ANN Control of DSTATCOM for Improving Power Quality and Dynamic Performance

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Abstract- With advanced and complicated technologies being implemented in today's power systems, electrical power quality faces many problems including voltage sags, swells, harmonics, unbalance and flicker. Here we are making the voltage distribution system using artificial neural network (ANN) this is eliminating the flickers. Dynamic Voltage Restorer (DVR) is a custom power device used as an effective solution in protecting sensitive loads from voltage disturbances in power distribution systems. The efficiency of the control technique, that conducts the switching of the inverters, determines the DVR efficiency. The power electronic based power conditioning devices can be the effective solution to enhance the quality of the power supplied to the power distribution system.

Keywords- ANN, DSTATCOM, Power

I. INTRODUCTION

The MPPT calculation therefore proposed will recognize the reasonable duty ratio in which the DC/DC converter ought to be worked to get most extreme power yield. The advantage of this theory is to offer access to an everlasting and contamination free use of energy. In this thesis, analysis is prepared by InC and PandO techniques for DC motor analysis, the THD is improved by 27.1% [1]. Low voltage poor power quality can be caused by the demand in reactive power as it loads up the supply system unnecessarily. This can also be due to harmonic pollution and load imbalance as these causes extra stress on the networks and excessive voltage imbalance causing stress on other loads connected to the same network [2]. The electric power system is classified in to three division viz. generation, transmission and distribution. The generation unit is required to produce adequate amount of power to meet the customer's demand for a reliable power supply system. Transmission systems must transport bulk power generated over long distances without overloading and damaging the equipment and distribution systems should deliver the electric power to each customer's premises [3]. The performance of the DSTATCOM depends on the control algorithm i.e. the extraction of the current components. For this purpose, there are many control schemes which are reported in the literature and some of these are instantaneous reactive power (IRP) theory, instantaneous compensation, instantaneous symmetrical components, synchronous reference frame (SRF) theory, computation based on per phase basis, and scheme based on neural network. Among these control schemes instantaneous reactive power theory and synchronous rotating reference frame are most widely used [4]. The effectiveness of DSTATCOM depends upon the control algorithm used for generating the switching signals for the voltage source converter and value of interfacing inductors. Many control algorithms are reported in the literature based on the instantaneous reactive power theory, deadbeat or predictive control instantaneous symmetrical component theory nonlinear control technique , modified power balance theory, enhanced phase locked loop technique, Adaline control technique, synchronous reference frame control technique, ANN and fuzzy based controller, SVM based controller, correlation and cross-correlation coefficients based control algorithm for the control of DSTATCOM[5]. A Distribution compensator is the power device which is implemented in shunt configuration to improve the problems related to quality of the power. It provides stability in the voltage by controlling reactive power, suppresses flicker noise and also does compensation [6]. This issue is more genuine in electronic based frameworks. The level of sounds and responsive power request are prevalent parameters that determine the level of contortion and receptive power request at a specific transport of the utility [7]. The power quality is primarily exaggerated due to current harmonics introduced by the nonlinear loads into the distribution network. The PQ issues featured with harmonic distortion, low power factor and phase disproportion produce astonishing turbulence in the function of electrical equipment [8]. These custom power devices are classified as the DSTATCOM (Distribution Static Compensator), DVR (Dynamic Voltage Restorer) and UPQC (Unified Power Quality Conditioner). The effectiveness of DSTATCOM depends upon the control algorithm used for generating the switching signals for the voltage source converter and value of interfacing inductors. In this Paper, the designed [9]. Voltage sags associated with faults in transmission and distribution systems, energizing of transformers, and starting of large induction motors are considered as the most important power quality disturbances [10].

