Artificial Neural Network based Compensation of Voltage Sag and Swell by using Dynamic Voltage Restorer

Mr. O. Karthikeyan, A. Mohamed Ansari , K. Sathish Babu, M. Tamilselvi, R. Vanitha,
Department of Electrical and Electronics Engineering,
Indra Ganesan College of Engineering,
Trichy, India.

***Abstract*: The electrical energy is one of the easily available in the world. power quality is an net worthy topic. At present day power quality issues in major problem in this world. power quality is any abnormal behavior on a power system arising in the form voltage and/or current which adversely affects the normal operation of electrical or electronic equipement. power system consists of transmission and distribution Line. There are many power quality issues in power system such as like harmonic distortions, voltage sag ,voltage swell, voltage unbalance, power frequency variation etc. We are project compensate the voltage sag and swell by using DVR artificial neural network based. Dynamic voltage restorer is a custom power device used as an effective solutions in protecting sensitive loads from voltage disturbance in power distribution system. The efficiency of control technique that conductor switch in of the inverter. DVR is to inject a controlled voltage. A dc to ac inverter regulates the voltage by sinusoidal PWM technique. ANN a number of nodes act as these neurans and when a node receives any information.**

Key words: Voltage sag ,voltage swell, dynamic voltage Restorer

I. INTRODUCTION

Power quality abnormal behavior on a power system arising voltage and\or current. The voltage sag and swell widely recognized as one of the important power quality disturbances. Voltage sag is an momentary decrease in RMS voltage magnitude in the range of 0 .1 to 0.9 per unit. Voltage sag caused by short circuit and fault. Voltage swell is an RMS voltage increases between 1.1 and1.8 per unit at the power frequency. Voltage swell caused by sudden reduction. DVR is to inject a controlled voltage. Dynamic voltage restorer employ gate turnoff thyristor solid state power electronic switches in a pulse width modulated inverter structure. The DVR is a solid state DC to AC switching power converter that injects set of three phase AC output voltage in series and synchronously with the distribution transmission line voltage. Artificial Neural Network control strategy for voltage sag and swell mitigation of a power system network.

II. BLOCK DIAGRAM

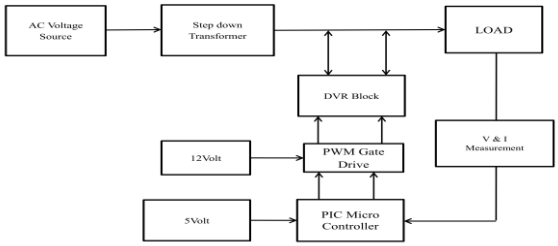

Fig.1.proposed block diagram

The DVR is controlled by the controller. The Artificial neural network is an controller. The hardware part simulation is to interface with the PIC micro controller under 5volt supply. Pulse generated by the PWM gate drive in 12 volt supply. In the proposed system DVR acts as virtual impedance. This system can be used to protect a group of customers when the fault occurrence is in the DVR feeder and the large fault current passes through the DVR. This system can be used to protect a group of customers when the fault occurrence is in the DVR's feeder and the large fault current passes through that DVR. This DVR can limit the faulted current and protect the sensitive loads in parallel feeders until the breaker works and disconnects the faulted feeder. In this system, the DVR acts like a pure effective inductance which does not take any real power from the external source and hence, it protects the dc link capacitor and battery.

III. DYNAMIC VOLTAGE RESTORER

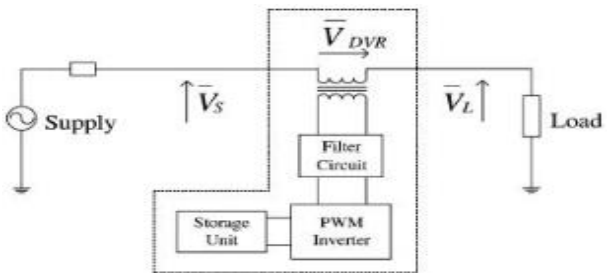

Fig.2.DVR block diagram

A DVR is a solid state power electronics switching device consisting of either GTO or IGBT ,a capacitor bank as an energy storage device and injection transformers. It is connected in series between the distribution system and a load .The basic idea of the DVR is to inject a controlled voltage generated by a forced commutated converter in series to the bus voltage by means of an injecting transformer. A DC capacitor bank which act as an energy storage devices , provides a regulated dc voltage source. A DC to AC inverter regulates this voltage by sinusoidal PWM technique. The inverter generates a three phase ac output voltage which is controllable in phase and magnitude .During normal operating conditions ,the DVR injects only a small voltage to compensate for the voltage drop of the injection transformer and devices losses.

