Using Artificial Neural Network (ANN) Improved Power quality based Dynamic Voltage Restorer (DVR).

Ashabai Shivaji Gadhave [1], Prof.Malad Hanumant M [2], Prof.Patil Vijay Jagannath[3].Salunkhe Suraj.H.[4]
Department of Electrical Engineering,
Student of FTCCOER,Sangola
Faculty of Shriram Institute of engineering and technology (Poly),
Paniv, Maharashtra, India
Department of Electrical Engineering, Faculty of Fabtech College of Engineering,
Sangola, Maharashtra, India Department of Electrical Engineering,
Faculty of Shriram Institute of engineering and technology (Poly),

I. ABSTRACT

Power quality is crucial in modern power systems. Including the stability and reliability of electrical supply, voltage levels, frequency, and the presence of disturbances like harmonics, surges, or sags. Voltage harmonics sags, and swells can indeed damage sensitive equipment. As the reliance on sensitive and sophisticated equipment grows, maintaining high power quality becomes even more critical. The use of an artificial neural network (ANN) controller voltage sag and swell is compensated by DVR . For voltage source converter (VSC) switching the generation of reference voltage for, the voltage conversion from rotating vectors to stationary frame, synchronous reference frame (SRF) theory is applied. Using MATLAB software The DVR Control Strategy and its performance is simulated. The ANN controller, by being able to approximate complex functions and adjust its behavior based on real-time input. The Dynamic Voltage Restorer (DVR) is indeed a specialized device designed to protect sensitive loads from voltage disturbances in power distribution systems. The efficiency of the control technique used for managing inverter switching is a critical factor in the overall performance of a Dynamic Voltage Restorer (DVR). The power quality of non-linear systems such as a Dynamic Voltage Restorer (DVR). Comparison of the ANN controller with the conventional Proportional Integral controller (PI), which showed ANN controller's superior performance with less Total Harmonic Distortion (THD) it is also shown a detailed.

Key words: **power quality, DVR, enhancement, voltage sags, dynamic, stability, voltage swell.**

1. INTRODUCTION

Electrical energy is regarded as a daily consumer need a universal commodity available throughout the world and The sources of renewable energies like wind, solar, etc. are used to support the primary demand of energy. The intermittency of the renewable sources, reactive power issues and harmonics reducing the performance of the power system by causing problems of power system stability. Flexible AC Transmission Systems (FACTS) devices are commonly incorporated to compensate reactive power, regulate voltage stability and improve power quality. FACT devices, however, also change different system parameters, so as to study the quality of power and determine the causes and solutions to these issues of power quality. In power systems, power quality has a major role during supply of variable power to the load. Consequently, the customers of industrial domestic and with sensitive loads will get affects by poor power quality. When any disturbance occurs in system voltage, results in voltage transient, sag, swell, harmonics causing increasing distortions and faults causing Total Harmonic Distortion (THD). The DVR can control the system voltage from these problems and protect against tripping and resulting losses. Various problems and solutions related to DVR were reported, such as the production and installation of (PVPPs) increased. The level of penetration continues to grow. This increasing high growth of PVPPs generation and integration is anticipated. The PVPPs have different various characteristics that differ from the traditional power plants, The turn lead to new challenges for grid-connected PV systems (GCPS). This renewable power source starts to affect the stability, security, reliability, and quality of the power system by the high penetration. The DVR is designed for balancing load side voltage with minimal injection of active power, even in the event of unbalanced disturbances compensation, through a cascaded H- bridge multilevel inverter. The help of DVR is a cost-effective way of

