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SURVEY OF HARMONICS DETECTION METHOD BASED ON ANN AND FUZZY SETS

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ABSTRACT
Soft computing techniques have proven to have several benefits, such as exceptional fault tolerance, fast performance, and flexibility. These techniques work especially well in situations where strong and adaptable answers are needed. The suggested method in this case is superior to conventional harmonic current detection methods because of its simple design, lower processing overhead, and quick execution. For shunt active power filters (SAPF) to operate at their best, a reference current must be created. To assess load currents and eliminate their harmonic components—a necessary step in preserving power efficiency and quality—a variety of techniques have been used. Conventional techniques might be counterproductive in dynamic contexts where prompt responses are required since they frequently include intricate computations and lengthier processing times. The suggested method is quite beneficial due to its speed and ease of use. It can achieve faster execution times by using less computing, which is essential for real-time applications. This efficiency is a great substitute for more laborious conventional approaches without sacrificing efficacy or accuracy. Many architectures based on artificial neural networks (ANNs) have been created to improve SAPF performance even more. These architectures improve the detection and elimination of harmonic components in load currents by utilising the learning capabilities of artificial neural networks (ANNs) to adapt and respond to changing situations. The literature has extensively documented the usage of ANNs in this setting, showing how they can have a major impact on SAPF performance. All things considered, the combination of ANN-based designs with soft computing techniques provides a potent way to improve the efficacy and efficiency of shunt active power filters, offering a harmony of precision, speed, and adaptability that is difficult to achieve with conventional techniques.

Keywords: Artificial Neural Networks (ANN), p-q theory, (SAPF), Harmonics, Total Harmonic Distortion, Fuzzy sets.

INTRODUCTION
For many years, researchers have researched soft computing techniques and achieved computational performance. Significantly quick speed, excellent fault tolerance, and adaptive capacity are among the benefits. ANN, fuzzy logic, particle swarm, and other approaches are examples of soft computing techniques.

Applications of artificial neural networks (ANN) to power systems fall into three categories: combinatorial optimisation, regression, and categorization. Regression is used in transient stability analysis, load forecasting, and harmonic analysis, among other applications. Static and dynamics analysis, as well as harmonic load identification, are applications that use classifications.

Unit commitment and capacitor control are included in the combinational optimisation domain. Artificial neural networks are composed of small, highly interconnected processing units called neurons. Each neuron processes inputs from other neurons and generates an output based on the inputs that have been aggregated.

Artificial intelligence-based techniques have been used recently to enhance harmonic current detection time processing. Artificial Neural Networks (ANNs), which are distinguished by their capacity for learning and quick identification despite their straightforward architecture, have witnessed a sharp rise in attention over the last ten years. ANNs have found numerous applications in the power electronics component of both machinery and filtration devices.

Unsupervised artificial neural networks (ANNs) are those that can be trained without the help of a teacher or supervisor. In the supervised or competitive learning modules of the output layer fight for the opportunity to react to a specific input pattern. Adaptive resonance theory and Kohonen's Self-organizing Feature Map are two instances of unsupervised learning. The most popular technique for training networks is the back propagation learning algorithm, which is presented in this paper as a methodology for electrical load forecasting. of ensure the material is comprehensive, a quick introduction of the backpropagation algorithm will be provided. The Widrow-Hoff error correction rule is generalised by the backpropagation learning algorithm.

This paper aims to showcase several uses of neural networks in energy-related issues. Rather than being presented chronologically or in any other manner, the difficulties are presented thematically. This will demonstrate the potential of artificial neural networks as modelling, electrical system, and energy prediction tools.

LITERATURE SURVEY

The literature shows that (seemaAgrawal*[1], Sunil Kumar Vaishnav[2]) uses of SAPF-based positive sequence to improve the PV supply quality under non-linear loads. Decetor synchronisation with proportinal integral controller via phase locked loop (PLL). The fuzzy logic controller (FLC) is based on the Mamdani implication. To improve PV array use, the MPPT technique with perturbation and observation is used. As a regulator, the conventional PI controller maintains the DC side voltage constant. Positive sequence detector PLL synchronisation and a PI controller are used to create reference current.

