"Review on Simulink Modeling of PWM Rectifier for Static Automatic Voltage Regulator"

Ms. Priyanka V. Raut[1]
[1]PG Student S.D. College of Engineering, Selukate, Dist Wardha, India.

Mr. K. N. Sawalakhe [2]
[2]Head of Department(Electronics & Telecommunication)
S.D. College of Engineering, Selukate, Dist. Wardha, India.

Mr. R. G. Shriwastava [3]
[3]Associate Professor & Head of Department of Electrical Engineering, B.D. College of Engineering, Sevagram, Dist Wardha, India

***Abstract*— Good functioning of the majority of electrical and electronic equipment depends on the supply voltage correctness and steadiness. Nowadays, many industries and private users are subjected in long-lasting fluctuations that can be inconvenient or even dangerous. The static stabilizer offers a reasonable improvement on slow servo controlled stabilizer as well as other static tap changing stabilizers. .The basic topology is with buck-boost transformer with high primary to secondary ratio for voltage correction of ± 25%. The control voltage is imposed on the primary of this buck-boost transformer. The voltage regulation with help of buck and boost topology is achieved electronically without the step changes in voltage that occur when the system regulates. This task is accomplished through a feedback and a control system implemented. The system uses IGBTs as power switches. Direct AC-AC converter circuit improves the overall system response and fast voltage correction. Number of storage capacitor increase life of the system. 20 KHz PWM control operation using MICROCONTROLLER Atmega16 to achieve correction time of 1 to 1.5 cycles.**

Keywords*— *PWM rectifier, Boost Inductor, EMI, Inverter, AVR, SVR.

I. INTRODUCTION

Recently, OA, POS, VAN, LAN and other high- function computer-applied equipment's are considerably used and are forming an information oriented society. However, these computer-applied equipment's are vulnerable to disorder of AC input power and a momentary power failure or voltage drop may destroy valuable data. To protect the data from trouble of AC input source, installing AVR for stabilizing the input power of computer applied equipment's is an effective means. For this purpose, demand for AVR is increasing. Recently in particular, demand for small capacity, compact, high performance and low cost AVR is increasing incidental to decrease in size and sophistication in performance of data processing equipment's [4]. The input power circuit for computer-applied equipment is usually composed of a capacitor-input type rectifying circuit and the input current contains a lot of low order harmonic components. Even when a distorted current which contains much of these low order harmonic components is allowed to flow, the output voltage must be free from excessive distortions. This is an important performance imposed on AVR which operates computer-applied equipment's properly [2].

When harmonic current flows from a computer applied equipment to distribution line, there may arise harmonic troubles on a power distribution system. To cope with it recently, such a AVR has come to be demanded that computer applied devices are protected from disturbance of AC input source and that harmonic components in the input current are reduced to apply a high quality input current. PWM based static automatic voltage regulator consists of two stage conversion with PWM switching and buck-boost transformer. Rectifier module converts voltage to stable DC voltage, a floating charge of battery and, at the same time, supplies power to a subsequent PWM inverter. If a power failure of AC input source occurs, rectifier stops and the DC link capacitor discharges to supply power to the inverter. PWM inverter converts DC power supplied from rectifier or DC link capacitor to AC power of constant voltage and constant frequency [3].

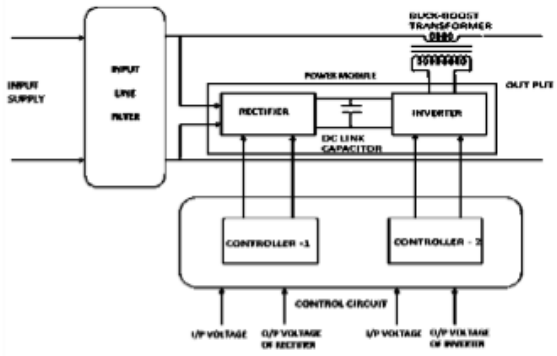

Fig1 Block Diagram of Static AVR

The primary winding of the buck- boost transformer is connected between main supply and load whereas secondary winding is connected to the output of two sage converters. The difference between input voltage and output voltage is generated across the primary winding of buck-boost transformer by PWM switching using a micro controller. According to the difference, generated voltage is in phase or 180 degree out of phase with respect to the input line-to-neutral voltage. Depending upon the phase, difference voltage is added or subtract from input voltage, and we get output voltage constant.

