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Power Quality Enhancement Of Miso Converter For Combined Upqc And Photovoltaic Array

P.P.Srinivass[#1], L.Umasankar[#2], N.Kalaiarasi[#3] , A.Shanmugasundaram[#4]
R.Prasanna Venkatesh[#5]
[2]Asst.Prof.,[3]Professor & Head,[1,4,5]U.G Student, Electrical & Electronics Engineering, RMK College of Engineering and Technology, R.S.M Nagar,
Puduvoyal, Taluk, Gummidipoondi Chennai, India

***Abstract*:** *The people in the industrial and residential areas have in the need of the equal power distribution. Proposed system is dealt with the enhancement of power quality generation. This proposed system also deals with the voltage distortion and sag in the industrial and residential areas, which is mainly due to the heavy loads. The voltage sag or distortion can be compensated by implementing the proposed system which includes the combination of UPQC and photo voltaic array, the general working of the UPQC is to increase the voltage in the heavy load condition i.e., the compensation volt age is given to the transmission lines and the role of the photo voltaic array system is that the solar energy is converted into the electrical energy, the generated energy will be in DC form. It is mandatory to note that the photo voltaic array unit is connected through the DC-DC converter (ex: chopper) which has the Multi Input Single Output (MISO) in a link which is in the DC form, this is further connected to the UPQC, the photo voltaic arrays gives the energy to operate the UPQC. The system is based on the theory of instantaneous power. Finally the MATLAB software is used to check efficiency of the system by help of simulation, Thus this system is an efficient method for compensating the voltage sag and the voltage distortion with the improvement of the power quality and to develop the power generation for the betterment of future generation.*

Keywords: *voltage sag, voltage interruption, Active power injection, UPQC, Photo voltaic Array.*

I. Introduction

According to Akagi and Fujita [13] the basic device can control the power quality and to improve the efficiency of the circuit. It mainly deals with the UPQC; the duty of it is to reduce the distortion which affects on the operation on the heavy loads. It is able to compensate voltage sag and swell, voltage and current reactive power using shunt and series inverter. The shunt inverter is to compensate the voltage sag and series inverter is to compensate the current which is reduced during the heavy load condition. But the UPQC is not able to compensate voltage interruption and active power injection to grid, because in its DC link, there is no energy source.

According to YashPal et.al.[11] this presentation says, a comprehensive review of compensating custom power devices mainly DSTATCOM (distribution static compensator), DVR (dynamic voltage restorer) and UPQC (unified power quality compensator). It is mainly aimed of the compensating device in electric power distribution system.

N.G.Hingorani and L.Gyugi [4] various power electronics technology devices have been proposed especially to be applied to medium voltage networks, N.G.Hingorani [5] has proposed on the custom power concept to ensure high quality of power supply in distribution networks using power electronic devices.

From the existing system the proposed system is modified. The proposed system uses UPQC to compensate the voltage and photovoltaic array is used to give the power to run the UPQC, also it is used to control the power electronics devices and the boost converter is used to boost up the voltage.

UPQC is the static equipment used for AC transmission of electrical energy. it is a combination DSTATCOM and DVR. It's shunt series compensation is used for solving the problem related to power quality such as voltage sag and reactive power. When it gets the source through the boost converter from the Photo Voltaic arrays, current sag is supported by the DSTATCOM and similarly voltage sag is supported by DVR. It is actually used to boost up the input and it gives the very high output. The output very much higher than the actual output. The energy to the UPQC is given by the photovoltaic arrays.

Photo voltaic arrays is a inter connection of Photo voltaic modules which in turn made of many Photo voltaic cells connected either in series or in parallel. The modules are connected to form arrays so that load can be supplied. One of the favorable Dispersed Generations (DC's) are used to tap the light energy from huge resource i.e. sun and it play the key role in sustainable energy system. Photo voltaic array is the system used for converting solar energy into electrical energy. Thus the obtained electrical energy will be in DC form.

In this system the Boost converter that is DC-DC converter used as a power converter in which the output DC voltage is greater than its input DC voltage. It is also called as step up converter.