It had been found that (Dr. Agam Das Goswami[1],* Shreyas R Hole[2]) An adaptive parameter calibration strategy for DC-DC buck power converters was proposed by this study. The suggested approach was evaluated using a DC-DC converter along with the passive converter and parasite components . The suggested method may precisely calculate a converter's parameter values by taking into account both the passive and parasitic components, according to test results. We've looked at a power generation system's power electronics circuit in brief. An ideal boost converter's fundamental functioning is demonstrated by a circuit diagram.

(Radek Martinek) had found that innovative control technique for parallel active filters is the focus of this paper. The authors concentrated on developing a method that would successfully offset higher harmonic. Currents in nonlinear loads in contemporary power grids, where it is impossible to forecast the frequency of disruptive signals since they fluctuate over time. After correction, the THD of the source current is less than the 5% harmonic limit set by the IEEE-519 &IEC-6000-3 standards, or roughly 10% for ANFIS models A and 1% for models B, C, and D.

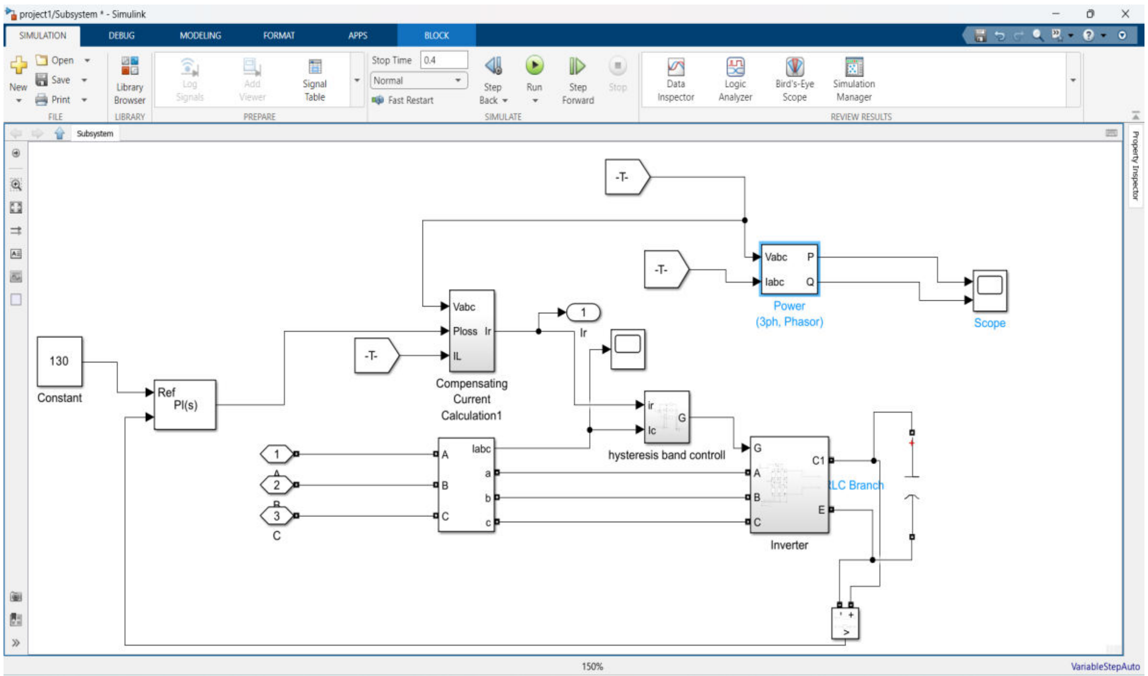
(Pankaj H. Chandankhede) article used Evolving Fuzzy Neural Networks (EFuNN) and artificial neural networks to try and identify three different kinds of textures. DCT coefficients are utilised to identify textural features. DCT coefficients eliminate the need for extra intricate computations during feature extraction. The first few coefficients of each block are produced because the high frequency coefficient is less perceptible to human visual systems. The computational cost of EFuNN is lower than that of neural networks. EFuNN utilises a training technique that is ideal for online learning: one-pass, or one epoch. Conversely, the soft computing-based prediction models that have been suggested are simple to put into practice. The neural network with the best classification (82.85%) was surpassed by EFuNN.

