International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169
Volume: 4 Issue: 1 274 - 277

"Power Quality Improvement in Power System Using Multi Level Inverter Under Unbalanced Voltage Conditions"

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Abstract :-Power quality is very important aspect in power system. The harmonics in power systems are produced by various electronic devices. Conventional inverters produce more harmonics and distortions in power system which can be reduced by filters with increase in size and cost. Multi level inverter (MLI) reduces the harmonic contents and achieves sinusoidal signals without extra circuitry. A Multilevel Inverter (MLI) is a power electronic device built to produce a desired A.C voltage from several levels of DC voltages. Generally unbalanced voltages will occur at supply side these can be eliminated by using Multi level Inverter. It avoids stress on switches and amplifies the power rating of system. Cascaded H-bridge inverters are modular type of inverters. It can integrate the renewable energy resources like solar, fuel cell, wind energy, to the grid with elimination of transformer from the system. In this paper different control strategies i.e. carrier based PWM (pulse width modulation) for generating pulses to the inverter are discussed for various levels of the system with its applications. A closed loop Control system is designed using PI controller in order to maintain load voltage constant for under voltage and Over voltage conditions and MATLAB simulations have been carried out.

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I. LITERATURE SURVEY:

B.Harish, U.Raja Kiran, B.Madan lal, Soubhagya Kumar Dash, "Power Quality Improvement of DC-AC Converter by Using Cascaded H-Bridge Multilevel Inverter," in this paper the different control strategies (carrier based pulse width modulation) for generating pulses to the inverter are discussed for various levels.

P.Adhityan, M.Rajkumar, M.R.Neetu Singh "Improvement of power quality using cascaded multilevel inverter in t-statcom based system", in this paper the proposed technology has been designed using Cascaded Multilevel Inverter in T-STATCOM based system which significantly rectifies the power quality issues and reduces harmonics which is conformed through simulation investigation. [2].

Bhim Singh, Kamal Al-Haddad, Senior Member, IEEE, and Ambrish Chandra, "A Review of Active Filters for Power Quality Improvement", in this paper presents a comprehensive review of active filter (AF) configurations, control strategies, selection of components, other related economic and technical considerations, and their selection for specific applications. [3].

B.-R. Lin, member, IEEE and T.-L. Hung, "Analysis. and Implementation of a Single-phase Multilevel Inverter for Power Quality Improvement", in this journal the inverter is based on a conventional full-bridge inverter with one ac power switch. The switching signals of the power switches are derived from the voltage balance compensator, current controller and detected operation region of mains voltage [4].

Bhim Singh, Brij N. Singh, Ambrish Chandra, Kamal Al-Haddad, Ashish Pandey, and Dwarka P. Kothari, Senior Member, IEEE, "A Review of Single-Phase Improved Power Quality AC–DC Converters", in this journal deals with a comprehensive review of improved power quality converters (IPQCs) configurations, control approaches, design features, selection of components, other related considerations, and their suitability and selection for specific applications [5].

The ac power system has viewed the problems concerning reactive power and unbalance . It has deteriorated with the increased use of power electronic converters as some of these converters not only increase reactive currents, but also generate harmonics in the source current. These power electronic converters are used in variable frequency AC motor drives, large power supplies, standby inverters and UPS, battery chargers, etc., which produces harmonics with large harmonic ranges. The current quality problem also concerned under unbalance. The increased reactive power, harmonics, and unbalance cause an increase in line losses, instability, and voltage distortion when harmonics increases and produce voltage drop across the line impedance, which spoils the power system.

Cascaded H-bridge multilevel inverter can be implemented using only a single dc power source and capacitors. Cascaded H-bridge multilevel boost inverter for electric vehicle (EV) and hybrid EV (HEV) applications implemented without the use of inductors. New feedback control strategy for balancing individual dc capacitor voltages in a three-phase cascade multilevel inverter-based static synchronous compensator. Single-phase cascaded H-bridge converter for a grid-connected photovoltaic (PV) application. The independent control of each dc link voltage, for the tracking of the maximum power point of each string of PV panels is carried out. Direct torque control (DTC) scheme for electric vehicles (EVs) or hybrid EVs using hybrid cascaded H-bridge multilevel motor drive based on DTC operating principles is implemented. Generalized multiband hysteresis modulation and its characterization have been proposed for the sliding-mode control of cascaded H-bridge multilevel-inverter (CHBMLI)-controlled systems. Symmetric hybrid multilevel topologies are introduced for both single- and three-phase medium-voltage high power systems. The impacts of the connected load to the cascaded H-bridge converter as well as the switching angles on the voltage regulation of the capacitors are studied. Used a new topology of a cascaded multilevel converter based on a cascaded connection of single-phase sub multilevel converter units and full-bridge converters then, the structure is optimized.

