L. Lee, and M. Chandorkar, “Advanced control architectures for intelligent microgrids—Part II: Power quality, energy storage, and ac/dc microgrids,” IEEE Trans. Ind. Electron., vol. 60, no. 4,pp. 1263–1270, Dec. 2013.

[6] Y. Li, D. Vilathgamuwa, and P. C. Loh, “Microgrid power quality enhancement using a three-phase four-wire grid-interfacing compensator,” IEEE Trans. Ind. Appl., vol. 41, no. 6, pp. 1707–1719, Nov. 2005.

[7] M. Schonardie, R. Coelho, R. Schweitzer, and D. Martins, “Control of the active and reactive power using dq0 transformation in a three-phase grid-connected PV system,” in Proc. IEEE Int. Symp. Ind. Electron., May 2012, pp. 264–269.

[8] R. S. Bajpai and R. Gupta, “Voltage and power flow control of grid connected wind generation system using DSTATCOM,” in Proc. IEEE Power Energy Soc. Gen. Meeting—Convers. Del. Elect. Energy 21st Century, Jul. 2008, pp. 1–6.

[9] M. Singh, V. Khadkikar, A. Chandra, and R. Varma, “Grid interconnection of renewable energy sources at the distribution level with power-quality improvement features,” IEEE Trans. Power Del., vol. 26, no. 1, pp. 307–315, Jan. 2011.

[10] H.-G. Yeh, D. Gayme, and S. Low, “Adaptive VAR control for distribution circuits with photovoltaic generators,” IEEE Trans. Power Syst., vol. 27, no. 3, pp. 1656–1663, Aug. 2012.

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CHARGE SYSTEM ON ENERGY-SAVING CONFIGURATION BYSMART CHARGE MANAGEMENT USING PHOTOVOLTAIC BURP : A STUDY

N.Avinash [1] B.Veerababu [2]
[1] M.Tech Student, Dept of EEE, RK College of Engineering and Technology,Kethanakonda,Amaravathi, A.P., India
[2] Assistant Professor, Dept of EEE, RK College of Engineering and Technology,Kethanakonda,Amaravathi, A.P., India

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ABSTRACT

To achieve pulse charge using direct photovoltaic (PV) energy, it is necessary to keep the energy supply from PV module continuous and optimum, especially to prevent energy supply from interrupting during the pulse break period. To perform the mentioned idea, a PV burp charge system (PV-BCS) proposed is to make PV energy pump continuous with optimum maximum power point tracking (MPPT), which increases the PV utilization, and to dispatch the remaining PV energy for further storage in the pulse break period. A smart charging management (CM) presents three kinds of charge statuses, a burp pulse (BP) charge and two pulse charges, which charges three batteries, Bm, B1, and B2 concurrently and individually. The two pulse charges provided are for accompanying the BP charge in order to keep the PV energy supply continuous and cherish the remaining energy for further storage. The BP charge for Bm is composed of a positive pulse (PP) charge in a positive burp pulse (PBP) period and negative pulse (NP) charge in non-PBP period. The other two batteries B1 and B2 are always with PP charge in the non-PBP period, in which B1 charges the remaining PV energy to keep the PV energy supply continuous, realizing the energy treasuring concept; B2 charges the discharge amount from Bm by intensely discharging, which indeed is equivalent to the NP charge, achieving the energy recovery concept. A laboratory prototype, 250-W PV-BCS, with elaborated simulation and experiment demonstrates the proposed concurrent charging idea, which is feasible for conceiving an energy-saving concept, especially applicable in a large-scale energy management for such as battery exchange station to electric vehicle service. In addition, the PV-BCS can be further as a hybrid charger for renewable energy application if additional renewable energy is mixed with the PV energy, such as wind energy.

INTRODUCTION

The ever-increasing energy consumption, fossil fuels' soaring costs and exhaustible nature, and worsening global environment have created a booming interest in renewable energy generation systems, one of which is photovoltaic. Such a system generates electricity by converting the Sun's energy directly into electricity. Photovoltaic-generated energy can be delivered to power system networks through grid-connected inverters. A single-phase grid-connected inverter is usually used for residential or low-power applications of power ranges that are less than 10 kW. Types of single-phase grid-connected inverters have been investigated. A common topology of this inverter is full-bridge three-level.

The three-level inverter can satisfy specifications through its very high switching, but it could also unfortunately increase switching losses, acoustic noise, and level of interference to other equipment.

Improving its output waveform reduces its harmonic content and, hence, also the size of the filter used and the level of electromagnetic interference (EMI) generated by the inverter's switching operation. Multilevel inverters are promising; they have nearly sinusoidal output-voltage waveforms, output current with better harmonic profile, less stressing of electronic components owing to decreased voltages, switching losses that are lower than those of conventional two-level inverters, a smaller filter size, and lower EMI, all of which make them cheaper, lighter, and more compact. Various topologies for multilevel inverters have been proposed over the years.

Common ones are diode-clamped, flying capacitor or multicellular, cascaded H-bridge, and modified H-bridge multilevel. This paper recounts the development of a novel modified H-bridge single-phase multilevel inverter that has two diode embedded bidirectional switches and a novel pulse width modulated (PWM) technique.

Photovoltaic technology

Photovoltaic is the field of technology and research related to the devices which directly convert sunlight into electricity using semiconductors that exhibit the photovoltaic effect. Photovoltaic effect involves the creation of voltage in a material upon exposure to electromagnetic radiation.

The photovoltaic effect was first noted by a French physicist, Edmund Becquerel, in 1839, who found that certain materials would produce small amounts of electric current when exposed to light. In 1905, Albert Einstein described the nature of light and the photoelectric effect on which photovoltaic technology is based, for which he later won a Nobel Prize in physics. The first photovoltaic module was built by Bell Laboratories in 1954. It was billed as a solar battery and was mostly just a curiosity as it was too expensive to gain widespread use. In the 1960s, the space industry began to make the first serious use of the technology to provide power aboard spacecraft. Through the space programs, the technology advanced, its reliability was established, and the cost began to decline. During the energy crisis in the 1970s, photovoltaic technology gained recognition as a source of power for non-space applications.

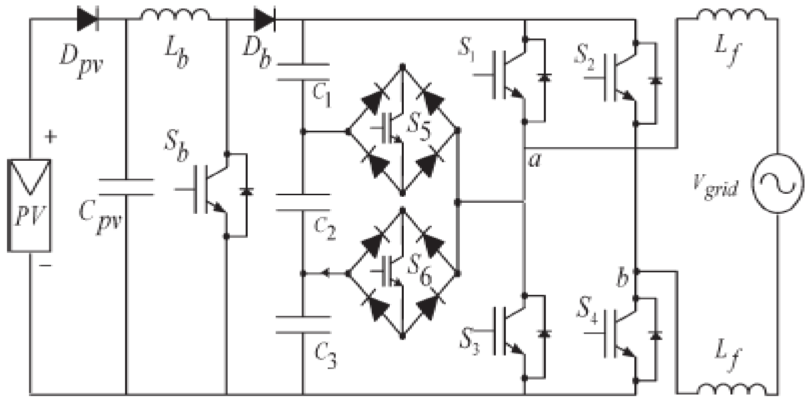
The solar cell is the elementary building block of the photovoltaic technology. Solar cells are made of semiconductor materials, such as silicon. One of the properties of semiconductors that makes them most useful is that their conductivity may easily be modified by introducing impurities into their crystal lattice. For instance, in the fabrication of a photovoltaic solar cell, silicon, which has four valence electrons, is treated to increase its conductivity. On one side of the cell, the impurities, which are phosphorus atoms with five valence electrons (n-donor), donate weakly bound valence electrons to the silicon material, creating excess negative charge carriers.

Inverter classification:

Solar inverters may be classified into three broad types:

- Stand-alone inverters, used in isolated systems where the inverter draws its DC energy from batteries charged by photovoltaic arrays and/or other sources, such as wind turbines, hydro turbines, or engine generators.
- Many stand-alone inverters also incorporate integral battery chargers to replenish the battery from an AC source, when available. Normally these do not interface in any way with the utility grid, and as such, are not required to have anti-islanding protection.
- Grid tie inverters, which match phase with a utility-supplied sine wave. Grid-tie inverters are designed to shut down automatically upon loss of utility supply, for safety reasons. They do not provide backup power during utility outages.
- Battery backup inverters. These are special inverters which are designed to draw energy from a battery, manage the battery charge via an onboard charger, and export excess energy to the utility grid.

PROPOSED MULTILEVEL INVERTER TOPOLOGY

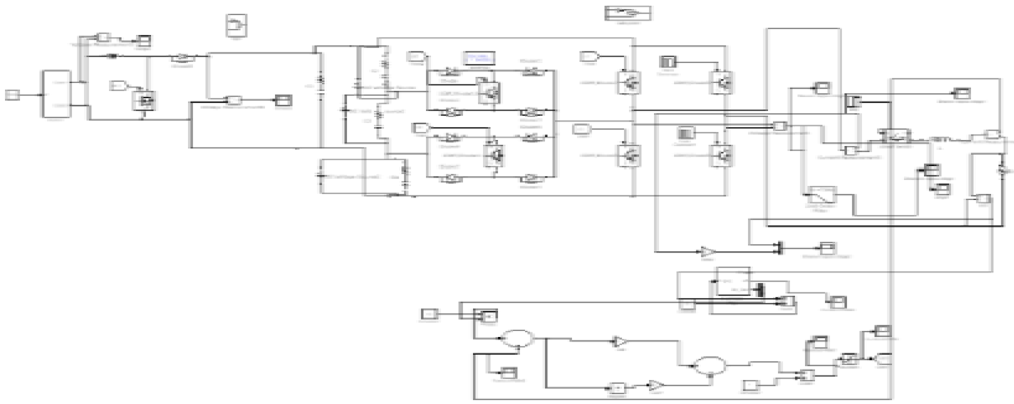


Proposed single phase seven-level grid connected inverter for photovoltaic systems.

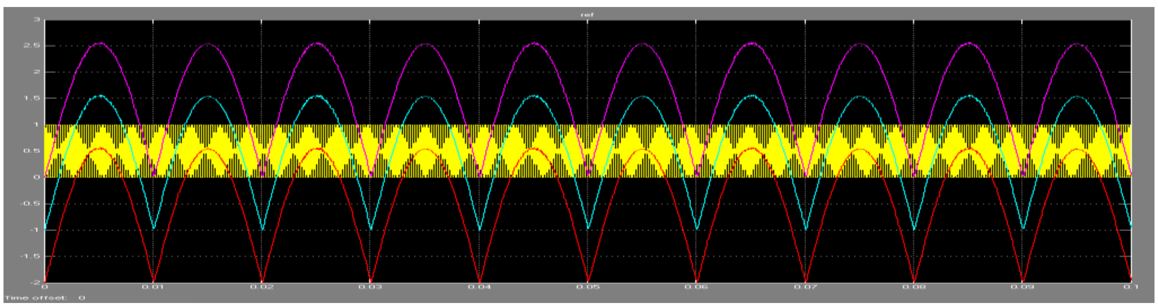
- The proposed single-phase seven-level inverter was developed from the five-level inverter. It comprises a single-phase conventional H-bridge inverter, two bidirectional switches, and a capacitor voltage divider formed by *C*1, *C*2, and *C*3, as shown in Fig. 1. The modified H-bridge topology is significantly advantageous over other topologies, i.e., less power switch, power diodes, and less capacitor for inverters of the same number of levels. Photovoltaic (PV) arrays were connected to the inverter via a dc–dc boost converter. The power generated by the inverter is to be delivered to the power network, so the utility grid, rather than a load, was used. The dc–dc boost converter was required because the PV arrays had a voltage that was lower than the grid voltage. High dc bus voltages are necessary to ensure that power flows from the PV arrays to the grid. A filtering inductance *Lf* was used to filter the current injected into the grid.
- Proper switching of the inverter can produce seven output-voltage levels (*V*dc, 2*V*dc⁄3, *V*dc⁄3, 0, −*V*dc,−2*V*dc⁄3,−*V*dc⁄3) from the dc supply voltage. The proposed inverter's operation can be divided into seven switching states, as shown in Fig. 5.3(a)–(g). Fig. 5.3(a), (d),and (g) shows a conventional inverter's operational states in sequence, while Fig. 5.3(b), (c), (e), and (f) shows additional states in the proposed inverter synthesizing one- and two-third levels of the dc-bus voltage.