II. Theory And Methodology

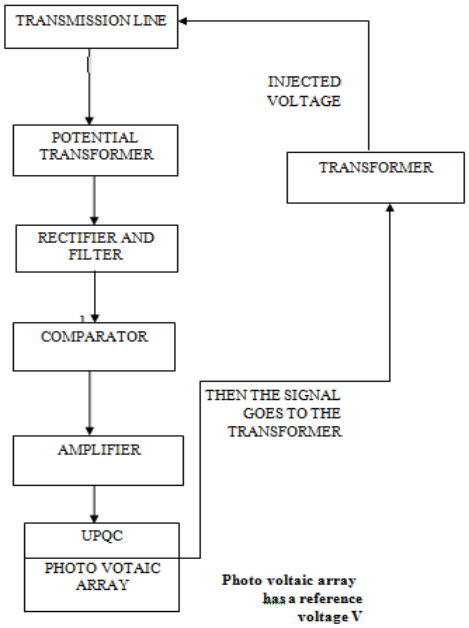

Fig.1. Operational flow chart

The Fig.1 shows one end of the transmission line is connected to the load; the other end is connected to potential transformer this gives the potential to the transformer. Its other end is connected to rectifier and filter which converts the unidirectional voltage/current to the ac voltage/current, this rectifier and filter connected to the comparator whose function is to compare the voltage of the previous cycle and the present cycle, then this is connected to the amplifier which is used to amplify the voltage, from this amplifier the signal is sent to UPQC, that whether there is any voltage sag due to the heavy load condition. Actually the UPQC and photo voltaic array is connected together; this photo voltaic array gives the necessary charge to UPQC. Then this UPQC is connected to the primary of the transformer and the secondary of the transformer is again connected to the transmission line. If there is any voltage sag in the transmission line the voltage is sent by UPQC the voltage which is sent is called Injector voltage.

The performance analysis of a static compensator (STATCOM)-based voltage regulator for self-excited induction generators (SEIGs) supplying nonlinear loads. In practice, a number of loads are nonlinear in nature, and therefore, they inject harmonics in the generating systems. The SEIG's performance, being a weak isolated system, is very much affected by these harmonics. The additional drawbacks of the SEIG are poor voltage regulation and that it requires an adjustable reactive power source with varying loads to maintain a constant terminal voltage. A three-phase insulated-gate-bipolar-transistor-based current-controlled voltage source inverter working as STATCOM is used for harmonic elimination, and it provides the required reactive power for the SEIG, with varying loads to maintain a constant terminal voltage. A dynamic model of the SEIG-STATCOM feeding nonlinear loads using stationary d-q axes reference frame is developed for predicting the behaviour of the system under transient conditions. The simulated results show that SEIG terminal voltage is maintained constant, even with nonlinear balanced and unbalanced loads, and free from harmonics using STATCOM-based voltage regulator

The UPQC is the combination of both the DSTATCOM and the DVR. It is custom power device which is similar in construction of Unified Power Flow Conditioner (UPFC). The UPQC is just like the UPFC which employs two voltage source inverters (VSIs) and dc energy storage capacitor is connected to it. One of these two VSIs is connected in series with the ac line and other is connected in shunt with an ac system. The series components of the UPQC to maintain the voltage at the point of common coupling (PCC) it gives an insert voltage now it is balanced and is free of distortion.

Now this system is done in the Matlab. Matlab is the high performance language for technical computing. It is an easy to use environment where problems and solutions are familiar to the mathematical notation. The name mat lab stands for matrix laboratory toolboxes are the compressive collection mat lab

function (M-files) that extends the matlab environment to solve particular classes of problem. Areas in which toolboxes are available include signal processing, control system, neutral network, fuzzy logic and many others. This is implemented in the physically i.e. the hardware implementation is done.

III. Hardware Implementation

In this we use different components. They are:

- PIC Microprocessor 16F84A
- Voltage Regulators
- 7812 voltage regulator
- 7805 voltage regulator

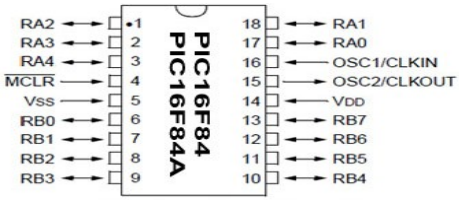

Fig.2 PIC Microcontroller pin Diagram

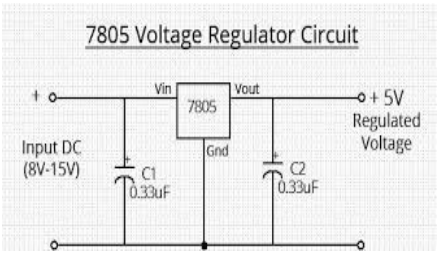

Fig.3. Voltage Regulator circuit

IV. Results And Discussion

The important fact is that the load varies from place to place; hence the operating voltage becomes lower than the supply voltage in some places .The condition at which the voltage is very low may affect the electrical machines or equipments and it may even damage them. The proposed system will be more helpful in solving the problem in a better way. Power distribution is not equal in many places and also quality of the power is needed to be improved, to compensate such conditions this system may play a vital role in the enhancement of power quality and power distribution.