IV. CIRCUIT DIAGRAM

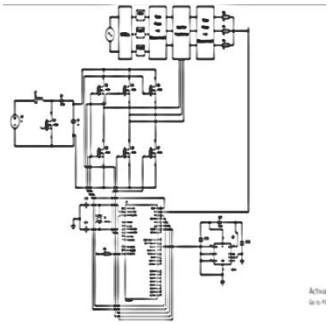

Fig.3.proposed circuit diagram

The basic idea of the DVR is to inject a controlled voltage generated by a forced commutated converter in series to the bus voltage by means of an injecting transformer. A capacitor bank which act as an energy storage device provides a regulated dc voltage source . A DC to AC inverter regulate this voltage by sinusoidal PWM technique . The inverter generates a three phase output voltage which is controllable in phase and magnitude. The 16f877A is one of the most popular pic microcontroller and its easy to see why-it comes in 40 pin DIP pin out and it has many internal peripheral , the only disadvantage that you could level at it does not have an internal clock source like most of the other more modern PICS. However, using an external clock usually results in faster operation .since you can select a 20 MHz crystal instead 8 MHz oscillator .The 16F777A is capable microcontroller that can do many task because ,has large enough programming memeory (large intrems of sensor and control projects) . Pulse width modulation (PWM) is a modulation process or technique used in most communication system for encoding the amplitude of a signal right into a pulse width or duration of another signal, usually a carrier signal , for transmission. Pulse-width modulation (PWM) is used for controlling the amplitude of digital signals in order to control devices and applications requiring power or electricity. It essentially controls the amount of power, in the perspective of the voltage component , that is given to a device by cycling the on-and-off phases of a digital signal quickly and varying the width of the "on" phase or duty cycle.

V. CONTROL STERGY

The efficiency of the DVR depends on the performance of control technique ,which involved in switching the inverter. If control unit is operating properly DVR cannot compensate the voltage sag and swell and the primary purpose of DVR installation in power system can viewed as unless.

A.CONTROL UNIT WITH ARTIFICIAL NEURAL NETWORK:

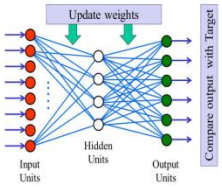

Fig.4. Artificial Neural Network diagram.

An artificial neuron network is a computational model based on the structure and functions of biological model work . Information that flows through the network affects the structure of ANN because a neural network changes or learns , in a sense based on that input and output . Artificial neural network considered nonlinear statistical data modelling tools where the complex relationship between input and output are modeled or patterns are found

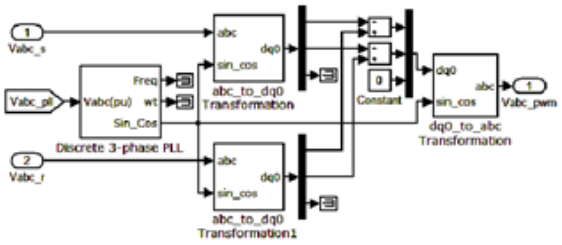

Fig.5. DVR control unit using park's transformation

VI. SIMULATION RESULT

A three phase power system with a source , a transmission line, two transformer at both ends of it, and a nonlinear load has been desired to test the proposed compensation technique .The waveform of three phase supply voltage, sag condition ,required voltage to mitigate it, and voltage after restoration by proposed ANN drive DVR .