MATLAB CASE STUDY & SIMULATION RESULTS

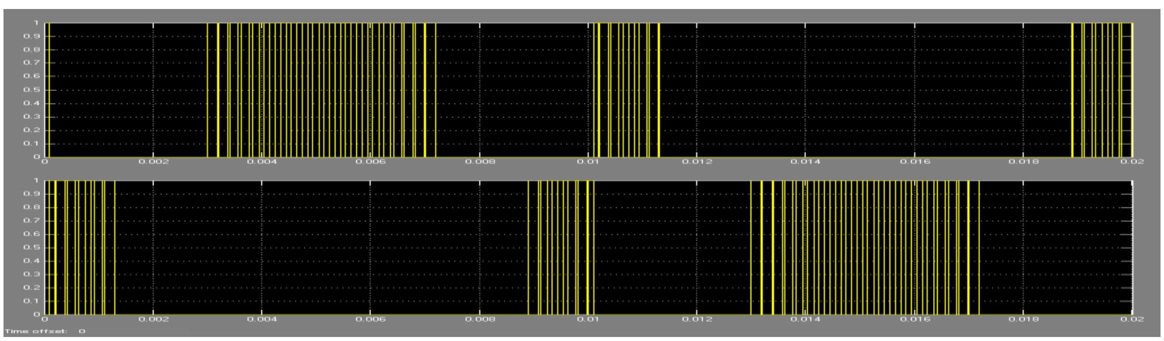
MATLAB SIMULINK simulated the proposed configuration before it was physically implemented in a prototype. The PWM switching patterns were generated by comparing three reference signals (*V*ref1, *V*ref2, and *V*ref3) against a triangular carrier signal (see Fig. 7.1).



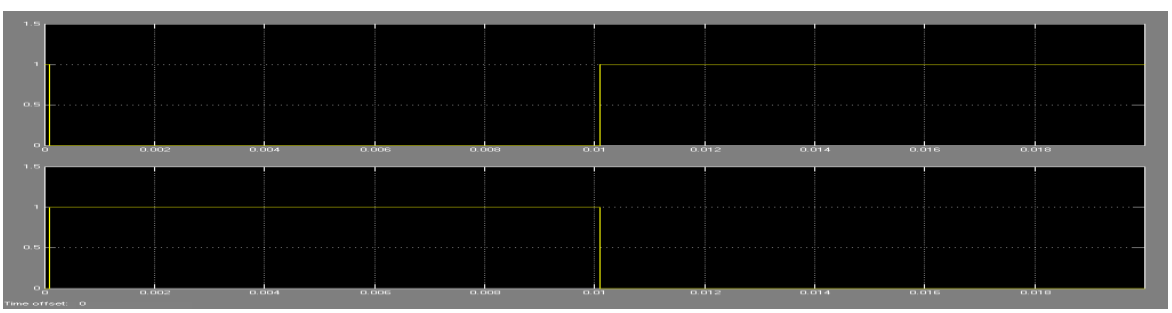
Matlab/Simulink model of Grid connected PV system



PWM switching signal generation.



PWM signals for *S*1 and *S*3.



PWM signals for *S*2 and *S*4.

CONCLUSION

Multilevel inverters offer improved output waveforms and lower THD. This paper has presented a novel PWM switching scheme for the proposed multilevel inverter. It utilizes three reference signals and a triangular carrier signal to generate PWM switching signals. The behavior of the proposed multilevel inverter was analyzed in detail. By controlling the modulation index, the desired number of levels of the inverter's output voltage can be achieved. The less THD in the seven-level inverter compared with that in the five- and three-level inverters is an attractive solution for grid-connected PV inverters.

REFERENCES

[1] M. Calais and V. G. Agelidis, "Multilevel converters for single-phase grid connected photovoltaic systems—An overview," in *Proc. IEEE Int. Symp. Ind. Electron.*, 1998, vol. 1, pp. 224–229.

[2] S. B. Kjaer, J. K. Pedersen, and F. Blaabjerg, "A review of single-phase grid connected inverters for photovoltaic modules," *IEEE Trans. Ind. Appl.*, vol. 41, no. 5, pp. 1292–1306, Sep./Oct. 2005.

[3] P. K. Hinga, T. Ohnishi, and T. Suzuki, "A new PWM inverter for photovoltaic power generation system," in *Conf. Rec. IEEE Power Electron. Spec. Conf.*, 1994, pp. 391–395.

[4] Y. Cheng, C. Qian, M. L. Crow, S. Pekarek, and S. Atcitty, "A comparison of diode-clamped and cascaded multilevel converters for a STATCOM with energy storage," *IEEE Trans. Ind. Electron.*, vol. 53, no. 5, pp. 1512– 1521, Oct. 2006.

[5] M. Saeedifard, R. Iravani, and J. Pou, "A space vector modulation strategy for a back-to-back five-level HVDC converter system," *IEEE Trans. Ind. Electron.*, vol. 56, no. 2, pp. 452–466, Feb. 2009.

[6] S. Alepuz, S. Busquets-Monge, J. Bordonau, J. A. M. Velasco, C. A. Silva, J. Pontt, and J. Rodríguez, "Control strategies based on symmetrical components for grid-connected converters under voltage dips," *IEEE Trans. Ind. Electron.*, vol. 56, no. 6, pp. 2162–2173, Jun. 2009.

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A CASCADED MULTILEVEL INVERTER BASED ON SWITCHED-CAPACITOR FOR HIGH-FREQUENCY AC POWER DISTRIBUTION SYSTEM

P.VISHALINI[1] ***B.KANAKARAO*** [2]

[1] M.Tech Student, Dept of EEE, RK College of Engineering & Technology, Krishna-521456, A.P., India

[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India

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ABSTRACT:

The increase of transmission frequency reveals more merits than low- or medium-frequency distribution among different kinds of power applications. High-frequency inverter serves as source side in high-frequency ac (HFAC) power distribution system (PDS). However, it is complicated to obtain a high-frequency inverter with both simple circuit topology and straightforward modulation strategy. A novel switched-capacitor-based cascaded multilevel inverter is proposed in this paper, which is constructed by a switched-capacitor frontend and H-Bridge backend. Through the conversion of series and parallel connections, the switched-capacitor frontend increases the number of voltage levels. The output harmonics and the component counter can be significantly reduced by the increasing number of voltage levels. A symmetrical triangular waveform modulation is proposed with a simple analog implementation and low modulation frequency comparing with traditional multicarrier modulation. The circuit topology, symmetrical modulation, operation cycles, Fourier analysis, parameter determination, and topology enhancement are examined. An experimental prototype with a rated output frequency of 25 kHz is implemented to compare with simulation results. The experimental results agreed very well with the simulation that confirms the feasibility of proposed multilevel inverter.

INTRODUCTION

HIGH-FREQUENCY ac (HFAC) power distribution system (PDS) potentially becomes an alternative to traditional dc distribution due to the fewer components and lower cost. The existing applications can be found in computer [1], telecom [2], electric vehicle [3], and renewable energy microgrid [4], [5]. However, HFAC PDS has to confront the challenges from large power capacity, high electromagnetic interference (EMI), and severe power losses [6]. A traditional HFAC PDS is made up of a high-frequency (HF) inverter, an HF transmission track, and numerous voltage-regulation modules (VRM). HF inverter accomplishes the power conversion to accommodate the requirement of point of load (POL). In order to increase the power capacity, the most popular method is to connect the inverter output in series or in parallel. However, it is impractical for HF inverter, because it is complicated to simultaneously synchronize both amplitude and phase with HF dynamics. Multilevel inverter is an effective solution to increase power capacity without synchronization consideration, so the higher power capacity is easy to be achieved by multilevel inverter with lower switch stress. Nonpolluted sinusoidal waveform with the lower total harmonic distortion (THD) is critically caused by long track distribution in HFAC PDS. The higher number of voltage levels can effectively decrease total harmonics content of staircase output, thus significantly simplifying the filter design [7]. HF power distribution is applicable for small-scale and internal closed electrical network in electric vehicle (EV) due to moderate size of distribution network and effective weight reduction [8]. The consideration of operation frequency has to make compromise between the ac inductance and resistance [9], so multilevel inverter with the output frequency of about 20 kHz is a feasible trial to serve as power source for HF EV application. The traditional topologies of multilevel inverter mainly are diode-clamped and capacitor-clamped type [10], [11]. The former uses diodes to clamp the voltage level, and the latter uses additional capacitors to clamp the voltage. The higher number of voltage levels can then be obtained; however, the circuit becomes extremely complex in these two topologies. Another kind of multilevel inverter is cascaded H-Bridge constructed by the series connection of H-Bridges [12], [13]. The basic circuit is similar to the classical H-bridge DC–DC converter.

LITERATURE SURVEY

[1]*Multilevel Inverters: A Survey of Topologies, Controls, and Applications José Rodríguez, Senior Member, IEEE, Jih-Sheng Lai, Senior Member, IEEE, and FangZhengPeng, Senior Member, IEEE Transactions on Industrial Electronics, vol. 49, no. 4, august 2002.*

Multilevel inverter technology has emerged recently as a very important alternative in the area of high-power medium-voltage energy control. The multilevel inverter has different topologies like diode-clamped inverter (neutral-point clamped), capacitor-clamped (flying capacitor), and cascaded multi cell with separate dc sources. Emerging topologies like asymmetric hybrid cells and soft-switched multilevel inverters are also discussed. Special attention is dedicated to the latest and more relevant applications of these converters such as laminators, conveyor belts, and unified power-flow controllers. The need of an active front end at the input side for those inverters supplying is regenerative loads.

[2].*Junfeng Liu, K. W. E. Cheng and Yuanmao Ye, A Cascaded Multilevel Inverter Based on Switched-Capacitor for High-Frequency AC Power Distribution System IEEE Transactions On Power Electronics, Vol. 29, No. 8, Aug 2014 .*

The increase of transmission frequency reveals more merits than low- or medium-frequency distribution among different kinds of power applications. High-frequency inverter serves as source side in high-frequency ac (HFAC) power distribution system (PDS). However, it is complicated to obtain a high-frequency inverter with both simple circuit topology and straightforward modulation strategy. A novel switched-capacitor-based cascaded multilevel inverter is proposed in this paper, which is constructed by a switched-capacitor, by the conversion of series and parallel connections, the switched capacitor frontend increases the number of voltage levels. The output harmonics significantly decreased by the rising number of voltage levels.

POWER ELECTRONICS

The application of solid state electronics in which the electric power is controlled and converted is called power electronics. As it deals with designing, computation, control, and integration of electronic systems where energy is processed with fast dynamics which is non linear time varying ,it is referred in electrical and electronic engineering as a research subject.

CASCADED MULTILEVEL INVERTER WITH SWITCHED CAPACITOR

Operation of SC-based Cascaded Inverter with Nine Level Output

The proposed circuit is comprised of the SC frontend and fell H-Bridge backend. In the event that the quantities of voltage levels acquired by SC frontend and fell H-Bridge backend are N_1 and N_2 , individually, the quantity of voltage levels is $2 \times N_1 \times N_2 + 1$ in the whole operation cycle.

Circuit Topology

Fig.5.1 demonstrates the circuit topology of nine-level inverter ($N_1 = 2$, $N_2 = 2$), where S_1, S_2, S_1', S_2' as the exchanging gadgets of SC circuits (SC_1 and SC_2) are utilized to change over the arrangement or parallel association of C_1 and C_2. S_{1a}, S_{1b}, S_{1c}, S_{1d}, S_{2a}, S_{2b}, S_{2c}, S_{2d} are the exchanging gadgets of fell H-Bridge. $V_{dc\,1}$ and $V_{dc\,2}$ are data voltage. D_1 and D_2 are diodes to limit the current heading. i_{out} and v_o are the yield current and the yield voltage, individually.

Disadvantages in Existing System

These are some of disadvantages of existing system

- High cost for source.
- Used only in low frequency applications.
- Difficult to control the system.
- Output voltage is low.

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- Need high switches.
- THD is more.
- Used only in Non renewable sources.

