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Wavelet Decomposition Along with ANN used for Fault Detection

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Abstract – *In the Early times detection of process faults can help avoid abnormal event progression. Fault detection technique plays very important role in high cost and safety-critical responsive processes. Here Fault detection can be accomplished through various means of technologies. This paper presents the new approach of wavelet decomposition of major methods and current state of research in the field of research with a selection of important practical applications. Transmission lines faults are inevitable part of any power system. They might cause a disruption in the power supply, which is undesirable in nature. With an every ever-increasing demand for better performance and with the minimal interruptions, accurate fault analysis is necessary to restore a system to its normal operation by detecting and clearing the transmission line fault. This paper presents a comprehensive techniques employed in fault analysis which have evolved over the last decade. This paper mainly focuses on the implementation of discrete wavelet transform (WT), and Artificial Neural Network(ANN) for Fault detection of any system.)*

Key Words: Fault analysis, Wavelet transforms, Artificial Neural Networks(ANN), wavelet decomposition

1. INTRODUCTION

These types of methods can encompass information from not only just one process variable but also include nonmeasurable variables as process state, parameters and characteristics quantities, [1, 2, and 3].In the Increasing demands on reliability and safety of technical plants require early detection of process faults . Methods are required to develop that enable earlier detection of process faults than conventional limit and trend checking based on single process variable.. Some methods are require accurate process models while other rely primarily on available historical process data. In Transmission line protection has always been a topic of the major concern with field of Electrical engineering, In this brief of paper is outlined introduction to the field with the major methods and its literature references.as it is a vital power system and its constantly exposed to the environmental conditions. Indeed, the faults due to overhead transmission lines are about 50% as compared to the different types of faults that can be occur in a power system [1]. It is a direct measure of a system's capability to detect, classify and to locate the fault and take preventive measures to protect the remaining equipment of the power system. This One of the most important equipment in the protection of transmission line is the protective relay. It is found that Relay continuously monitors the transmission line by receiving voltages and/or currents as inputs from voltage and current transformers Thus the detection, classification and location of faults using different protective relays have become more effective in a major area of research historically. Due to Over the past century, the protective relays have evolved from electromechanical relays to static relays to computer based digital relays. The digital relays operate based on fast accurate algorithms for fault detection, classification and location. Due to the dynamic nature of fault transients in the system, recent studies show that frequency domain analysis needs to be employed to capture the mix transient frequency components to accurately detect the occurrence of the fault [2-5].

1.1 Quantitative Approach

In this approach the parameters are measured and compared with parameters of a reference model and the corresponding conclusion is obtained. This mix approach requires immense knowledge and behavior of system and difficult for many nonlinear systems. In [3] these abnormal variation of DC bus bar is used to detect fault. In [5] the parameter used is normalized mean voltages method for model reference. This best approach is difficult for complex nonlinear system since accurate mathematical models are not available resulting in large modeling errors.

1.2 Qualitative Approach

In this a disjoint set of input and output created and the relationship between them is formed using the differential equations and calculations are carried out to detect the fault in a system. In this approach the large errors due to modeling has been removed due to the fact that partial knowledge of the system is enough to detect the fault. This outstanding method requires high computational power and a good skill of forming the differential equation from disjoint set. Qusim was the software tool used for this technique. Another methodology to detect the fault was a development of above method when instead of forming disjoint set a fuzzy set was formed and fuzzy relation was obtained to detect the fault. Fusim was the simulation tool used for this method. This methodology requires partial knowledge of the system. A similar approach for fault detection using fuzzy controller is explained in [4]

2. ANN in Fault Detection

The process of obtaining the fault from the parameter can be described by following steps shown in flowchart shown in Fig. 1 [8]. In this paper only fault detection techniques are discussed

2.1 Selection of Proper Detection Signal

Each type of fault has a unique result in the parameter of the circuit. For example an open circuit fault in the switch for a cascaded H-Bridge multilevel inverter shows change in output voltage, while the short circuit of the switch results in the change in the input current but does not have any specific effect on the output voltage until the fuse of corresponding cell is blow due to high current. Thus making a decision about type of fault is necessary as it dictates selection of proper signal