PWM based static automatic voltage regulator gives better regulation, fast dynamic response and wide input range than the other voltage regulation topology.

This paper introduces basic concept of Static AVR, design details & simulation results of PWM rectifier. AVR consist of a combination of high frequency PWM Rectifier using power IGBTs as switching elements and high frequency PWM inverter using power IGBTs likewise. For Inverter module of

AVR, input current is controlled to maintain sinusoidal waveform by PWM Rectifier & a high quality current free from excessive harmonics flows from AC-power source. SVR regulates the voltage through the tapping selection by means of semi-conductor static switching devices viz. Thyristors, IGBTs which respond instantaneously. In addition, microprocessor-based control circuitry along with Thyristors results in high correction speed and higher efficiency. There is no moving part inside SVR and it is a fully electronic & automatic unit. [1] [2][4]

Static Voltage Regulator is a Thyristor- controlled microprocessor-based electronic device, having an Isolation Transformer & RFI/EMI filters. It regulates fluctuating voltages in a precise manner & constitutes a high-level spike suppression system which protects the equipment by virtually eliminating any transients in the distribution network. Static Voltage Regulator is most suitable for 24-hour continuous process operations where break downs due to fluctuations results in heavy financial losses and damage of expensive equipments. A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage regulators: linear and switching. A linear regulator employs an active (BJT or MOSFET) pass device (series or shunt) controlled by a high gain differential amplifier. It compares the output voltage with a precise reference voltage and adjusts the pass device to maintain a constant output voltage. A switching regulator converts the dc input voltage to a switched voltage applied to a power MOSFET or BJT switch. The filtered power switch output voltage is fed back to a circuit that controls the power switch on and off times so that the output voltage remains constant regardless of input voltage or load current changes.

II. LITERATURE SURVEY

[1] Pratik J. Munjani1, NitinH. Adroja2, VinodJ. Rupapara3 Modelling of PWM Rectifier for Static Automatic Voltage Regulator, International Journal of Advance Engineering and Research Development (IJAERD) ETCEE-2014 Issue, March 2014, e-ISSN: 2348 - 4470 , print-ISSN:2348-6406

--In this paper, A single phase two-quadrant PWM rectifier to power fixed DC voltage at the input of inverter module will be presented in this paper. The proposed PWM rectifier can be operated as a Single phase bridge rectifier to maintain well-regulated and boosted DC-link voltage for Inverter module. The control of this converter is realized using analog type closed loop circuit. A proportional-Integral type controller is designed, and the PWM type switching control signal for IGBT is generated by Op-amp circuitry. In idle case, the proposed PWM rectifier can be arranged to act as a single phase full bridge rectifier.

[2] Matrin Electronic Devices & Instruments" AC – AC PWM mode Static voltage Stabilizerusing IGBT and DSP"

--In this is an SMPS type voltage stabilizer for mains voltage (AC input and AC output). This is a new switching topology where PWM is made directly in AC-to-AC switching, without any harmonic distortion. In this topology there is no need to convert the AC input to DC and again convert it back to regulated AC output. This simplifies the design, reduces the component count and improves the efficiency and reliability.

[3] " AUTOMATIC VOLTAGE STABLIZER" prepared by Electrical Division MSME-Development Institute Ministry of MSME Government of India 34, Industrial Estate Nunhai , Agra- 282001

--This paper presents The Voltage stabilizer provides an output voltage with a specified limit for supplying to load irrespective of wide fluctuation in the input voltage, independent of load power factor and without introducing harmonic distortion. The voltage stabilizer adjusts automatically the voltage variation whether high or low to the proper voltage level necessary for the safe operation of equipments

[4] S.Gupta "POWER QUALITY IMPROVEMENT USING PWM VOLTAGE REGULATOR" IJMIE Volume 2, Issue 5 ISSN: 2249-0558

-- In this present paper, stress has been laid upon the present scenario of power quality in every grid. With more and more use of non linear electrical loads instead of linear loads, we get increased efficiency with reduced power requirements; however this degrades the power quality of whole power system. Power quality is basically determined by the voltage magnitude and frequency in a system. To improve it, we can use voltage regulators, filters, etc