II. PROPOSED METHODOLOGY & SIMULATION RESULTS

The concept of ANN is basically introduced from the subject of biology where neural network plays an important and key role in human body. In human body work is done with the help of neural network. Neural Network is just a web of inter connected neurons which are millions and millions in number. With the help of these interconnected neurons all the parallel processing is done in human body and the human body is the best example of Parallel Processing. Artificial Neural Network "ANN" has been applied successfully to a wide range of control system applications in recent years. Artificial neural networks have high learning and nonlinear mapping essences and its parallel and distributed structure can provide a nonlinear mapping between inputs and outputs of an electric drive system, without the knowledge of any predetermined model. This makes ANN a good choice to be used in the adaptation mechanism of a MRAC system. In the proposed work, a speed control strategy for BLDC motor is proposed using a model reference adaptive controller based on Artificial Neural Networks. The performances of the proposed ANN drive system and the conventional PID control are designed and implemented using TMS320LF2407A digital signal processor and evaluated under different operating conditions, such as sudden load impact, parameter variations, etc,

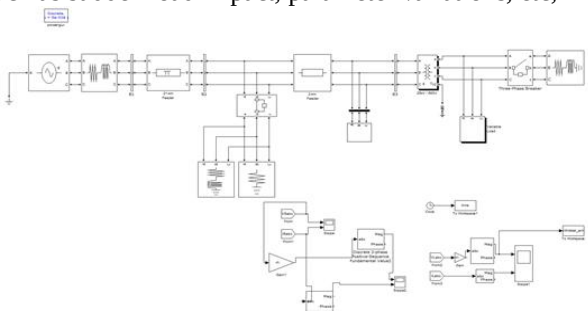

Figure 1: DSTATCOM Mode ANN

The DSTATCOM is commonly used for voltage sags mitigation and harmonic elimination at the point of connection. The DSTATCOM employs the same blocks as the DVR, but in this application the coupling transformer is connected in shunt with the ac system, as illustrated in Figure 1. The VSC generates a three-phase ac output current which is controllable in phase and magnitude.

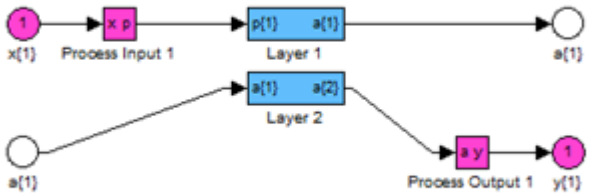

Figure 2: ANN Subsystem

ANN is a structure comprised closely interconnected neurons which can adapt simple processing elements (named as artificial neurons or nodes) that are capable of performing massively parallel computations for data processing and knowledge representation. Although ANN is the main abstractions of the biological counterparts, the idea of ANN is not to replicate the operation of the biological systems but to make use of what is known as the functionality of the biological networks for solving complex problems.

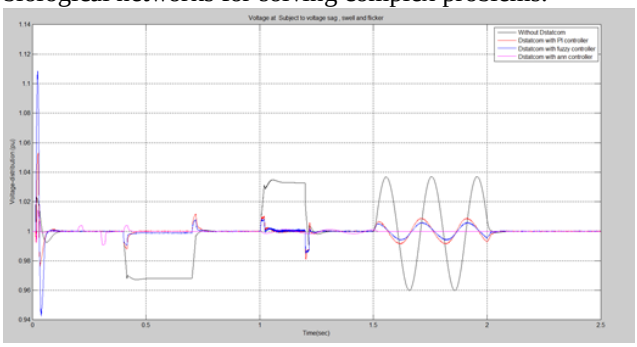

Figure 3: Comparison of DSTATCOM with PI, fuzzy AND ANN Controller

The above figure shows the Comparison of DSTATCOM with PI, fuzzy AND ANN Controller. Attempts are being made to enhance the drive performance by intelligent control using fuzzy logic (FL) and neural network techniques. One of the frequently discussed applications of artificial intelligence in control is the replacement of a standard proportional plus integral (PI) speed controller with an FL or artificial neural network (ANN) speed controller.