It has been found that (Kishore Kumar Pedapenki,S.P.GUPTA)The simulation findings indicate that the responsiveness in shunt can be improved by introducing soft computing techniques such as FL, NN, and NF Controllers. Active Power Filters by selecting the amount of hidden layers for NN and NF Controllers and the suitable fuzzy rule basis for FL and NF Controllers for the whole system.

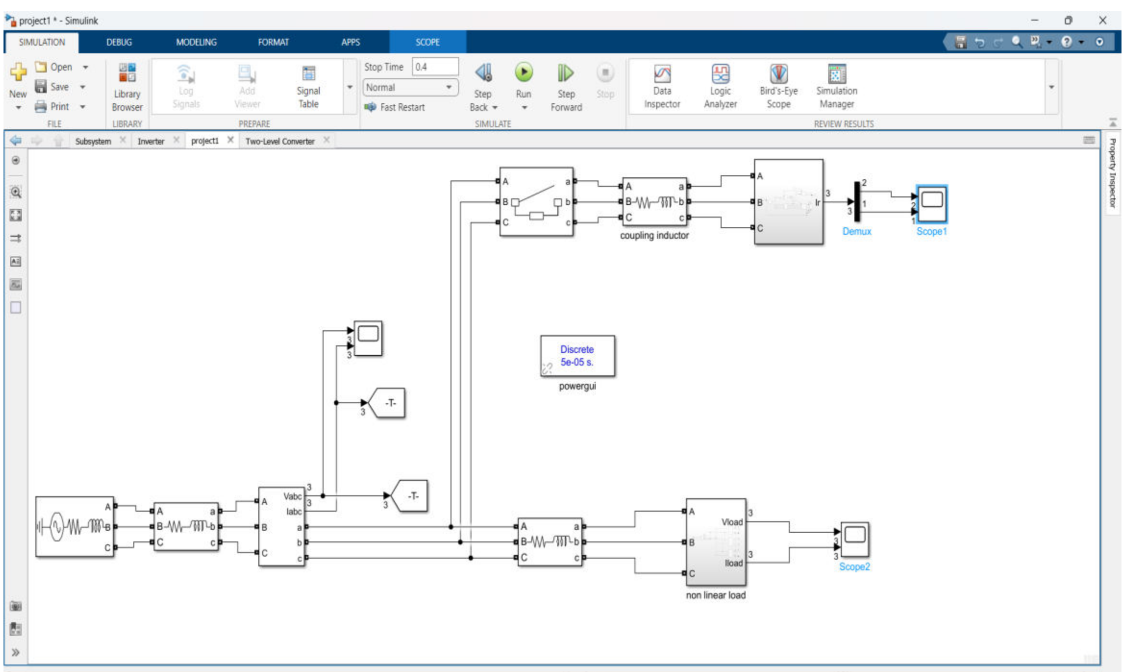
(Unnikrishnan S, prof biji G) In order to extract harmonic components from the distorted signals, a notch harmonic extractor is developed as a result of the control algorithm selection. This paper's series structure eliminates the need for a large, cumbersome series transformer for compensating. When there are faults in the grid, the thse AF includes an inbuilt current limiting function. One benefit of the suggested system is that it simply requires lower dc voltage for compensation. Additionally, as the series compensator covered in this work can compensate for both voltage and current problems, it can be used in place of UPQC devices.

AUTOMATIC DETECTION AND CLASSIFICATION OF PQ DISTURBANCES

The flowchart shown in Figure can be used to explain the basic idea of PQD&C. The input disturbance signal was first processed by a feature extraction unit, which is a type of preprocessing unit. The extracted features are then run through a feature selection unit to produce the best feature vector with the fewest features—one that is distinctive, one-of-a-kind, and optimal. Next, in the next step, the intelligent classifier receives the chosen feature vector as input. During the decision-making stage, the intelligent classifier's output is utilised to get a final choice.