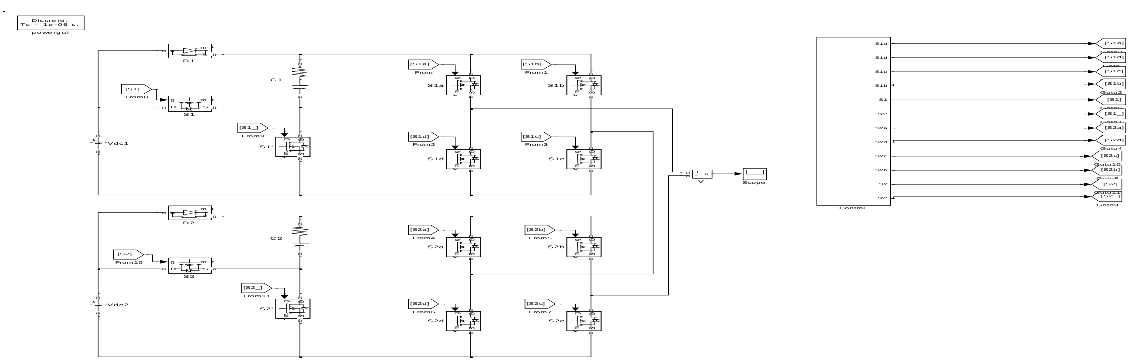
Advantages of Proposed system

These are some of better advantages of conventional systems

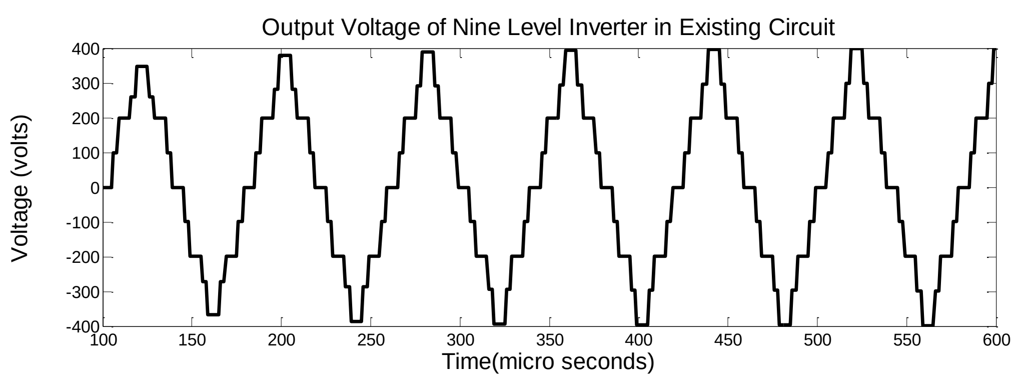
- Cost less.
- High output voltage.
- We can use in industrial applications.
- THD is less.
- Pollution free.
- Non- dependable sources.
- Levels of output are increased.

SIMULATION RESULTS

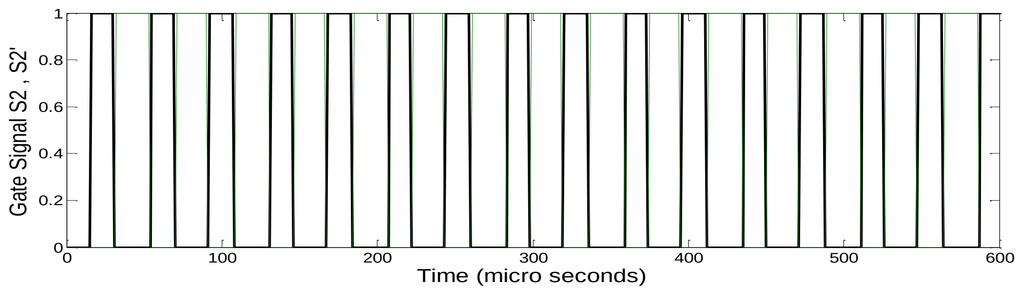
Cascaded Multilevel Inverter Simulation Circuit & waveforms



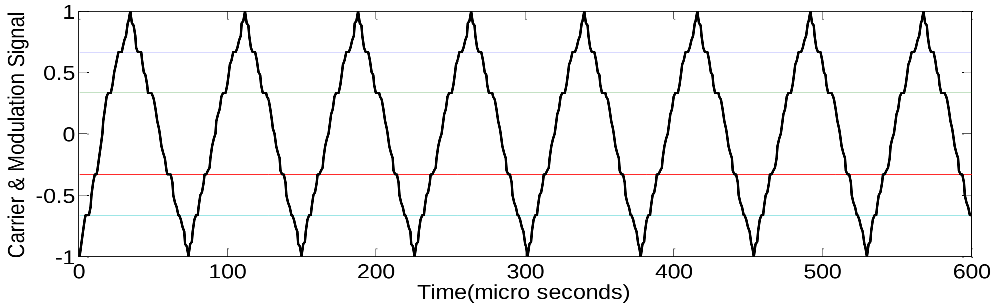
Existing Simulation Circuit



Output voltage of cascaded inverter



Gate signals of S_2, S_2



Waveforms of Symmentrical PSM

CONCLUSION

. a novel SC-based fell multilevel inverter was proposed. Both 9-level circuit topology are inspected top to bottom. Contrasted and ordinary fell multilevel inverter, the proposed inverter can enormously diminish the quantity of exchanging gadgets. A solitary transporter regulation named by symmetrical PSM, was given the low exchanging recurrence and straightforward usage. The agreeing consequences of reproduction and test further affirm the practicality of proposed circuit and tweak system.

Contrasting and customary course H-connect, the quantity of voltage levels can be further expanded by SC frontend. Case in point, the quantity of voltage levels expands twice fifty-fifty cycle of 9-level circuit, and the quantity of voltage levels in-wrinkles three times into equal parts cycle. With the exponential increment in the quantity of voltage levels, the music is essentially chopped down in staircase yield, which is especially noteworthy because of straightforward and adaptable circuit topology. Then, the extent control can be fulfilled by pulse width regulation of voltage level, so the proposed multilevel inverter can serve as HF force source with controlled greatness and less sounds.

REFERENCES

[1]Adrian ioinovici, “switched capacitor power electronics circuits”. CAS technical committee on power system and power electronics circuits (PSPEC).

[2]Divya Subramanian, Rebiya rasheed. “nine level cascaded h-bridge multilevel inverter”. International journal of engineering and innovative technology (IJEIT),vol.3, issue 3, September 2013.

[3]Ganan Prakesh M, Balamurugan M, Umashankars, “a new multilevel invereter with reduced number of switches” Internatinal jounal of power electronics and drive system (IJPEDS) vol.5, no.1, july 2014,pp.63-70.

[4]Gobinath.K, Mahendran.S, Ganambal.I, “new cascaded h-bridge multilevel inverter with improved efficiency”. International jounal of advanced research in electrical and instrumentation engineering, vol.2, issue 4, apirl 2013.

[5]Hiroumi Akagi, fellow, IEEE. “classification terminology,and application of the modular multilevel cascaded converter (MMCC)”.IEEE transcation of power electronics, vol.26, no.11, November 2011.

[6]Jagadish kumar, Biswarup Das, and pramod Agarwal,“harmonic reduction technique for a cascaded multilevel inverter” International journal of recent trends in engineering ,vol 1,no.3,may 2009.

[7]Junfeg liu, K.W.E.Cheng, senior member, IEEE, and Yuanmao ye, “a cascaded multilevel invereter based on switched-capacitor for high-frequency ac power distribution sysytem”. Senior member, IEEE transactions on power electronics vol.29, no.8, august 2014.

[8]Youghei Hiango, student member, IEEE, and Hiraotaka koizumi, member, “a single phase multilevel inverter using switched series/parallel dc voltage sources”. IEEE transactions on industrial electronics, vol.57, no.8, august 2010.

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DESIGN AND SIMULATION OF 10MW PHOTOVOLATIC POWER PLANT USING MATLAB AND SIMULINK

S.VANAJA RANI[1] **T.PARVATHI [2]**
[1] M.Tech Student, Dept of EEE, RK College of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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Abstract:

The paper manages the parts plan and the simulation of a photovoltaic power age framework utilizing MATLAB and Simulink programming. The power plant is made out of photovoltaic boards associated in arrangement and parallel strings, a DC-DC support converter and a three-stage inverter which interfaces with a 0.4 kV three-stage low voltage matrix and a 20 kV medium voltage lattice by methods for a stage up transformer. The DCDC support converter utilizes a MPPT controller and the inverter utilizes a control strategy in view of d-q hypothesis with a PI current controller. A few cases for which the dynamic conduct of the arranged photovoltaic framework presents intrigue are recreated. They address the sun based irradiance and temperature change. Keywords: photovoltaic, MPPT controller, DC-DC converter, PI current controller.

Introduction

Mechanical robotization, car, modern drives, power quality, and renewable vitality MATLAB and Force hardware application ranges from force supplies to automated controls, frameworks. Specifically, before the establishment of force plant, MATLAB discovers applications in selecting the framework in view of the necessities and to pick specific parts for the Sun based PV application. This section is to investigate the part and plausibility of MATLAB alongside its tool stash in Sun based PV Frameworks to advance Displaying, and Reproduction with accentuation on Examination, and Outline.

In renewable vitality frameworks applications, MATLAB helps for selecting the lattice controls in the converters to network inverter, plotting of capacities and information, usage of MPPT calculations, making of client interfaces for observing would be composed in different dialects. As an aftereffect of the MATLAB reproduction of the segments of the sun oriented PV framework one can profit by this model as a photovoltaic generator in the structure of the MATLAB/SIMULINK tool kit in the field of sun based PV power change frameworks. Furthermore such models examined in this part would give an apparatus to anticipate the conduct of sun oriented PV cell, module and cluster, charge controller, SOC battery, inverter, and MPPT, under atmosphere and physical parameters changes.

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Charge Controller

Which electric current is added to or drawn from electric batteries. It counteracts cheating and may anticipate against overvoltage, which can lessen battery A charge controller, charge controller or battery controller constrains the rate at execution or lifespan, and may represent a danger. To ensure battery life, charge controller may keep battery from profound releasing or it will perform controlled releases, contingent upon the battery innovation. The expressions "charge controller" or "charge controller" may allude to either a stand-alone gadget, or to control hardware incorporated inside of a battery pack, battery-fueled gadget, or battery recharger.

Sun oriented Charge Controllers are the controllers which manage the force yield or the DC yield voltage of the sun based PV boards to the batteries. Charge controllers take the DC yield voltage as the info voltage changes over it into same DC voltage required for battery charging. These are generally utilized as a part of off lattice situation and uses Maximum Power Point Tracking plan which amplifies the yield effectiveness of the Solar PV Panel. In battery charging framework, the yield voltage regulation is an imperative component as batteries require particular accusing technique for different voltage and current levels for particular stage.

Charge Controller Types

There are two essential charge controller

(i) Shunt Controller and

(ii) Series Controller

Inverter

Inverters are utilized to change over DC current into AC streams in PV frameworks. Diverse sorts of inverters create an alternate "quality" of power. In this way, the client must match the force quality required by your heaps with the force quality delivered by the inverter. Real disparities exist between force era with PV modules and the prerequisites of people in general lattice. The employment of the inverter is to join the frameworks with one another and to sustain the sun powered force into the matrix with the most noteworthy conceivable productivity.

Fuzzy Logic Control

Microcontrollers have made using fuzzy logic control popular for MPPT over last decade. Fuzzy logic controllers have the advantages of working with imprecise inputs, not needing an accurate mathematical model, and handling nonlinearity. Fuzzy logic control generally consists of three stages: fuzzification, rule base table lookup, and defuzzification. During fuzzification, numerical input variables are converted into linguistic variables based on a membership function similar to Figure. In this case, five fuzzy levels are used: NB (Negative Big), NS