The literature survey focuses its attention towards multilevel inverter, particularly to utilize under low power consumption, better performance and improved efficiency. The implementation feasibility in VLSI environment is also studied and analyzed in depth.

N.A. Rahim et al, (2009) presented a Field Programmable Gate Array-Based Pulse-Width Modulation for Single Phase Active Power Filter [58]. Further they designed and implemented of a sinusoidal Pulse-Width Modulation (PWM) generator for a single-phase hybrid power filter is presented. The PWM was developed in an Altera Flex 10 K Field Programmable Gate Array (FPGA) and the modulation index was selected by calculating the DC bus voltage of the active filter through a digital controller, by Proportional-Integral-Derivative (PID) technique. The implemented PWM generator using an FPGA required less memory usage while providing flexible PWM patterns whether same phase, lagging, or leading, the reference voltage signal. Experiment results showed the proposed active power filter topology to be capable of compensating the load current and the voltage harmonic, up to IEC (Integrated Electronic Circuit) limit.

S.Albert Alexander (Research Scholar), T.Manigandan(Dean,SES), N.Senthilnathan(Asst.Professor), "Digital Switching Scheme for Cascaded Multilevel Inverters", in this paper, a new digital switching technique for cascaded H bridge multilevel inverter (CMLI) for the purpose of power quality improvement is proposed in order to ensure an efficient voltage utilization and better harmonic spectrum [6].

II. PROPOSED METHODOLOGY:

The main objective is to improve the quality output voltage of the multilevel inverter with reduced number of switches. An important issue in multilevel inverter design is that to generate nearly sinusoidal output voltage waveform and to eliminate lower order harmonics. A key concern in the fundamental switching scheme is to determine the switching angles in order to produce the voltage with fundamental frequency A multilevel converter has several advantages over a conventional two-level converter that uses high switching frequency pulse width modulation (PWM). The attractive features of a multilevel converter can be briefly summarized as follows. Staircase waveform quality: Multilevel converters not only can generate the output voltages with very low distortion, but also can reduce the dv/dt stresses; therefore electromagnetic compatibility (EMC) problems can be reduced. Furthermore, CM voltage can be eliminated by using advanced modulation strategies such as that proposed in [14]. Input current: Multilevel converters can draw input current with low distortion. Switching frequency: Multilevel converters can operate at both fundamental switching frequency and high switching frequency PWM. It should be noted that lower switching frequency usually means lower switching loss and higher efficiency. Unfortunately, multilevel converters do have some disadvantages. One particular disadvantage is the greater number of power semiconductor switches needed. Although lower voltage rated switches can be utilized in a multilevel converter, each switch requires a related gate drive circuit. This may cause the overall system to be more expensive and complex.