Modelling of P-Q for MATLAB Simulation for Comparison.



A. A. Girgis et.al [2005] There are two groups of conditions that make up the Kalman filter: the estimation overhaul circumstances and the time redesign conditions. The current state and error covariance evaluations are projected forward (in time) by the time upgrading criteria in order to obtain from the previous gauges at every step. In order to obtain an improved a posteriori gauge, the estimation redesign conditions are in charge of combining another estimation into the earlier gauge. While the estimation redesign conditions may be thought of as corrector conditions, the time overhaul conditions can be thought of as indicator conditions. In this sense, the final estimate serves as an indication corrector for resolving various numerical problems.

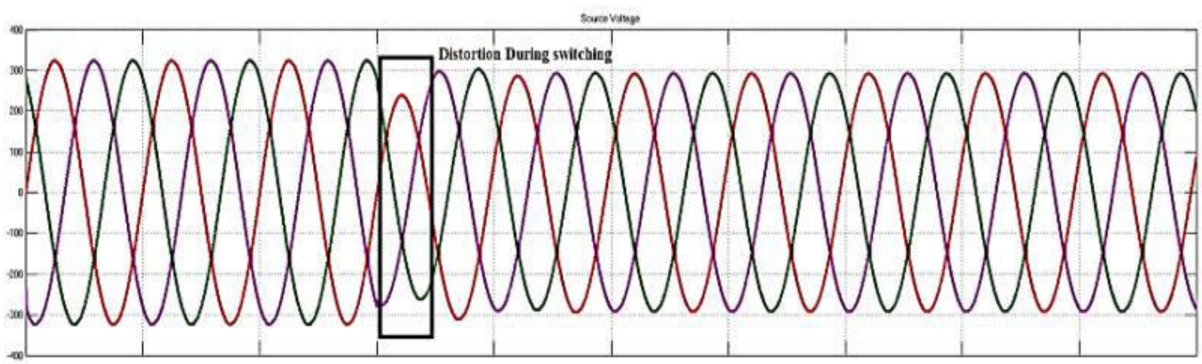
Methods of Harmonic Mitigation

The methods of harmonic mitigation square measure methods are primarily line acquisition methods. These methodologies are mostly employed in the creation of functionality of the system. The three main goals are reactive power compensation, harmonic reduction, and P.F. enhancement. There are various kinds of filters available on the market for this use. There are three categories for the different filters that are available on the market. There are three types of filters: hybrid, active, and passive. Each sort of filter is again divided into distinct categories based on how it is configured and used.

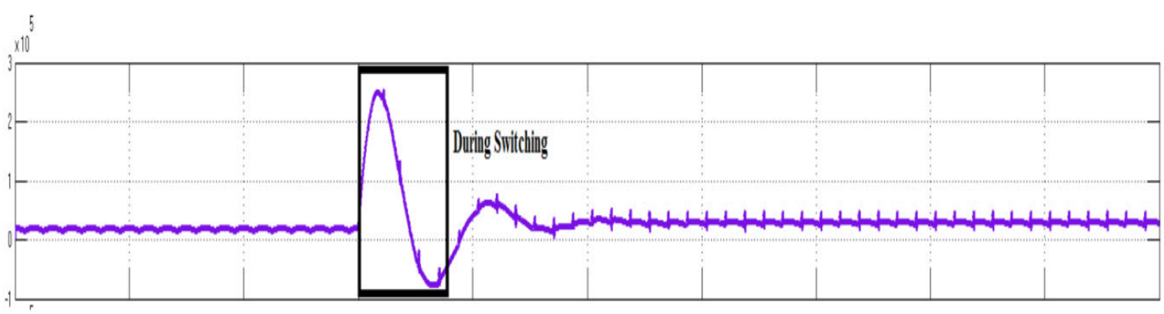
Active Filters

Active filters are more likely to reduce current harmonics than passive filters because of their dynamic reactivity. They will even be applied to voltage distortions and reactive power adjustment. PWM approaches are frequently used to eliminate imbalanced loads and problems with neutral shifting. A combination of active and passive components make up an active filter. An active filter is a voltage supply device that may support its setup by providing compensating voltages or currents. Active filters include devices that have a passive, energy-storing component. The gadget transforms the storage component's ability to provide the load with the harmonic current it needs when the component is being charged and discharged.