A. compensation of voltage sag

The proposed system shown in Fig .6.is mainly used to compensate the voltage sag or distortion in the transmission lines, the valuable units such as the UPQC and photo voltaic array works ultimately for increasing the voltage. when heavy loads are applied. For example when the voltage lowers to 140v which is less than input voltage then the UPQC will equalize the voltage sag and will increase the voltage to the operating voltage of the equipment , the effective working of UPQC is because it is a combination of DSTATCOM and DVR . The main cause of voltage sag is because of the utility systems at customer side and sudden increase in the load current like starting motor and generator.figure.4 shows the simulation done on the line compensation with the UPQC and photo cell using MATLAB software.

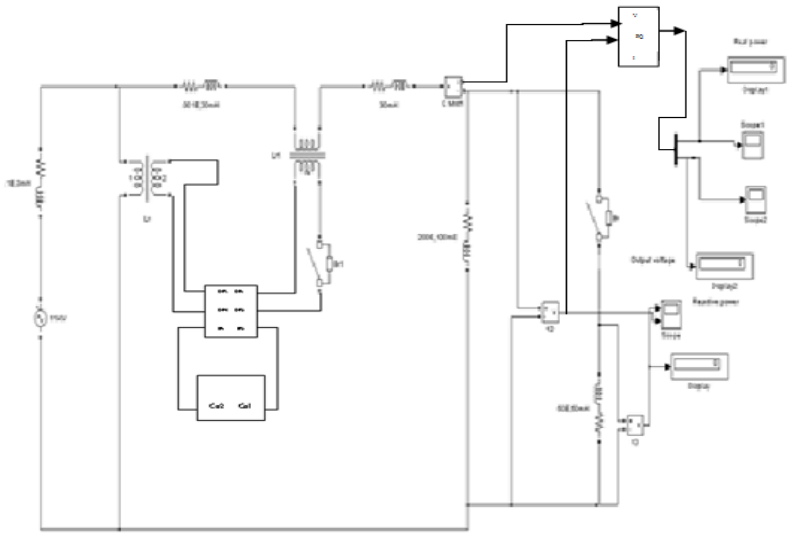

Figure.4 Simulik Diagram

Figure.5.1 shows the output voltage graph of load 1 and load 2.In this graph it is clear that when load 1 operates there is no voltage interruption but after a interval of 0.2 seconds load 2 is applied ,then the sag appears in the line and hence the voltage across the load 1 get decreased. When the compensation is applied at 0.3 seconds then the output voltage of load 1 and loads 2 increases correspondingly.

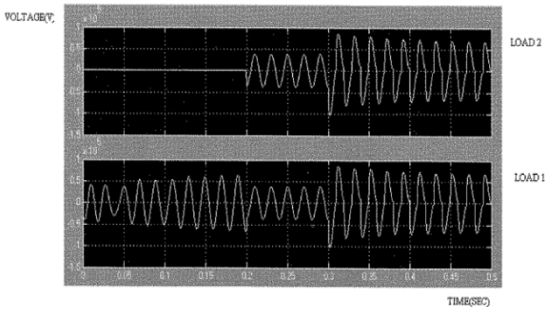

Figure.5.1

B. Enhancement in the power quality using distribution system

The ultimate aim of the system is to improve the quality of power. The power is the vein of machines and electrical based equipments without which there is no comfort in the human life. The quality is basic characteristic feature needed for the power to operate anything without any diversion from their working. As the increase in the power usage, it is needed to provide quality and reliable power. Based on the study the main factors which affect the quality are voltage sag, harmonic distortion and low power factor The figure 5.2 gives an idea about the decrease and increase of real power when load is applied and removed respectively .when the load 1 is operated there is no distortion but when load 2 is applied at 0.2 seconds the real power decreases. finally when the compensation is applied the real power increases.