Mitigating sensitive load voltage sags and swells. The disadvantages of the existing method are solved through the application of the Artificial Neural Network (ANN) controller. For design and simulation of DVR to improve power quality and minimize harmonic distortions in sensitive loads the ANN controller is used. To increase the real power of the inverter in any disturbance DVR is utilized. The DVR can be used as a voltage sag restorer and the voltage distortion compensator with ANN, to decrease the harmonics and voltage sag/swell produced with zero sequence components, using the Delta connected transformer between electricity supply and Booster transformer. ANN work as emulates animal brains, is a connection of various nodes acts as neurons, organized in different layers. After doing necessary process, Each node upon receiving information forwards to the next node. Any input is process by all the layers generating an output. ANN all the nodes need to be trained with relevant data For any specific task to be performed. A back propagation optimization is carried out to train a feed forward ANN.The uses transfer functions in layers.due to its adaptive nature and its ability to be trained on all possible cases and It is a robust ANN approach,. The presented work will be simulated in MATLAB/Simulink software. The DVR to reduce the voltage sag and swell in the distribution system use ANN controller. For the control of the DVR with ANN controller the synchronous reference frame (SRF) theory is used. for validation of the effectiveness of the proposed ANN control method together with DVR over conventional method Over conventional methods, The simulation results based on the MATLAB/SIMULINK model were presented here. ANN loosely imitates animal brains, where numerous neurons are connected in an intricate nexus. In ANN, a number of nodes act as these neurons, and when a node receives any information, it forwards it to the next one in line after required processing. The nodes are arranged in different layers, and each input is processed through all the layers to produce an output. Before being able to employ ANNs in any specific task, they need to be trained with data related to the purpose it is supposed to serve. With fault data and the corresponding actions to mitigate those instabilities the ANN is trained. A feed forward ANN is trained with back propagation and Leven berg Marquardt optimization. Bias is used during the training; transfer functions are used in the layers. DVR has proved to be a useful and well-performing device to improve power quality. The operation and the structure of the DVR were explained.

1.1 REVIEW ON LEAF DISEASE RECOGNITION

1] Kumari Sarita Sachin Kumar, Aanchal Singh S.,Rajvikram Madura,R.K.Saket Studied the power enhancement of grid- connected solar photovoltaic and wind energy (PV-WE) system.

2] Prashant Kumar, Sabha Raj Arya, Khyati D. Mistry, Shekhar Yadav, studied that DVR compensator based on the emotional controller to improve the voltage-related issues and total harmonic distortion (THD) & Artificial neural network (ANN) learning implementation is involved for the current controlling of the shunt filter despite of the classical PI Controller.

3] Alfiya Abdul Kalim Dhalayat,R. P. Hasabe**,** designed a smart building automation system based on Arduino and Arduino software for programming. The system supports various sensors and its functionality with a very practical and convenient cost system configuration.

4] Kummari Geethika, Vinay Kumar Awaar, and Praveen Jugge studied that Dynamic Voltage Restorer (DVR) is a method of overcoming voltage sag and swell in electrical power distribution

5] Arpitha M J, Sowmyashree N,M S Shashikala studied has The quality of power delivering to the consumer is reducing day by day because of semiconductor devices. In the distribution system Voltage sag, voltage swell & Harmonics are most commonly occurring power quality problems.

[6] Vijay Rama Raju, Bhavya Doddi, Saurav Dixit, Lingam studied to control and reduce voltage disturbances, a variety of techniques are available.

[7] Someshwara Thota, Vinay Kumar Awaar, Praveen Jugge, and Tara Kalyani studied an Voltage sag and voltage swell are frequently occurred power quality problems in present power distribution system.

1.2. DISCUSSION

Advanced and complicated technologies being

Power systems Implemented in todays, electrical power quality faces many problems including voltage sags, swells, harmonics, unbalance and flickers. As the most important power quality disturbances Voltage sags associated with faults in transmission and distribution systems, energizing of transformers, and starting of large induction motors are considered. Reduces power factor at load side during sags. Reactive power issues. Unstable power system.

1.3 Below are few gaps we found in existing system:

This controller are limited, and it produces significant amount of harmonics The power quality restoration capabilities of – all of which stems from this linear technique's application for controlling non- linear DVR. For enhancing restoration and harmonics suppression capabilities of DVR An Artificial Neural Network (ANN) based controller. Where the proposed controller demonstrated superior performance with a reduced Total Harmonic Distortion A detailed comparison of Neural Network controller with PID driven controller and Fuzzy logic driven controller is also illustrated.