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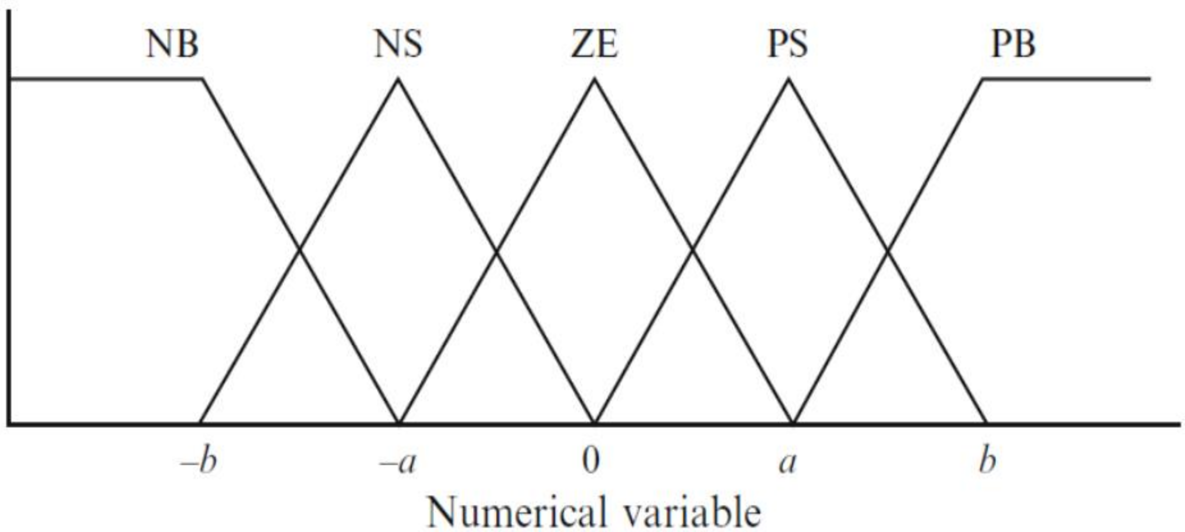
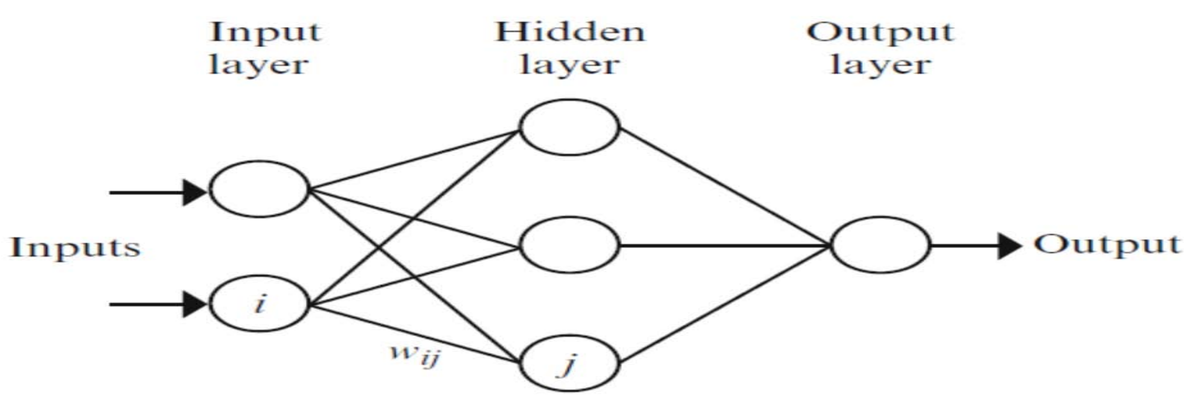
(Negative Small), ZE (Zero), PS (Positive Small), and PB (Positive Big). In some cases seven fuzzy levels are also used probably for more accuracy. In Figure.a and b are based on the range of values of the numerical variable. The membership function is sometimes made less symmetric to give more importance to specific fuzzy levels.



Membership function for inputs and output of fuzzy logic controller

Neural Network

Along with fuzzy logic controllers another technique of implementing MPPT are the neural networks, which are also well adapted for microcontrollers. Neural networks commonly have three layers: input, hidden, and output layers as shown in Figure 4.8. The number nodes in each layer vary and are user-dependent. The input variables can be PV array parameters like VOC and ISC, atmospheric data like irradiance and temperature, or any combination of these. The output is usually one or several reference signal(s) like a duty cycle signal used to drive the power converter to operate at or close to the MPP.



Example of neural network

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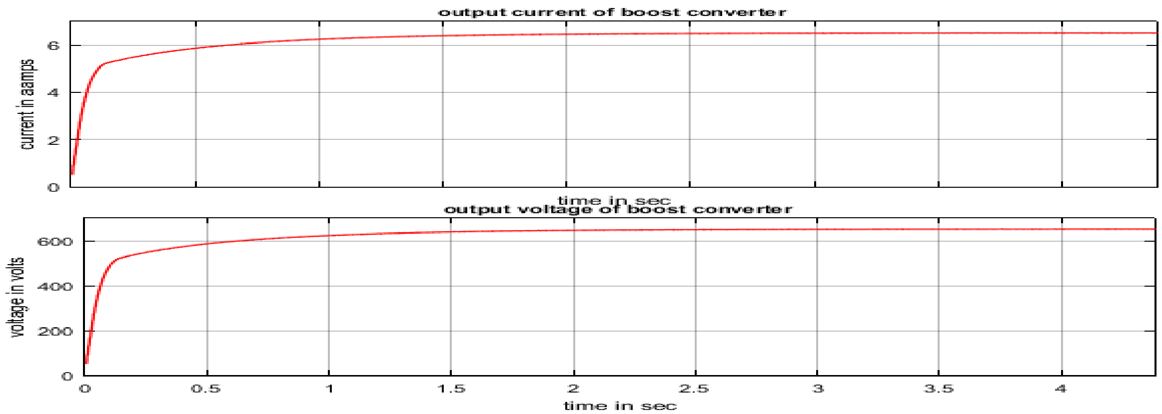
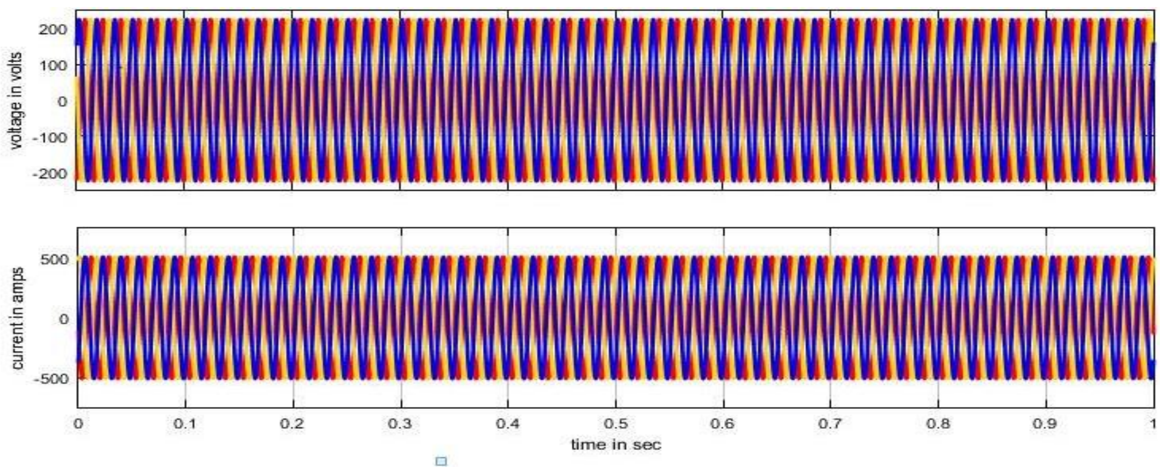
SIMULATION/RESULTS



Voltage and current from the boost converter



Voltage and current from the inverter

CONCLUSION

Since the energy of the coupled inductor's leakage inductor has been recycled, the voltage stress across the active switch S1 is constrained, which means low ON-state resistance RDS(ON) can be selected. Thus, improvements to the efficiency of the proposed converter have been achieved. The switching signal action is performed well by the floating switch during system operation; on the other hand, the residential energy is effectively eliminated during the nonoperating condition, which improves safety to system technicians. From the prototype converter, the turns ratio n = 5 and the duty ratio D is 55%; thus, without extreme duty ratios and turns ratios, the proposed converter achieves high step-up voltage gain, of up to 13 times the level of input voltage. The experimental results show that the maximum efficiency of 95.3% is measured at half load, and a small efficiency variation will harvest more energy from the PV module during fading sunlight.

REFERENCES

[1] T. Shimizu,K.Wada, andN.Nakamura, "Flyback-type single-phase utility interactive inverter with power pulsation decoupling on the dc input for an ac photovoltaic module system," IEEE Trans. Power Electron., vol. 21, no. 5, pp. 1264–1272, Jan. 2006.

[2] C. Rodriguez and G. A. J. Amaratunga, "Long-lifetime power inverter for photovoltaic ac modules," IEEE Trans. Ind. Electron., vol. 55, no. 7, pp. 2593–2601, Jul. 2008.

[3] S. B. Kjaer, J. K. Pedersen, and F. Blaabjerg, "A review of single-phasegrid-connected inverters for photovoltaic modules," IEEE Trans. Ind. Appl., vol. 41, no. 5, pp. 1292–1306, Sep./Oct. 2005.

[4] J. J. Bzura, "The ac module: An overview and update on self-contained modular PV systems," in Proc. IEEE Power Eng. Soc. Gen. Meeting, Jul. 2010, pp. 1–3.

[5] B. Jablonska, A. L. Kooijman-van Dijk, H. F. Kaan, M. van Leeuwen, G. T. M. de Boer, and H. H. C. de Moor, "PV-PRIV´E project at ECN, five years of experience with small-scale ac module PV systems," in Proc. 20th Eur. Photovoltaic Solar Energy Conf., Barcelona, Spain, Jun. 2005, pp. 2728–2731.

[6] T. Umeno, K. Takahashi, F. Ueno, T. Inoue, and I. Oota, "A new approach to lowripple-noise switching converters on the basis of switched- capacitor converters," in Proc. IEEE Int. Symp.Circuits Syst., Jun. 1991, pp. 1077– 1080.

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A New Multi-Level Inverter with FACTS Capabilities for Wind Applications

SHAIK SHABEER[1] **G.VEERA NAGA BABU**[2]
[1] M.Tech Student, Dept of EEE, RK College of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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Abstract:

The modular multilevel converter (MMC) is an attractive topology for HVDC/FACTS systems. In this paper a new single-phase MMC-based D-STATCOM inverter for grid connection is proposed. The proposed inverter is designed for grid-connected wind turbines in the small- to mid-sized (10kW-20kW) range using the most advanced multi-level inverter topology. The proposed MMC D-STATCOM inverter controls the DC link voltage as well as the active and reactive power transferred between the renewable energy source, specifically wind turbine, and the grid in order to regulate the power factor (PF) of the grid regardless of the input active power from wind turbine. The goal of this paper is to present a new inverter with D-STATCOM capability in a single unit without any additional cost. The 5-level D-STATCOM inverter is simulated and the results are presented to verify the operation of the proposed system. The simulation studies are carried out in the MATLAB/Simulink environment. To validate the simulation results, an experimental configuration of a 5-Level DSTATCOM inverter has been built and tested.

Introduction:

Recently renewable energy power supplied into the utility grid has been paid much attention due to increase in fossil fuel prices, environmental pollution and energy demand boom. Among various renewable energy resources such as solar, wind, tidal, geothermal, biomass etc., the solar photovoltaic system being more attractive and promising green resource because of its abundant availability, safe resource, cost free and eco-friendly [1]. The solar photovoltaic (PV) modules directly converts the light energy into the electrical energy, but energy obtained from the PV module acts as low voltage DC source and has relatively low conversion efficiency. In order to improve the efficiency and convert low voltage DC source into usable AC source, the power electronics converters are used to transform DC into AC. Conventional inverter topologies such as voltage source inverter (VSI) and the current source inverter (CSI) are being utilized to convert solar power generated electrical power into the utility grid. Whereas these topologies require additional DC/DC converter stage resulting in a two stage power conversion and also require interfacing transformer to inject power into the grid. These topologies not only increase the circuit complexity but also increase the cost and space requirements.

Features of CMLI

For real power conversions, (ac to dc and dc to ac), the cascaded-inverter needs separate dc sources. The structure of separate dc sources is well suited for various renewable energy sources such as fuel cell, photovoltaic, and biomass, etc.

Connecting separated dc sources between two converters in a back-to-back fashion is not possible because a short circuit will be introduced when two back-to-back converters are not switching synchronously. In summary, advantages and disadvantages of the cascaded inverter based multilevel voltage source converter can be listed below.

Advantages and Disadvantages of CMLI.

i) The regulation of the DC buses is simple.

ii) Modularity of control can be achieved. Unlike the diode clamped and capacitor clamped inverter where the individual phase legs must be modulated by a central controller, the full-bridge inverters of a cascaded structure can be modulated separately.

iii) Requires the least number of components among all multilevel converters to achieve the same number of voltage levels.

iv) Soft-switching can be used in this structure to avoid bulky and lossy resistor-capacitor-diode snubbers.

Disadvantages

i) Communication between the full-bridges is required to achieve the synchronization of reference and the carrier waveforms.

ii) Needs separate dc sources for real power conversions, and thus its applications are somewhat limited.

PROPOSED CONCEPT

Distributed energy sources such as wind and solar have been attracting increasing interest in recent years [1]-[3]. Recently, distributed generation (DG) has been introduced to the modern power systems in order to avoid generating power and transmitting it over a long distance. Relatively small power generations such as small wind or solar system, would be an approach to penetrate renewable to the power systems. Small renewable energy sources are connected to the low side of the distribution systems. In other words, in modern power systems, end customers do not act only as consumers, but as active power supplier as well. Deploying small renewable energy sources in distribution systems requires paying more attention to the power quality at the end point, specifically when the amount of installed renewable energy becomes significant compared to the total power of that system. There are numerous benefits to small wind applications such as: it is easier to install in urban landscapes, it requires little to no permitting, and it is easier to finance than large-scale wind. Among all power quality concerns, controlling the active and reactive power transferring to or from the grid requires major attention. Nowadays, this attention is possible using power electronics. Power electronic-based flexible AC transmission System (FACTS) devices have been developed in order to provide more knowledge and control on power systems. FACTS components have been found as the most efficient and economical way to control the power transfer in interconnected AC transmission systems. In this paper, a new single-phase multilevel D-STATCOM inverter is presented.