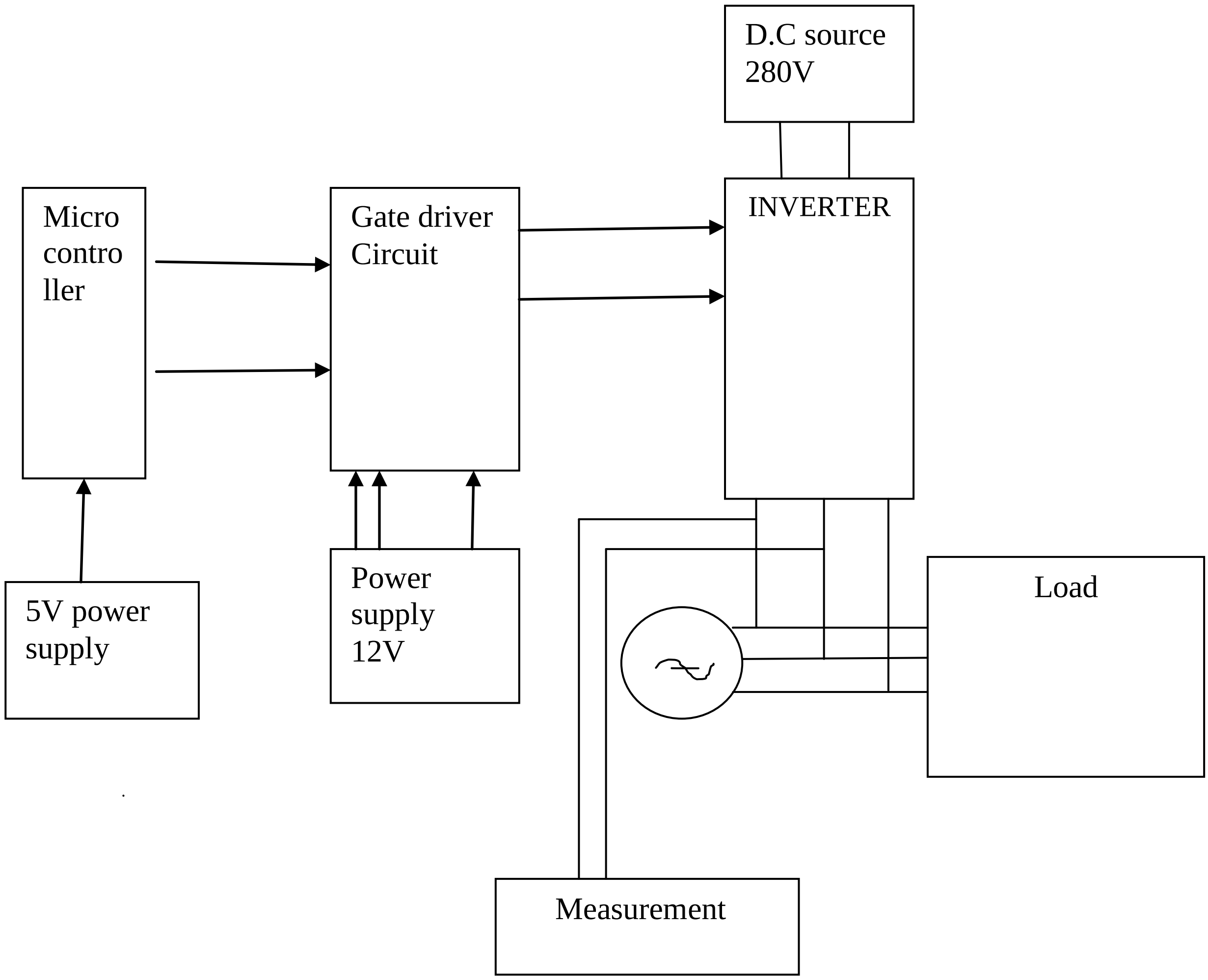
Principle of operation of Multilevel Cascade Inverter

Single phase five level cascaded H-bridge of various switching and they have the number of switches, diodes, and capacitors are comparison with proposed method of multilevel cascade inverter as especially shunt and series connected FACTS devices. The multilevel cascade inverter synthesizes its output nearly sinusoidal voltage waveforms by combining many isolated voltage levels. A series of single-phase full bridges makes up a phase for the inverter. A single-phase multilevel cascade Inverter topology is essentially composed of single identical phase legs of the series-chain of H-bridge inverter, which can possibly generate different output voltage waveforms and offers the potential for ac system phase-balancing. This feature is impossible in other Voltage source control topologies utilizing a common dc link. Since this topology consists of series power conversion cells, the voltage and power level may be easily scaled. The dc link supply for each full bridge inverter is provided separately, and this is typically achieved using diode rectifiers without using the single-phase transformer. The converter topology is based on the series connection of single-phase inverters with separate dc sources the resulting phase voltage is synthesized by the addition of the voltages generated by the different cells. In a five level cascaded inverter each single-phase full-bridge inverter generates five voltages at the output: +Vdc, + 2vdc, 0,-Vdc and -2vdc.

In this project both hardware and software setups are used. The hardware setup consists of Microcontroller, MOSFET/IGBT, Gate drivers, multiwinding Transformer for each gate driver,12v dc supply ,panel module.

In the software setup, MATLAB software is used to understand the graphical nature of temperature by simulation. For that Embedded C programming is prefer to use.