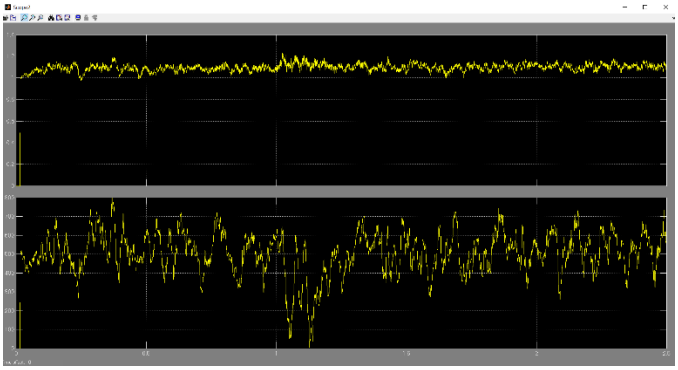

Figure 4: Input Voltage and Current

The above figure shows the Input Voltage and Current.in this figure we can see the flickers this will decreasing the proposed system.

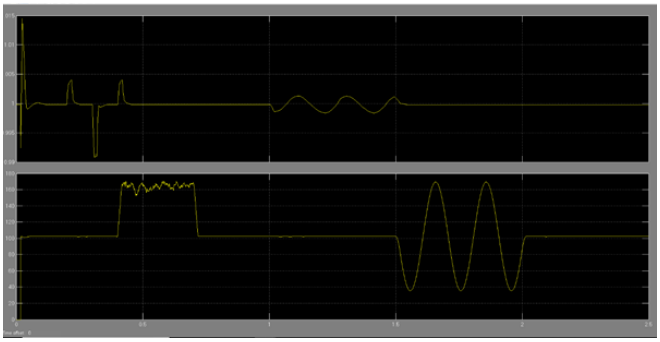

Figure 5: Output Voltage and Current.

The above figure shows the output voltage and current. It shows the voltage and current value in proposed system.here using arteficial neural network it will avoiding the flickers in voltage distribution.

III. CONCLUSION

Here we are using ANN using voltage distribution system it is avoiding the flickers in the system output. The ANN have lot of advantages its out is getting high quality output. Comparison study of the PI controlled and the optimal fuzzy logic controlled DSTATCOM for improving the power quality and dynamic performance of a distribution power system has been simulated using SimPowerSystem in MATLAB/Simulink environment. The performances of the DSTATCOM controllers are evaluated during grid side voltage sag and load variations. The simulation results obtained in MATLAB/SimPowerSystems show that the ANN controlled DSTATCOM provides better system dynamic response and hence improves power quality and stability for the distribution power system.

IV. REFERENCES

[1]. Juan Shi et al., "Fuzzy Logic Control of DSTATCOM for Improving Power Quality and Dynamic Performance" 978-1-4799-8725-2/15/$31.00 ©2015 IEEE

[2]. Saravanan A et al., "D-STATCOM for Power Quality Improvement Trained by ANN" Index Copernicus Value (2015): 62.86 | Impact Factor (2015): 3.791

[3]. P. Bapaiah et al., "Power Quality Improvement by using DSTATCOM" Vol. 2, Issue. 4, April-2013

[4]. S. Sherin Jasper et al., "Artificial Neural Network Controlled DSTATCOM for Power Quality Improvement" DOI 10.17148/IJIREEICE.2015.3538

[5]. G. Gupta et al.," A Comprehensive Review of DSTATCOM: Control and Compensation Strategies" Volume 12, Number 12 (2017) pp. 3387-3393

[6]. K. Satyanarayana et al., "An Improved Back Propagation Control strategy for a Distribution System connected STATCOM" April 19, 2018

[7]. D. Prakash et al., "Power Quality Enhancement in STATCOM connected Distribution Systems based on Gravitational Search Algorithm" Volume 8, Number 4, December 2016

[8]. Pallavi S et al., "A Novel Adaptive Control for DSTATCOM by using ANN" Vol-01, Issue 12, MAR 2016.

[9]. Md. Samiul Haque Sunny et al., "Artificial Neural Network based Dynamic Voltage Restorer for Improvement of Power Quality" 2018 IEEE

[10]. C. K. Sundarabalan et al.," Power Quality Enhancement in Power Distribution system using Artificial intelligence based Dynamic Voltage Restorer" Volume 5, Number 4, December 2013