A D-STATCOM inverter is a power electronic device that is placed between a renewable energy source and the distribution grid not only to provide active power, but to control reactive power on system. The proposed D-STATCOM inverter in this work could replace existing inverters used for renewable energy systems, specifically for small wind applications. Although the history of multi-level inverter goes back to the 1970, conventional two-level topology is still one the most common topologies for power converters. Due to the limits on current and voltage of the semiconductor components, multilevel inverters has recently gained more attention for applications such as large-scale utility applications, electric vehicles (EVs), and inverters for renewable energy systems. A multi-level converter has several advantages compared to the conventional two-level converter. It has the capability to perform at a lower switching frequency, it has lower total harmonic distortion (THD), it has better efficiency, and it possesses less $\frac{dv}{dt}$ and therefore less voltage stress on the devices [4-8]. The modular multilevel converter

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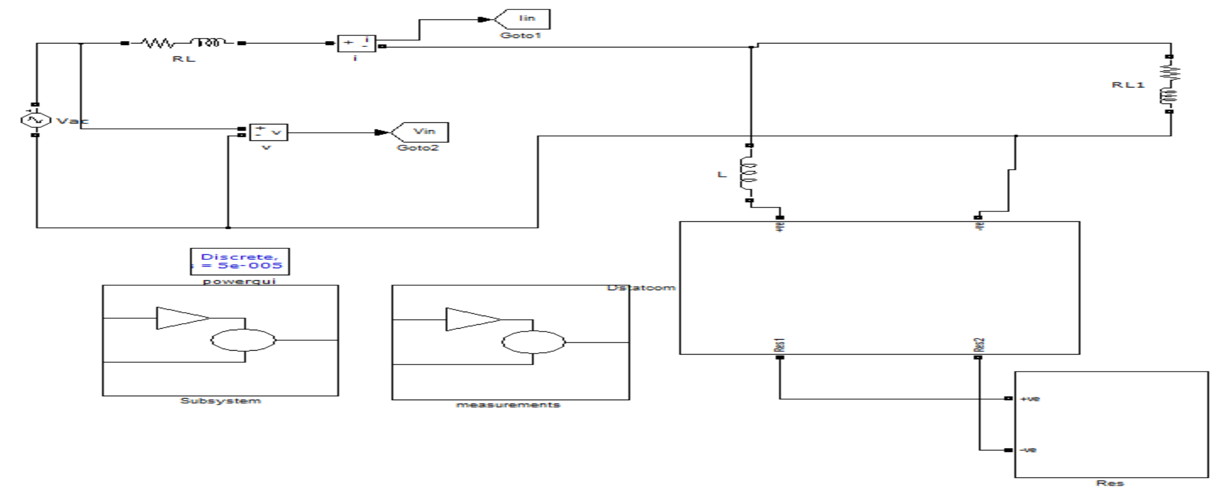
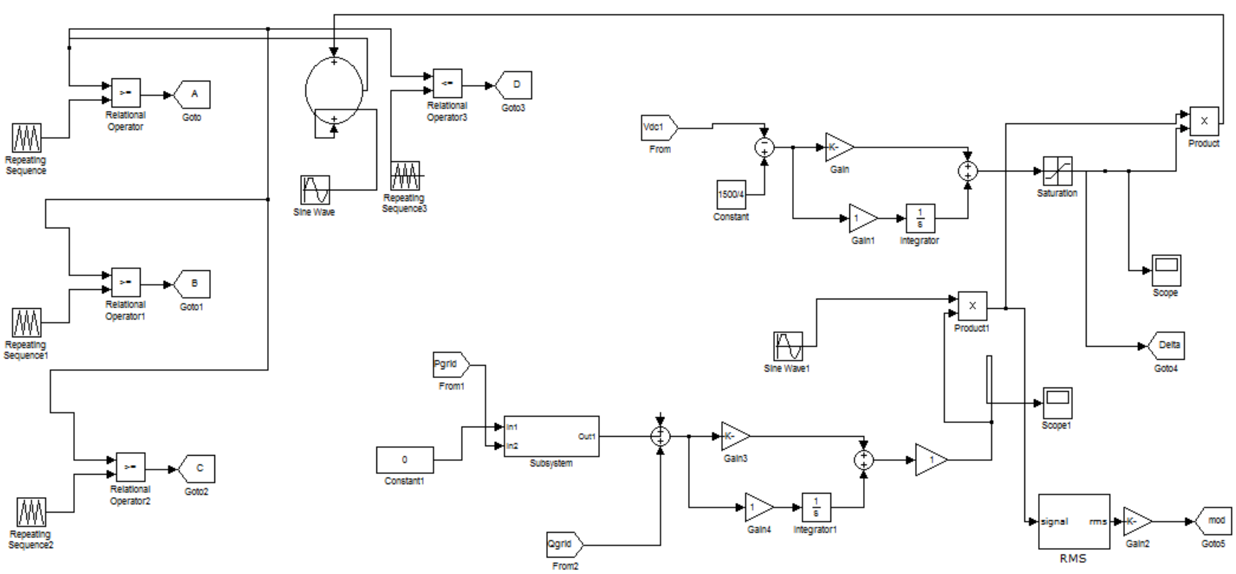
(MMC) topology has gained more and more attention specifically for mid- to high-voltage applications. The unique work in this paper is the use of MMC topology for an inverter and a DSTATCOM in a single unit for small to mid-sized wind applications.

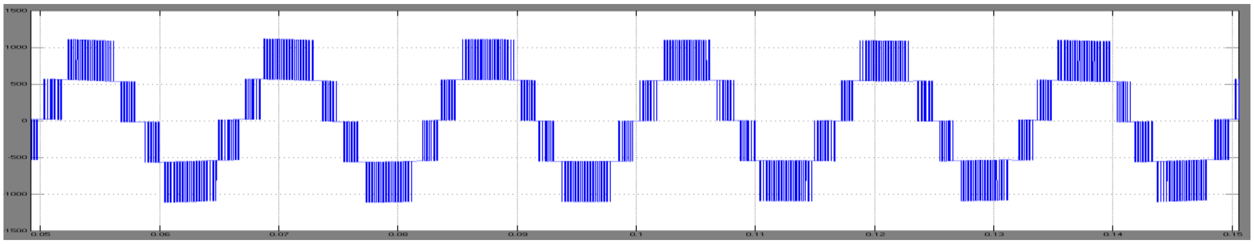
MATLAB/SIMULATION RESULTS



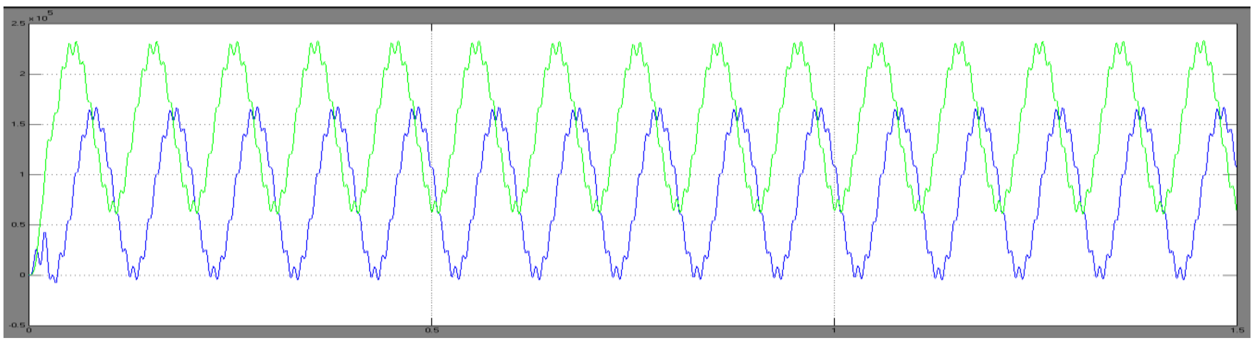
Matlab/Simulink circuit for proposed system



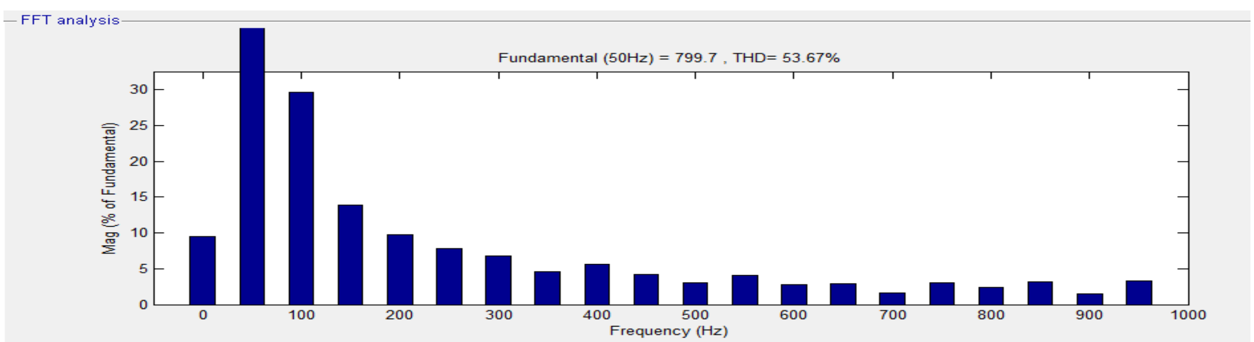
Control circuit



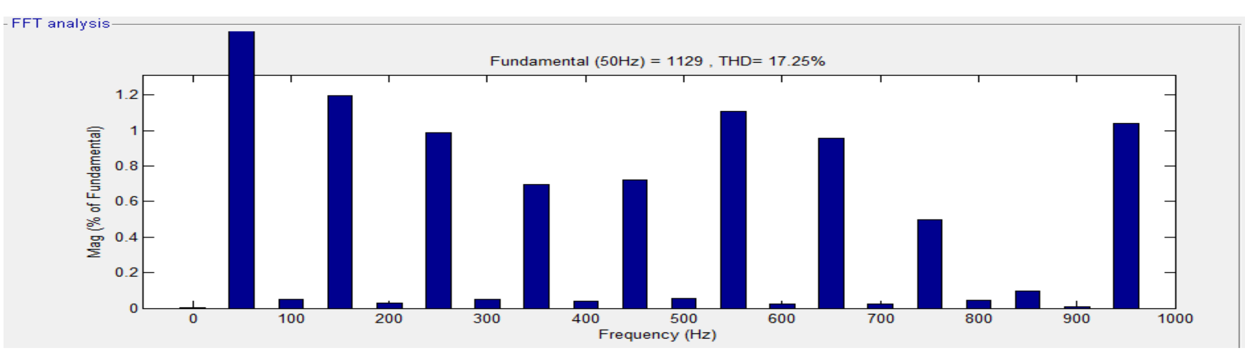
Output voltage of d statcom without filter



Active and reactive power of grid



FFT window for 5 level



FFT window for 7 level

CONCLUSION

The concept of a multi-level D-STATCOM inverter for small- to mid-sized (10-20kW) wind installations is presented and shows a new way in which distributed renewable sources can be used to provide control and support in distribution systems. The proposed single-phase DSTATCOM inverter using MMC topology can actively regulate the reactive power on individual feeder lines while providing the variable output power of the renewable energy source. The aim is to provide utilities with distributive control of VAR compensation and power factor correction on feeder lines. The proposed D-STATCOM inverter performs in two modes: 1) inverter mode, in which there is a variable active power from the wind turbine, 2) D-STATCOM mode, in which the DC link is open circuit and no active power is gained from the renewable energy source.