III. PROPOSED METHODOLOGY

The secondary winding of the buck/boost control transformer is connected in series to the supply line going to the load. Its primary winding is fed with a voltage from a IGBT based AC-AC converter. The voltage is induced in the secondary winding gets added to or is subtracted from the mains voltage depending upon its phase with respect to the line voltage. Fig 2 shows proposed block diagram. The induced voltage will either be in phase or out of phase by 180^0 with the supply voltage. Buck or boost voltage is obtained based on the output and is obtained by changing AC-AC converter output polarity. Output voltage amplitude is changed by changing the PWM duty cycle, PWM duty cycle of 20 KHZ frequency vary from 0-95% to regulate the output voltage in case of buck and boost mode. Nowadays, many industries and private users are subjected in long-lasting fluctuations that can be inconvenient or even dangerous.AC voltage stabilizers are used for obtaining a steady AC supply with very close tolerances from fluctuating mains.

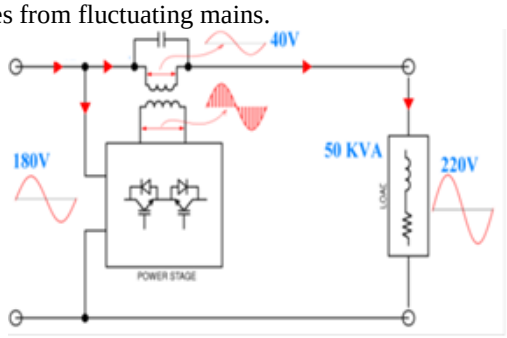

Fig. 2

IV. CONCLUSION

A static PWM based voltage regulator using IGBT power module gives better voltage regulation and large input voltage range. It provides fast dynamic response to input voltage variation as well as large Mean Time BetweenFailure because of solid state component used for it.

The simulation results will shows that IGBT Half bridge front end converter is the best choice among the two types – Phase Controlled & PWM rectifier, but it has higher cost and circuit complexity. Diode Bridge has the disadvantage of poor power factor and large harmonic in input current. Thus half bridge front end converter is the better choice for low cost and improved performance.

REFERENCES

[1] Zhong Du, Student Member, IEEE, Leon M. Tolbert, Member, IEEE, M. J. Hossain, Member, IEEE, "A Cascade Multilevel Inverter Usinga Single DC Source", *IEEE*-0-7803-9547-6/06/$20.00 ©2006 *IEEE.*

[2] M. Kavitha1, A. Arunkumar 2, N. Gokulnath 3, S. Arun, "New Cascaded H-Bridge Multilevel Inverter Topology with Reduced Number of Switches and Sources," IOSR Journal of Electrical and Electronics Engineering *(IOSR-JEEE*) ISSN: 2278-1676 Volume 2, Issue 6 (Sep-Oct. 2012).

[3] Divya Subramanian, Rebiya Rasheed on "Five Level Cascaded H-Bridge Multilevel Inverter Using Multicarrier Pulse Width Modulation Technique "International Journal of Engineering and Innovative Technology (IJEIT) Volume 3, Issue 1, July 2013

[4] P. Vinod Kumar, Ch. Santosh Kumar and K. Ramesh Reddy "Single Phase Cascaded Multilevel Inverter Using Multicarrier Pwm Technique" ARPN Journal of Engineering and Applied Sciences ©2006-2013 Asian Research Publishing Network (ARPN)

[5] Mr.R.G.Shriwastava,Dr. M.B.Daigavane,Dr.S.R.Vaishnav"Design Of A Permanent Magnet Synchronous Machine For The Electric Power Steering", International Journal of Engineering Research and Applications (IJERA-2011) Vol. 1, Issue 3, pp.646-653

[6] Mr.R.G.Shriwastava,Dr. M.B.Daigavane,Dr.S.R.Vaishnav "Intelligent control design of PMSM drive for Automotive Application",International Journal of Scientific & Engineering Research(IJSER-2012) Volume 3, Issue 5.

[7] Mr.R.G.Shriwastava,Dr. M.B.Daigavane,Dr. S.R.Vaishnav"Design Of A Permanent Magnet Synchronous Machine For The Electric Power Steering",International Journal of Advance Research in Electrical, Electronics and Instrumentation Engineeringn (IJAREEIE) ISSN (print:2320-765ISSN(online):2278-8875Vol.3 Issus 3, March 2014.