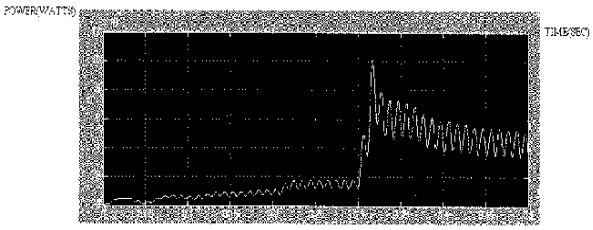

Figure.5.2

The next figure.5.3 consists of a graph that deals with the reactive power which is similar to that of the increase and decrease in the magnitude of real power when load is applied and removed correspondingly

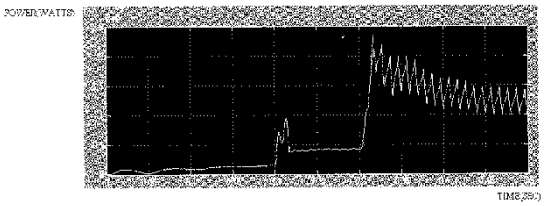

Figure.5.3

Fig.6. Experimental Setup

V. Conclusion

1. This study describes the combined operation of UPQC with Photo voltaic arrays. This system can compensate any voltage sag or interruption, when load is applied. It also used to control reactive power.
2. It is a system which is a powerful tool for making the power a reliable one and improving the quality in the distribution network due to the versatile compensation function and also for integrating characteristics of compensation.
3. Series converter will draw supply from the main source, so that it acts as a control rectifier and also to control the terminal voltage.
4. Shunt inverter control the power flow. These two converters control the voltage sag and power flow.
5. Thus the performance of the system can be improved by using FACTS devices.

References

[1]. C.Sankaran "POWER QUALITY", CRC Press 2002.
[2]. K.R. Padiyar "Facts controllers in power transmission and distribution" new age international (P) Ltd publishers, 2007.
[3]. N.G.Hingorani, "Flexible AC Transmission", IEEE Spectrum, vol. 30 pp. 40-44, 1993.
[4]. N.G.Hingorani and L Gyugi, Understanding FACTS- Concepts and Technology of Flexible AC Transmission Systems, IEEE press, New York, 2000.
[5]. N.G.Hingorani, "Introducing Custom Power", IEEE Spectrum, vol. 32, p. 41-48, 1995.
[6]. Guide for Application of Power Electronics for Power Electronics for Power Quality Improvement on Distribution Systems Rated 1 kV to 38 kV, IEEE P1409 Distribution Custom Power Task Force, 2003.
[7]. Masoud Aliakbar Golkar, "Power Quality in Electric Networks: Monitoring and Standards" the second world engineering conference, pp. 137-141 July 2002.
[8]. Michael D. Stump, Gerald J. Keane "The role, of the custom power products in enhancing power quality at industrial facilities", Energy Management and Power Delivery, vol. 2, pp. 501-517, International Conference 1998.
[9]. D. Daniel Sabin, Senior Member, IEEE, and Ambra Sannino, IEEE "A Summary of the Draft IEEE P1409 Custom Power Application Guide" Transmission and Distribution Conference and Exposition, IEEE PES, vol. 3.pp. 931-936, 2003.
[10]. C.Alvarez, J.Alamar A.Domijan Jr., A. Montenegro, and Song, "An investigation toward new technologies and issues in power quality," in Proc. 9th Int. Conf. Harmon. Qual. Power, vol. 2, pp. 444-449, 2000.
[11]. Yash pal, A. Swarup, Senior Member, IEEE, and Bhim Singh, Senior Member, IEEE "A Review of Compensating Type Custom Power Devices for power Quality Improvement" IEEE Power India Conference, pp. 1-8, 2008.
[12]. Bingsen Wang, Giri Venkataramanan and Mahesh Illindala, "Operation and Control of a Dynamic Voltage Restorer Using Transformer Coupled H-Bridge Converters", IEEE transactions on power electronics, vol. 21 pp. 1053- 1061, July 2006.
[13]. H. Akagi, and H. Fujita, "A new power line conditional for harmonic compensation in power systems, " IEEE Trans. Power Del., vol. 10, no. 3, pp. 1570-1575, Jul. 1995.