REFERENCES

[1] J.T. Bialasiewicz, "Renewable energy systems with photovoltaic power generators: Operation and Modeling", Ind. Electronics, IEEE Trans. on, vol. 55, pp. 2752-2758, 2008

[2] AWEA, "AWEA U.S. wind industry annual market report year ending 2010," American Wind Energy Association, Washington DC, 2011

[3] SEIA, "U.S. solar market insight, 2010 year end review executive summary," Solar Energy Industries Association, Washington DC, 2011

[4] J. Rodriguez, J. S. Lai and F. Z. Peng, "Multilevel inverters: Survey of topologies, controls, and applications," Industry Applications, IEEE Transactions on, vol. 49, no. 4, pp. 724-738, 2002

[5] F. Z. Peng, J. S. Lai, J. W. McKeever, J. VanCoevering, "A multilevel voltage-source inverter with separate DC sources for static vargeneration," Industry Applications, IEEE Transactions on, vol. 32, no. 5, pp. 1130-1138, 1996

[6] L. M. Tolbert, F. Z. Peng, "Multilevel converters as a utility interface for renewable energy systems," in Proceedings of 2000 IEEE Power Engineering Society Summer Meeting, pp. 1271-1274, 2000

[7] Kouro, S., Malinowski, M., Gopakumar, K., Pou, J., Franquelo, L.G., Bin Wu, Rodriguez, J., Pérez, M.A., Leon, J.I., “Recent advances and industrial applications of multilevel converters”, IEEE Electronics, IEEE Transaction on, vol. 57 , no.: 8, pp. 2553 – 2580, 2010

[8] C. Tareila, P. Sotoodeh, R. D. Miller., “Design and control of a singlephase D-STATCOM inverter for wind application”, Power Electronics and Machines in Wind Application PEMWA 2012, Denver, Co, 2012

[9] M. Davies, M. Dommaschk, J. Dorn, J. Lang, D. Retzmann, and D. Soerangr, “HVDC PLUS nasic and principle of operation,” Siemens AG Energy Sector, Erlandgen, Germany,2009

[10] B. Gemmell, Siemens USA, J. Dorn, D. Retzmann, D. Soerangr, Siemens Germany, “Prospects of multilevel VSC technologies for power transmission,” in Proc. IEEE Transmission and Distribution Conference and Exposition, pp. 1-16, 2008

[11] R. Marquardt and A. Lesnicar, "New concept for high voltage – modular multilevel converter," Power Electronics Specialists Conference, Aachen, Germany, 2004

[12] A. Lesnicar and R. Marquardt, "An innovative modular multilevel converter topology suitable for a wide power range," IEEE Power Tech Conference Proceedings, Bologna, Italy, 2003.

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A Hybrid Cascaded Multilevel Converter for Battery Energy Management Applied in Electric Vehicles

T.TRIPURA [1] ***B.VEERA BABU*** [2]
[1] M.Tech Student, Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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ABSTRACT

In electric vehicle (EV) energy storage systems, a large number of battery cells are usually connected in series to enhance the output voltage for motor driving. The difference in electrochemical characters will cause state-of-charge (SOC) and terminal voltage imbalance between different cells. In this paper, a hybrid cascaded multilevel converter which involves both battery energy management and motor drives is proposed for EV. In the proposed topology, each battery cell can be controlled to be connected into the circuit or to be bypassed by a half-bridge converter. All half bridges are cascaded to output a staircase shape dc voltage. Then, an H-bridge converter is used to change the direction of the dc bus voltages to make up ac voltages. The outputs of the converter are multilevel voltages with less harmonics and lower dv/dt, which is helpful to improve the performance of the motor drives. By separate control according to the SOCof each cell, the energy utilization ratio of the batteries can be improved. The imbalance of terminal voltage and SOC can also be avoided, fault-tolerant can be easily realized by modular cascaded circuit, so the life of the battery stack will be extended. Simulation and experiments are implemented to verify the performance of the proposed converter.

INTRODUCTION

The role of energy storage system (ESS) in electric vehicles (EV) is significant. The energy storage system (ESS) contains batteries made up of lead-acid and lithium-ion. These are used because of their advantages of cost and density of energy. As this kind of batteries has a very low voltage capacity, a number of batteries are to be cascaded to reach the required voltage rating of the electric drive. These cascaded batteries differ in properties like resistance, volume, manufacturing, the architecture of cells and their usage. As we know that basic general methods to increase the voltage capacity, connect the required number of battery cells in cascade to reach the demand of voltage. In this method, while charging and discharging, the amount of current passing through them is almost equal but state of charge (SOC) and the voltage values are different because of the variations in the characteristics of the electro chemicals among the battery cells. There is a requirement to stop charging even one of the cells among the cascaded reaches to cutoff voltage. And also if a cell is badly damaged in these cascaded cells then the entire stack of batteries will be damaged forever. Hence screening battery cells must be adopted to decrease those difficulties and to protect cells from over discharging and over charging we

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require SOC equalization circuit or voltage circuit. Usually, equalization circuits are two types the very first type is in order to control the terminal voltage of stack of cells on parallel resistance. Multilevel inverters have been pulling in wide mechanical intrigue. They are seen as a charming choice remembering the ultimate objective to diminishing switch stretch. The essential typical for these converters is a yield waveform with various voltage levels. In late decades, a wide bunch of multilevel structures appeared for the event, the fell H-connect, fair point cut, and flying capacitor. The Cascaded H-connect multilevel inverter is a notable topology and has found no matter how you look at it applications in industry, for the event, in high power medium voltage drives and open power pay. Most multilevel inverters have a stratagem of switches & voltage sources are capacitors.

AC-DC CONVERTER:

A rectifier is an electrical device that converts alternating current (AC), which periodically reverses direction, to direct current (DC), current that flows in only one direction, a process known as rectification. Rectifiers have many uses including as components of power supplies and as detectors of radio signals. Rectifiers may be made of solid state diodes, vacuum tube diodes, mercury arc valves, and other components.

A device which performs the opposite function (converting DC to AC) is known as an inverter.

Inverter:

An **inverter** is an electrical device that converts direct current (DC) to alternating current (AC); the converted AC can be at any required voltage and frequency with the use of appropriate transformers, switching, and control circuits.

Static inverters have no moving parts and are used in a wide range of applications, from small switching power supplies in computers, to large electric utility high-voltage direct current applications that transport bulk power. Inverters are commonly used to supply AC power from DC sources such as solar panels or batteries.

The electrical inverter is a high-power electronic oscillator. It is so named because early mechanical AC to DC converters were made to work in reverse, and thus were "inverted", to convert DC to AC. The inverter performs the opposite function of a rectifier.

PI controller

The general block diagram of the PI speed controller is shown in Figure 2

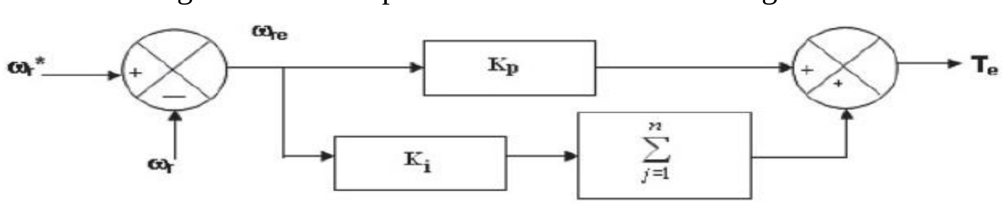

FIG. 2. Block diagram of PI speed controller.

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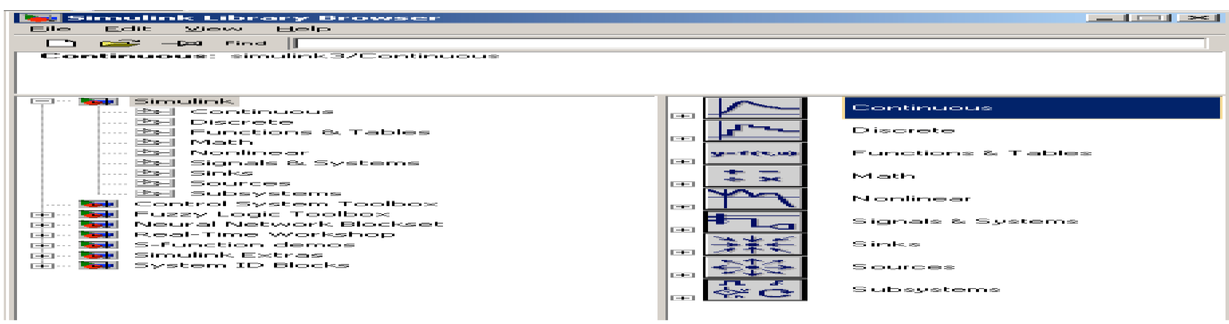
The output
Of the speed controller (torque command) at *n*-th instant is expressed as follows:
$Te(n)=Te(n-1)+Kp\_\omega re(n)+Ki\omega re(n)$ (10)
Where $Te(n)$ is the torque output of the controller at the *n*-th instant, and *Kp* and K*i* the proportional and integral gain constants, respectively.
A limit of the torque command is imposed as

$$T_{e(n+1)} = \begin{cases} T_{e\max} & \text{for} \quad T_{e(n+1)} \geq T_{e\max} \\ -T_{e\max} & \text{for} \quad T_{e(n+1)} \leq -T_{e\max} \end{cases}$$

The gains of PI controller shown in (10) can be selected by many methods such as trial and error method, Ziegler–Nichols method and evolutionary techniques-based searching. The numerical values of these controller gains depend on the ratings of the motor.

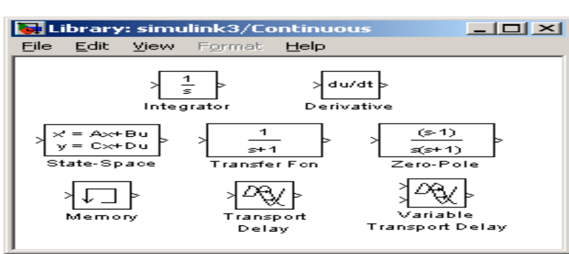
MATLAB / SIMULINK

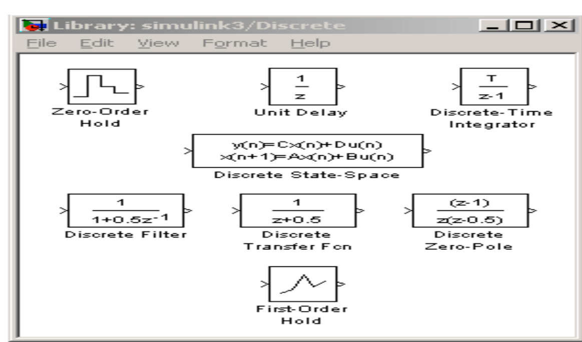
Matlab is a high-performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include Math and computation Algorithm development Data acquisition Modeling, simulation, and prototyping Data analysis, exploration, and visualization Scientific and engineering graphics Application development, including graphical user interface building.



Continuous and discrete systems:

All dynamic systems can be analyzed as continuous or discrete time systems. Simulink allows you to represent these systems using transfer functions, integration blocks, delay blocks etc.