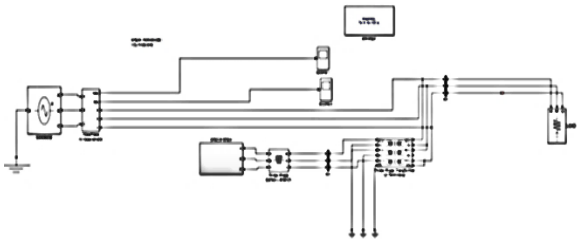

Fig.6. simulation diagram

It can be noted that the restored waveform is identical to the original and attained stability. The sag simulated here is also a drastic one, where real system do not usually change in such an abrupt way.The matlab simulink model of DVR system where an 11Kv/400v substation is feeding the sensitive load . A balaned voltage sag is generated by creating a three phase to ground fault in the main system .DVR system is connected with help of the secondary of injection transformer .Pulse width modultion is a fancy term for desribing a type of digital signal.PWM works by pulsating DC current,and varying stands on to control the amount of current that flows to a device such as LEM.The Fig.6.to represent the simulation diagram and result.ANN are considerd nonlinear statistical datamodelling tools where the complex.

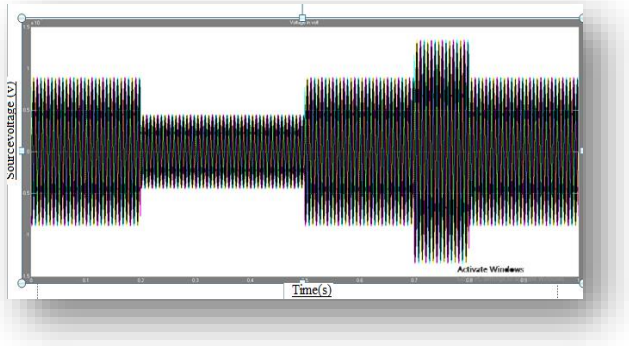

Fig .7. Sag and Swell output voltage

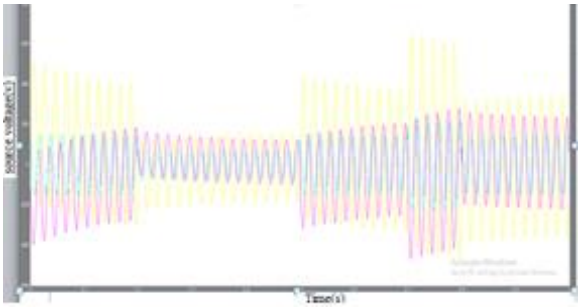

Fig.8.output current

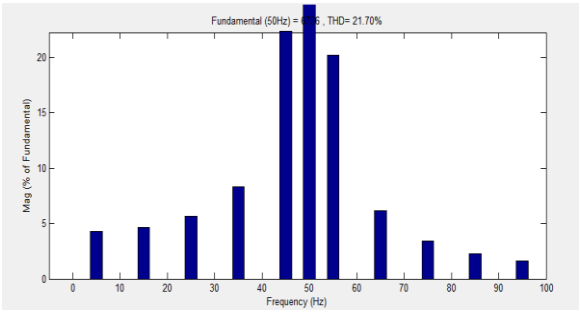

Fig.9.THD value of ANN

VII. CONCLUSIONS

DVR are popular choice for enhancing power quality in power systems ,with an array of control system on offer to drive these devices .In this paper application of ANN to operate DVR for providing better performance than existing systems to mitigate the voltage sag, swell has been demonstrated. Problem statement and theoretical backround, structure of proposed method, training procedure of the ANN used have been described in detail. Simulation result showing the DVR performance during voltage sag have been presented.

VIII. REFERENCE

[1] M. A. Kabir and U. Mahbub, “Synchronous detection and digital control of shunt active powe r filter in power quality improvement”, IEEE Power and Energy Conference at Illinois (PECI), Feb. 2011.

[2] D. Daniel Sabin, Senior Mem ber, IEEE, and Ambra Sannino, IEEE “A summary of the draft I EEE p1409 custom power application guide” Transmission and Distribution Conference and Exposition, IEEE PES, vol. 3, pp. 931-936 , 2003.

[3] R. Madhusudan and G. Ramamohon Rao, “Modeling and simulation of a dynamic voltage restor er for power quality problems-voltage sags and swells”, IEEE International Conference on Advances in Engineering, Science and Man agement (ICAESM), pp. 442-447, Mar. 2012.

[4] Bingsen Wang, Giri Venkataramanan and Mahesh Illindala, “Operation and control of a dynamic voltage restorer using transformer coupled h-bridg e converters”, IEEE transactions on power electronics, vol. 21, pp. 1053-1061, July 2006.