1.4 CIRCUIT DIAGRAM

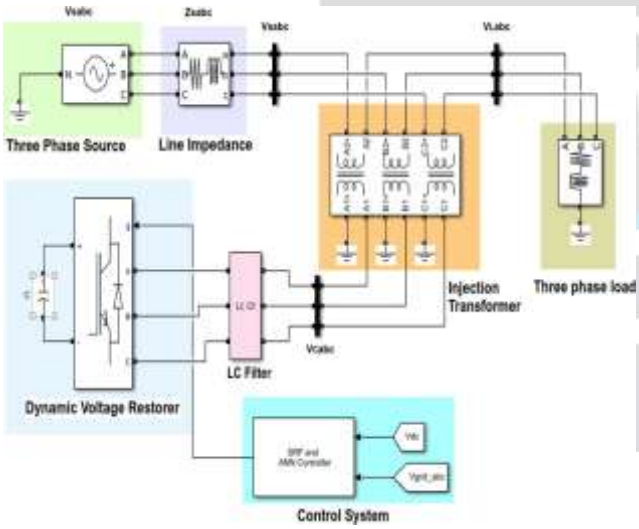

Fig. 2. System configuration of a three-phase dynamic voltage

CONCLUSION

DVR has proved to be a useful and well-performing device to improve power quality. Were explained the structure and the operation of the DVR. The %THD of ANN controller is less this paper proved when compared to PI controller. For improved performance in mitigating voltage sag and swell compared to the conventional controller this paper presented the ANN application to DVR. For the estimation of reference DVR voltages the SRF theory was used. The proposed system with sensitive load is carried out using MATLAB/Simulink software the simulation. The simulation result during voltage disturbances DVR performance has been shown. The proposed method was compared with the popular PI controller and proved to be the best option for restoring system voltage while reducing THD in the greater part. The proposed Energy mitigates compensation technique for dynamic voltage restorer to mitigate voltage sags and voltage swells are verified in MATLAB/SIMULINK getting satisfactory results. The compensation of voltage across the load during both sag and swell period occurs instantaneously. A% THD value of load voltage and current is within tolerable limits. In power systems DVRs are a popular choice for enhancing power quality, with an array of control system on offer to drive these devices. For providing better performance than existing systems to mitigate voltage sag, swell, and harmonics has been demonstrated Application of ANN to operate DVR. Training procedure of the ANN used have been described in detail problem statement and theoretical background, structure of the proposed method. Where the proposed ANN controller appeared as the best option to restore system voltage while mitigating THD to the greatest extent comparison of the proposed method with the popular PID controller, and nonlinear Fuzzy controller has been carried out.

V. References

[1] Kumari Sarita, Sachin Kumar, Aanchal Singh S., Rajvikram Madura, R. K. Saket "Power Enhancement With Grid Stabilization of Renewable Energy-Based Generation System Using UPQC-FLC-EVA technique". IEEE Access (Volume: 8), November 2020.

[2] Prashant Kumar, Sabha Raj Arya, Khyati D.Mistry, Shekhar Yadav, "Self-Tuning ANFIS DC Link and ANN-LM Controller Based DVR for Power Quality Enhancement." CPSS Transactions on Power Electronics and Applications (Volume: 8, Issue: 4, December 2023).

[3] Arpitha M J, Sowmyashree N,M S Shashikala, "Power Quality Enhancement using Dynamic Voltage Restorer (DVR) by Artificial Neural Network and Hysteresis Voltage Control Techniques". 2019 Global Conference for Advancement in Technology (GCAT) October 2019.

[4] Alfiya Abdul Kalim Dhalayat,R. P. Hasabe, "Dynamic Voltage Restorer for Power Quality Enhancement with Improved Efficiency using Artificial Neural Networks". 2022 2nd International Conference on Intelligent Technologies (CONIT).

[5] Arpitha M J, Sowmyashree N,M S Shashikala."Power Quality Enhancement using Dynamic Voltage Restorer (DVR) by Artificial Neural Network and Hysteresis Voltage Control Techniques." 2019 Global Conference for Advancement in Technology (GCAT)

[6] Kummari Geethika1, Vinay Kumar Awaar , and Praveen Jugge "Adoption of Multilevel Inverter based Dynamic Voltage Restorer for Power Quality Improvement with Adjustable DC-Link ." E3S Web of Conferences 184, 01055 (2020).

1) **Ashabai Shivaji Gadhave** *Department of Electrical Engineering, Faculty of Shriram Institute of engineering and technology (Poly),Paniv, Maharashtra, India lecturer in electrical department. She also 3 year experience in teaching field.*

2) **Prof.Malad Hanumant M.** *Department of Electrical Engineering, Faculty of Fabtech College of engineering and Research Sangola Maharashtra, India lecturer in electrical department.*

3) **Prof.Patil Vijay Jagannath** *Department of Electrical Engineering, Faculty of Fabtech College of engineering and Research Sangola Maharashtra, India lecturer in electrical department.*

4) **Salunkhe S.H.** *Department of Electrical Engineering, Faculty of Shriram Institute of engineering and technology (Poly),Paniv, Maharashtra, India lecturer in electrical department.*