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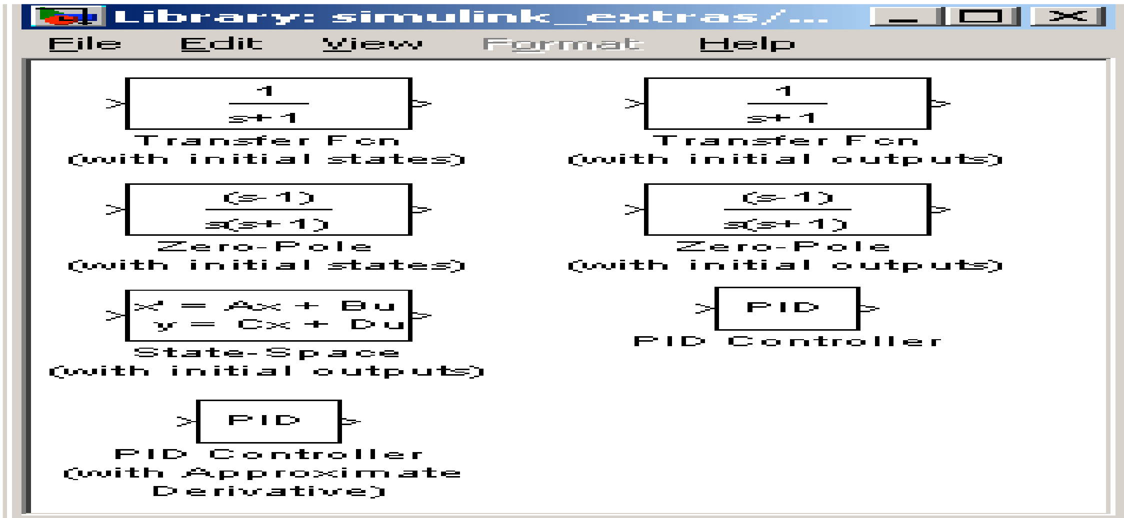
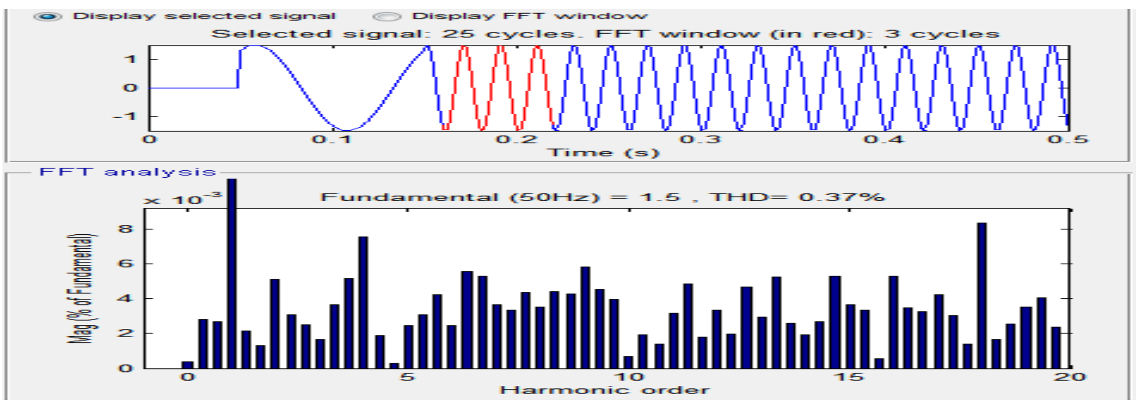
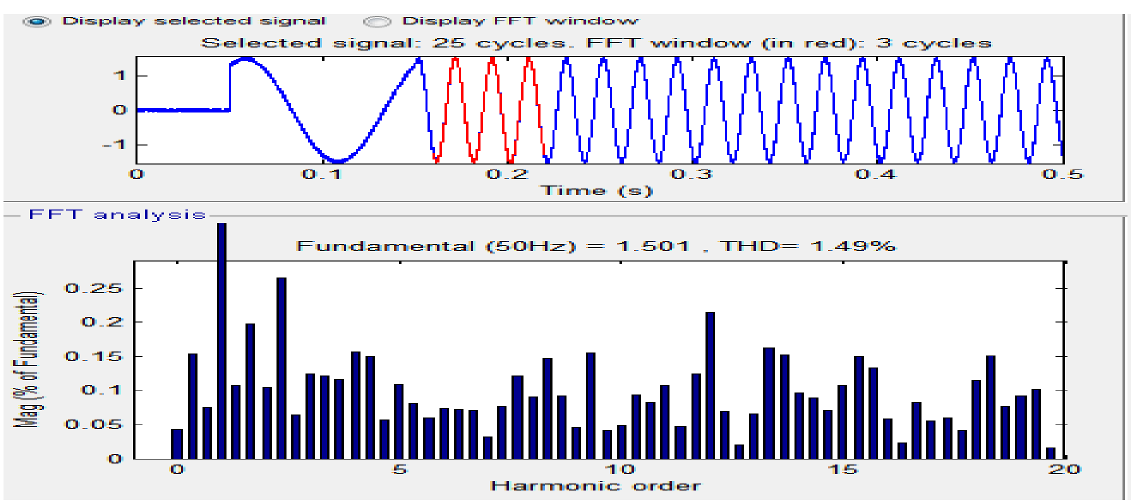


continous and descrete systems

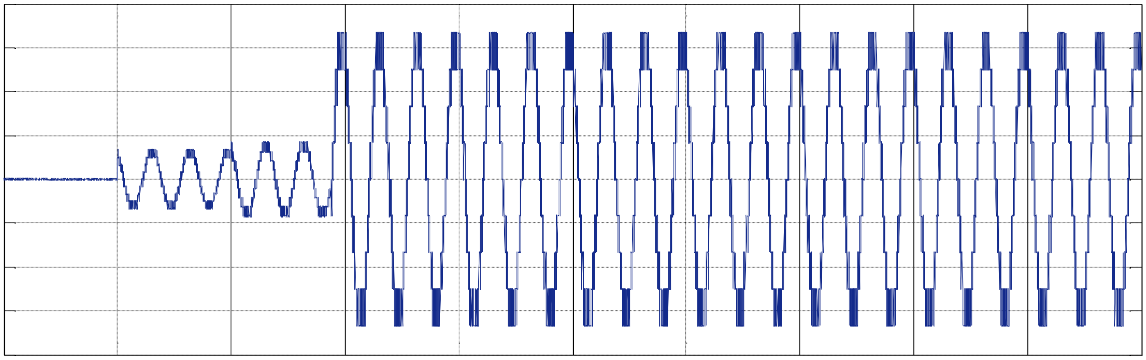
RESULTS



FFT analysis forthe MLI with fuzzy logic controller with inductive load



FFT of the MLI with PI controller for inductive load



Output Voltage waveform of Single Phase model

CONCLUSION

The existing hybrid cascade MLI for charging and discharging of the battery cells can be realized. Simultaneously the control of terminal voltage or state of charge balance can also be realized. The proposed method is suitable for all cascade battery level applications and also for low voltage energy storage system of battery cells or module of battery and fault mode, the current will be bypassed without affecting the running of other, hence the converter contains a good fault tolerance character, so by this system reliability is increased significantly. The adapted MSPWM having low switching loss, balance the control of charging & discharging control at the same time. The circuit output is AC output voltage at multilevel, where the no of themultilevelis proportional to the no of battery cells. So the AC output voltage is nearer to pure sin wave to increase controlling of motor control in theelectric vehicle. For battery charging mode a current external DC bus method with an external DC or AC source is also seen, where we realized the constant current control and do not require extra charger in proposed system. Simulationresults and desired control methods are verified in Matlab/Simulink software.

REFERENCES

[1] Zedong Zheng, Member, IEEE, Kui Wang, Member, IEEE, Lie Xu, Member, IEEE, and Yongdong Li, Member, IEEE" A Hybrid Cascaded Multilevel Converter for Battery Energy Management Applied in Electric Vehicles" IEEE transactions on power electronics, vol. 29, no. 7, July 2014.

[2] A. Emadi, Y. J. Lee, and K. Rajashekara, "Power electronics and motor drives in electric, hybrid electric, and plug-in hybrid electric vehicles, "IEEE Trans. Ind. Electron., vol. 55, no. 6, pp. 2237–2245, Jun. 2008.

[3] K.Jonghoon,S. Jongwon, C. Changyoon, and B. H. Cho,"Stable configuration of a Li-Ion series battery pack based on a screening process for improved voltage/SOC

balancing," IEEE Trans. Power Electron., vol. 27,no. 1, pp. 411–424, Jan. 2012.

[4] L. Yuang-Shung, T. Cheng-En, K. Yi-Pin, and C.Ming-Wang, "Charge equalization using quasi-resonant converters in battery string for medical power operated vehicle application," in Proc. Int. Power Electron. Conf.2010, pp. 2722–2728.

[5] H. Shen, W. Zhu, and W. Chen, "Charge equalization using multiple winding magnetic models for lithium-ion battery string," in Proc. Asia-Pacific Power Energy Eng. Conf., 2010, pp. 1–4.

[6] P. Sang-Hyun, P. Ki-Bum, K. Hyoung-Suk, M. Gun-Woo, and Y. MyungJoong, "Single-magnetic cell-to-cell charge equalization converter with reduced number of transformer windings" IEEE Trans. Power Electron. vol. 27, no. 6, pp. 2900–2911, Jun. 2012.

[7] K. Chol-Ho, K. Moon-Young, P. Hong-Sun, and M. Gun-Woo, "A modularized two-stage charge equalizer with cell selection switches for series connected lithium-ion battery string in an HEV,"IEEE Trans. PowerElectron., vol. 27, no. 8, pp. 3764–3774, Aug. 2012.

[8] S. M. Lukic, J. Cao, R. C. Bansal, F. Rodriguez, and A. Emadi, "Vitality stockpiling systems for car applications," IEEE Trans. Ind. Electron., vol. 55, no. 6, pp. 2258–2267, Jul. 2008.

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IMPROVED POWER QUALITY BRIDELESS CONVERTER BASED COMPUTER POWER SUPPLY

B.VAMSI [1] ***M.SURESH*** [2]
[1] M.Tech Student, Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
[2] Assistant Professor,Dept of EEE, RK college of Engineering & Technology, Krishna-521456, A.P., India
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ABSTRACT

power-factor-correction (PFC) multiple output switched-mode power supply (SMPS) using a bridgeless buck–boost converter at the front end. Single-phase ac supply is fed to a pair of back-to-back-connected buck–boost converters to eliminate the diode bridge rectifier, which results in reduction of conduction losses and power quality improvement at the front end. The operation of the bridgeless buck–boost converter in discontinuous conduction mode ensures inherent PFC operation and reduces complexity in control. The performance of the proposed multiple-output SMPS is evaluated under varying input voltages and loads by simulating this circuit in MATLAB/ Simulink environment, and the results obtained through simulation are validated experimentally.

INTRODUCTION

GENERAL

Normally, a half-bridge voltage source inverter (VSI) is used at the output for high-frequency isolation and multiple dc output voltages in computer power supplies because it provides better core utilization than any other unipolar converter and it is cost effective compared to push–pull and full-bridge converters . It is observed from the available literature that the bridgeless converter- based multiple-output SMPS has not been attempted so far, particularly targeting SMPSs for PCs. Therefore, an attempt is made here to reduce the current harmonics and to achieve high PF at the utility interface in a multiple-output SMPS by using a bridgeless buck–boost converter at the front end. The diode bridge at the front end is eliminated, and two buck–boost converters are connected back-to-back so that each takes care of one half cycle of the ac supply. The bridgeless buck–boost converter is designed in DCM for single control loop and for inherent PFC. This regulated dc voltage is given to half-bridge VSI for obtaining multiple-output dc voltages. The half-bridge VSI is designed in continuous conduction mode to reduce the component stress

SCOPE OF THE PROJECT

This project presents **S**WITCHED-MODE power supplies (SMPSs) are used for powering up different parts in a personal computer (PC) by developing multiple dc voltages from a single-phase ac voltage from the power grid.

EXISTING SYSTEM

SWITCHED-MODE power supplies (SMPSs) are used for powering up different parts in a personal computer (PC) by developing multiple dc voltages from a single-phase ac voltage from the power grid. Normally, a diode bridge rectifier (DBR) followed by a filter capacitor is used at the front end of these SMPSs. DBR causes significant deterioration in the power quality , leading to very low power factor (PF) and high harmonic distortion at the ac mains with a high crest factor of the input current ,the input voltage and input current of a typical SMPS that is currently employed in most of the PCs. The current waveform is very peaky, non sinusoidal, and highly distorted; the PF is around 0.48. At full load, the total harmonic distortion (THD) of input ac mains current is 83.5%. The performance of the power supply is violating the limits set by various international standards.

EXISTING SYSTEMS TECHNIQUE:

BRIDGE CONVERTER:

A full wave rectifier consisting of four rectifiers connected in the form of a bridge, in which two pairs of rectifying elements are used, each pair being in series and connected to the input in opposite polarity to the other pair, the output being derived from the center points of the two pairs.

PROPOSED SYSTEM TECHNIQUE

To simulate the proposed bridgeless-converter-based multiple output SMPS, it is essential to estimate the component values. To derive the necessary design equations, the switches and diodes are considered to be ideal, and the switching frequency is considered very high compared to the line frequency (50 Hz). This enables considering the average quantity in one switching cycle for analysis purposes.

ADVANTAGES OF PROPOSED TECHNIQUE

- High power factor
- Cost is low
- High power quality

SIMULINK

Simulink, developed by MathWorks, is a commercial tool for modeling, simulating and analyzing multi-domain dynamic systems. Its primary interface is a graphical block diagramming tool and a customizable set of block libraries. It offers tight integration with the rest of the MATLAB environment and can either drive MATLAB or be scripted from it. Simulink is widely used in control theory and digital signal processing for multi-domain simulation and Model-Based Design

Simulink is a block diagram environment for multi-domain simulation and Model-Based Design. It supports system-level design, simulation, automatic code generation, and continuous test and verification of embedded systems.Simulink provides a graphical editor, customizable block libraries, and solvers for modeling and simulating dynamic systems. It is integrated with MATLAB, enabling you to incorporate MATLAB algorithms into models and export simulation results to MATLAB for further analysis.

Modeling Custom Components

SimPowerSystems enables to model custom components by using the fundamental elements included in itslibraries and by combining these elements with Simulink blocks.