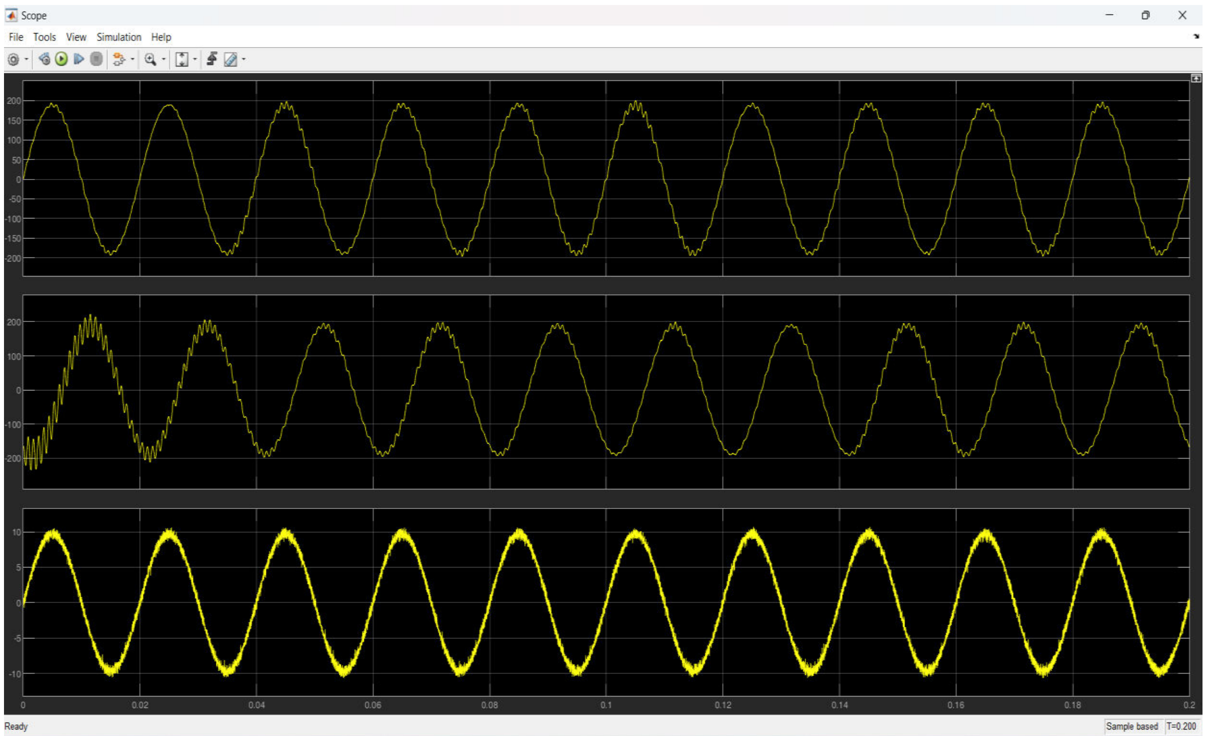
Simulink Results



Breaker Transition Time: 0.06 sec Simulation Run Time:0.2 sec SAPF



the waveform for the active power before and after the operation of SAPF



CONCLUSION

This paper's primary goal was to present a current overview of the techniques employed in the PCC's harmonic source detection. The direction of active power flow method, reactive power method, and voltage-current ratio method are the three types of harmonic source detection techniques. The approaches' shortcomings were spoken about, along with the most popular software programmes that the researchers employed to simulate in the field. Several approaches' mathematical models were examined.

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