III. BLOCK DIAGRAM



IV. MICROCONTROLLER AT89C51

Features

• Compatible with MCS-51™ Products
• 4K Bytes of In-System Reprogrammable Flash Memory
– Endurance: 1,000 Write/Erase Cycles
• Fully Static Operation: 0 Hz to 24 MHz
• Three-Level Program Memory Lock
• 128 x 8-Bit Internal RAM
• 32 Programmable I/O Lines
• Two 16-Bit Timer/Counters
• Six Interrupt Sources
• Programmable Serial Channel
• Low Power Idle and Power Down Modes

V. DESCRIPTION

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmable and Erasable Read Only Memory (PEROM). The device is manufactured using Atmel's high density nonvolatile memory technology and is compatible with the industry standard MCS-51™ instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications.

VI. REFERANCES:

[1] B.Harish, U.Raja Kiran, B.Madan lal, Soubhagya Kumar Dash, "Power Quality Improvement of DC-AC Converter by Using Cascaded H-Bridge Multilevel Inverter," Vol. 3, Issue 2, February 2014.
[2] P.Adhityan, M.Rajkumar, M.R.Neetu Singh "Improvement of power quality using cascaded multilevel inverter in t-statcom based system" 4th IRF International Conference on 19th April 2015.
[3] Bhim Singh, Kamal Al-Haddad, Senior Member, IEEE, and Ambrish Chandra, "A Review of Active Filters for Power Quality Improvement", IEEE transactions on industrial electronics, vol. 46, no. 5, october 1999.
[4] B.-R. Lin, member, IEEE and T.-L. Hung, "Analysis. and Implementation of a Single-phase Multilevel Inverter for Power Quality Improvement", in 0-7803-7369-3/02/$17.00 0 2002 IEEE.

[5] Bhim Singh, Brij N. Singh, Ambrish Chandra, Kamal Al-Haddad, Ashish Pandey, and Dwarka P. Kothari, Senior Member, IEEE, “A Review of Single-Phase Improved Power Quality AC–DC Converters”, IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 50, NO. 5, OCTOBER 2003.

[6] S.Albert Alexander (Research Scholar), T.Manigandan(Dean,SES),.Senthilnathan(Asst.Professor),“Digital Switching Scheme for Cascaded Multilevel Inverters” , in 2009 Third International Conference on Power Systems, Kharagpur, INDIA December 27-29 PAPER IDENTIFICATION NUMBER: 31 .

[7] B. Suryajitt, G. Sudhakar, “Power Quality Improvement Using Cascaded H-Bridge Multilevel Inverter Based Dstatcom”, B. Suryajitt Int. Journal of Engineering Research and Applications. ISSN : 2248-9622, Vol. 4, Issue 11(Version 3), November 2014, pp. 31-37.

[8] Nainala Vasanthakumar , K.Ramcharan, “Power Quality Improvement Using 3 Phase Cascaded H-Bridge Multi Level Inverter Under Unbalanced Voltage Conditions”, International Journal of Engineering Research and Applications (IJERA) ISSN: 2248-9622, Vol. 2, Issue4, July-August 2012, pp.2203-2209.

[9] 1Ionel VECHIU, Member IEEE 1,2Aitor ETXEBERRIA, 1ESTIA, F-64210, Bidart, France 2UPV/EHU, San Sebastian, Spain, “Power Quality Improvement using an Advanced Control of a Four-leg Multilevel Converter”, 978-1-4673-6847-6/15/$31.00 ©2015 IEEE.

[10] Mahadzir Abdul Ghani, “A Simple Active Power Filter With 5-Level NPC Inverter”, 2014 4th International Conference on Engineering Technology and Technopreneuship (ICE2T).

[11] Dr. Sachin S. Bharatkar ,Mr. Raju R. Bhoyar, Mr. Sarang A. Khadtare.“ Analysis of Three Phase Cascaded H-Bridge Multilevel Inverter For Symmetrical & Asymmetrical Configuration”.

[12] G.Nageswara Rao,Dr.K.Chandra Sekhar, Dr.P.Sangameswara Raju “Multilevel Inverter For Power Quality Improvement Using Intelligent Systems”, IEEE-International Conference On Advances In Engineering, Science And Management (ICAESM -2012) March 30, 31, 2012.