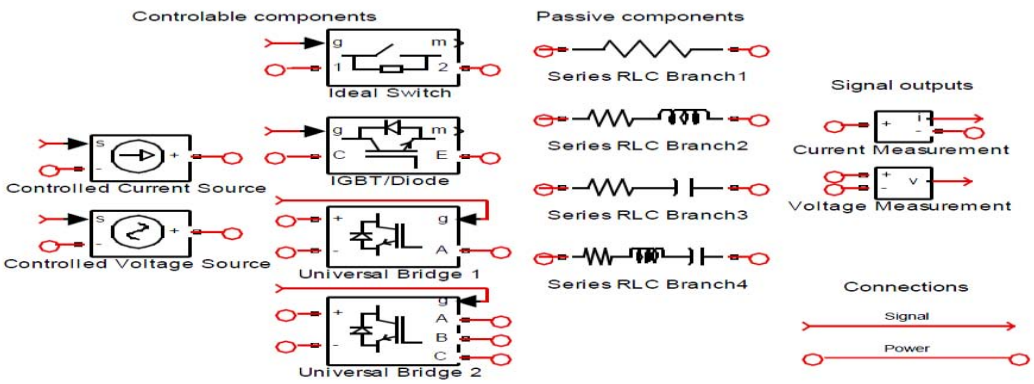

Fig.3.8. Simpower system Libraries

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Components provided in SimPowerSystems as shown in **Fig.3.8** include:

Electrical elements: Linear and saturable transformers; arrestors and breakers; and transmission line models.

Electric machinery: Models of synchronous, permanent magnet synchronous, and DC machines; excitationsystems; and models of hydraulic and steam turbine-governor systems

Power electronics: Diodes, simplified and complex thyristors, GTOs, switches, IGBT models, and universalbridges that allow selection of standard bridge topologies

Control and measurement: Voltage, current, and impedance measurements; RMS measurements; active andreactive power calculations; timers, multimeters, and Fourier analysis; HVDC control; total harmonic distortion;and abc-to-dq0 and dq0-to-abc transformations

Electrical sources: To implement sinusoidal current source, sinusoidal voltage source, generic battery model, Controlled AC Current and Voltage sources, DC Voltage Source. To implement three-phase voltage source with programmable time variation of amplitude, phase, frequency, and harmonics, and to implement three-phase source with internal R-L impedance. The entire blocksets is shown in **Fig.3.9.**

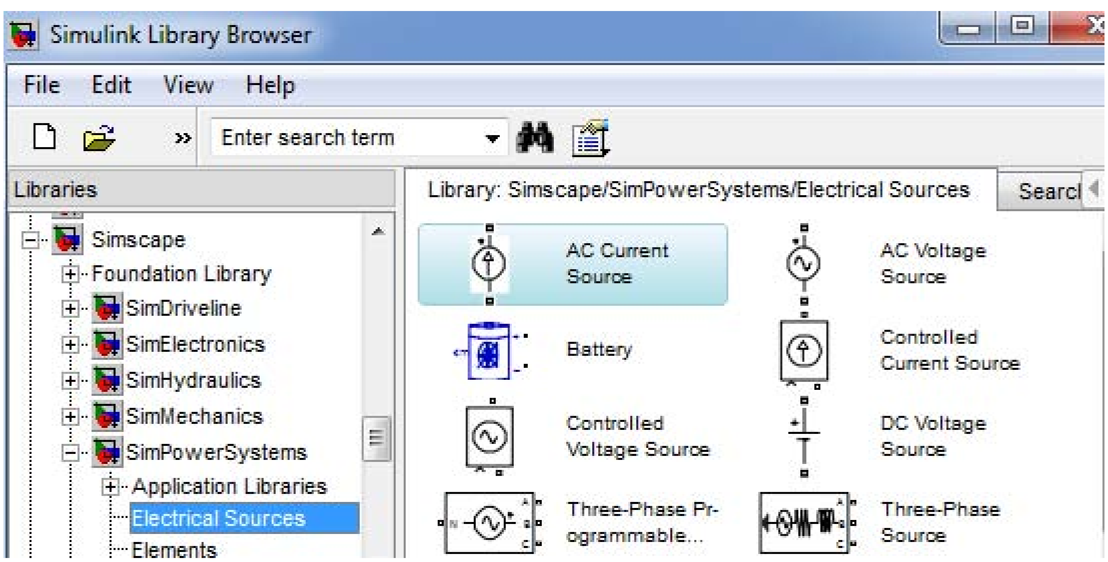


Fig.3.9.Blocksets of electrical sources used in SimPowerSystems

Three-phase components: RLC loads and branches; breakers and faults; *pi*-section lines; voltage sources;transformers; synchronous and asynchronous generators; and motors, analyzers, and measurements

Electric Drives and Other Application Libraries

SimPowerSystems provides the following specialized application libraries:

Flexible AC Transmission Systems (FACTS): Phasor models of flexible AC transmission systems

Distributed Resources: Phasor models of wind turbines

Electric Drives: Editable models of electric drives that include detailed descriptions of the motor, converter, andcontroller for each drive. The Electric Drives library includes permanent magnet, synchronous, and asynchronous (induction) motors. Theconverters and controllers implement the most common strategies for controlling the speed and torque for thesemotors, such as direct-torque control and field-oriented control.

SimPowerSystems supports the development of complex, self-contained power systems, such as those in automobiles, aircraft, manufacturing plants, and power utility applications. You can combine SimPowerSystems with other MathWorks physical modeling products to model complex interactions in multi-domain physical systems. The block libraries and simulation methods in SimPowerSystems were developed by Hydro-Québec of Montreal.

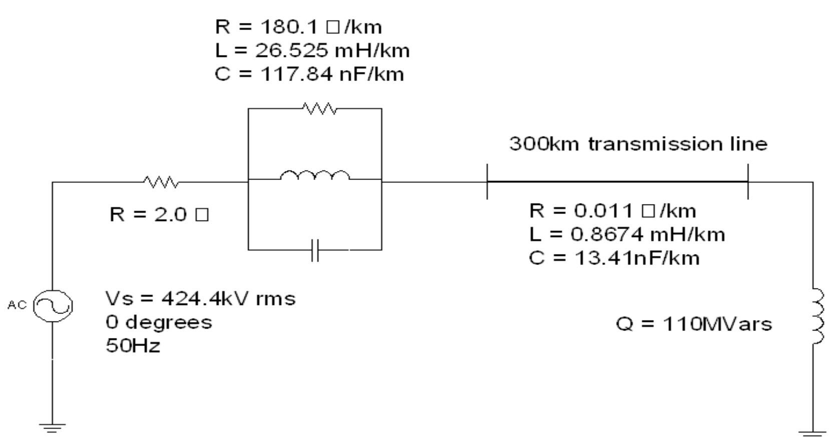


Fig.3.10. Circuit of a transmission line

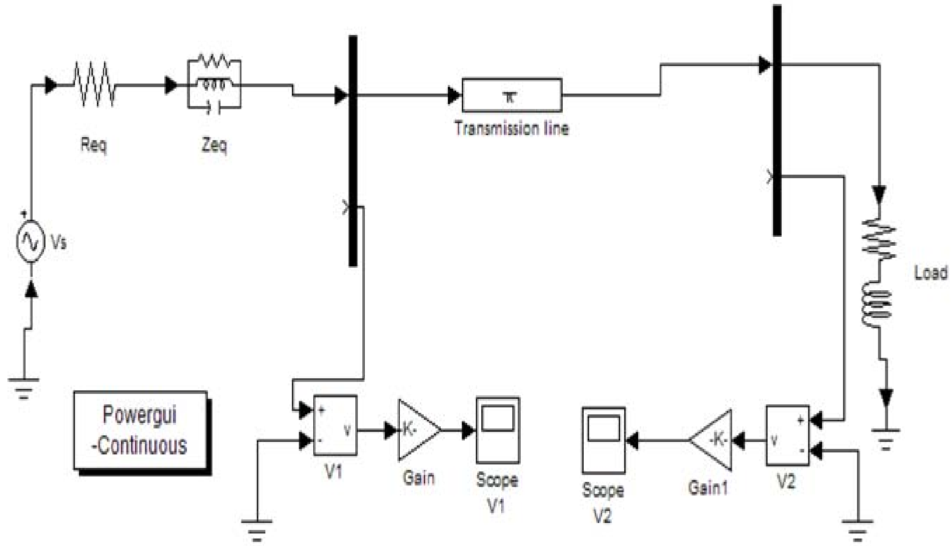
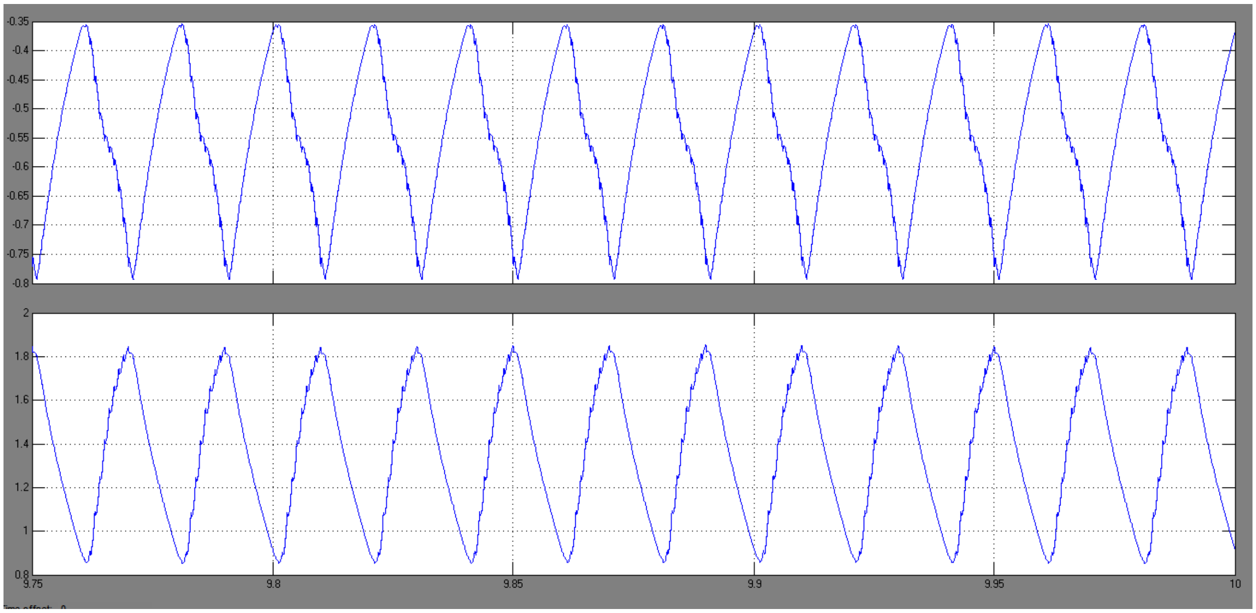


Fig.3.11. Same circuit designed in Simulink window

Thus users can rapidly put SimPowerSystems to work. The libraries that containing modelsof typical power equipment such as transformers, lines, machines, and powerelectronics are used to construct a electrical circuit shown in **Fig.3.10** and the completely designed circuit of the same in Simulink window as shown in **Fig.3.11**.

SIMULATION RESULTS



EXPECTED INPUT AND EXPECTED OUTPUT

Here the Input given to the circuit is 220V AC and 50Hzs frequency and the multiple output a got is 12, 5 , 3.3 VDC .

CONCLUSION

A bridgeless-converter-based multiple-output SMPS has been designed, modeled, simulated, and implemented in hardware to demonstrate its capability to improve the power quality at the utility interface. The output dc voltage of the first-stage buck–boost converter has been maintained constant, independent of the changes in the input voltage and the load, and it is operated in DCM to achieve inherent PFC at the single-phase ac mains. A satisfactory performance has been achieved during varying input voltages and loads with power quality indices remaining within the acceptable limits set by IEC.

REFERENCES

[1] P. J. Moore and I. E. Portugues, "The influence of personal computerprocessing modes on line current harmonics," IEEE Trans. Power Del.,vol. 18, no. 4, pp. 1363–1368, Oct. 2003.

[2] B. Singh et al., "A review of single-phase improved power quality AC–DCconverters," IEEE Trans. Ind. Electron., vol. 50, no. 5, pp. 962–981,Oct. 2003.

[3] Singh, S. Singh, A. Chandra, and K. Al-Haddad, "Comprehensive studyof single-phase AC–DC power factor corrected converters with highfrequencyisolation," IEEE Trans. Ind. Informat., vol. 7, no. 4, pp. 540–556, Nov. 2011.

[4] A. Canesin and I. Barbi, "A unity power factor multiple isolated outputsswitching mode power supply using a single switch," in Proc. IEEEAPEC, Mar. 1991, pp. 430–436.

[5] K.Matsuiet al., "A comparison of various buck–boost converters and theirapplication to PFC," in Proc. 28th IEEE IECON, 2002, vol. 1, pp. 30–36.

[6] E. H. Ismail, "Bridgeless SEPIC rectifier with unity power factor andreduced conduction losses," IEEE Trans. Ind. Electron., vol. 56, no. 4,pp. 1147–1157, Apr. 2009.