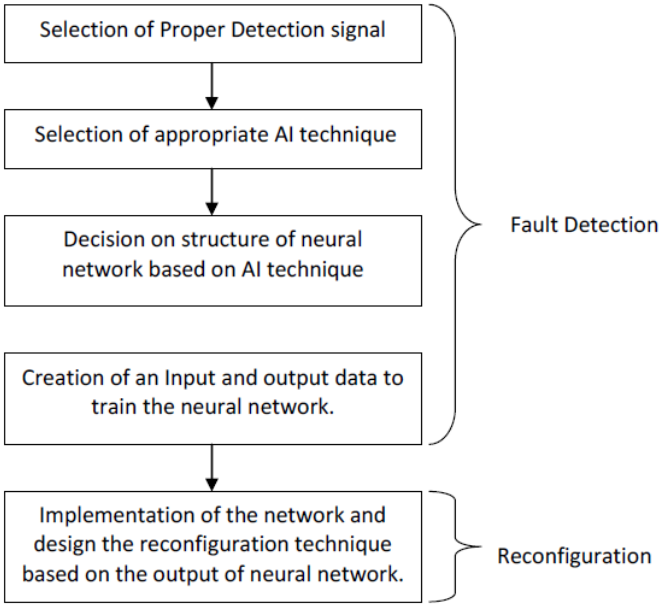

Fig -1: Flowchart showing Methodology of fault detection and reconfiguration

The AI technique consist of two components

3. Feature Extraction

Any abnormal behavior in the circuit can be easily detected visually by observing the waveform of the signals however computational unit cannot directly visualize, and the signals generated are difficult to

3.1 Fast Fourier Transform

In [7] it is shown that the FFT technique has an advantage over the Discrete Fourier Transform in terms of the computational efforts. There are certain adverse effects such as Gibbs phenomenon which are due to the fact that DFT averages only over a limited time period.

3.2 Wavelet packet transform

It is desirable to have normalized energy values rather than high value so that convergence of neural network is faster. In this paper it is given that this method is inherited and developed from the localization of the FFT. In this the parent signal is decomposed into different frequency bands and energy of each frequency is calculated. The energy content of different frequencies of the signal should vary significantly if any switch fault occurs.. The Flow chart which explains 3 level wavelet decomposition is shown below in fig.3 in this is parent signal, a represents the low frequency signal and D represents high frequency signal.

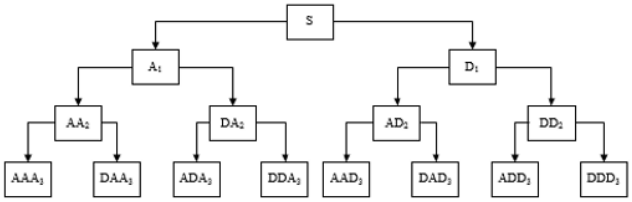

Fig -1: Three layer wavelet packet decomposition

3.3 Discrete Wavelet transform

In this paper, it is given that FFT has a limitation of detecting frequency and magnitude for a non-stationary signal. As the multilevel inverter is widely used in drives where the magnitude and frequency varies a lot it is not viable to use it., the mother wavelet is dilated and translated continuously over a real continuous number system. Therefore, it can generate substantial redundant information. DWT decomposes a signal into various scales with different time and frequency resolutions. It proposed the use of Discrete Wavelet Transform to overcome this problem and this also reduces number of inputs to the neural network there by reducing the size and computational efforts as well as memory requirements In the continuous wavelet transform (CWT). In the DWT, the procedure starts with passing the discrete signal x[n] of length N through a digital low pass filter with impulse response g[n] and a digital high pass filter with impulse response h[n]. The output of these filters consists of N wavelet coefficients. This constitutes first level of decomposition of the discrete signal and can be mathematically expressed as

4. CONCLUSIONS

it is understood that the most appropriate usable methodology for complex nonlinear system is soft computing techniques. Here, `Through this paper an attempt is made to select appropriate techniques for fault detection. Based on the discussion in fault detection techniques .The

soft computing techniques especially extraction techniques like FFT, Wavelet transform, DWT are reviewed and the most appropriate extraction technique may be DWT since it reduces the redundant data and number of inputs to neural network there by reducing

REFERENCES

[1] N. S. Choi, L. G. Cho, and G. H. Cho, "A general circuit topology of multilevel inverter," IEEE Power Electronics Specialist Conference, pp. 96-103, (1991)

[2] J. S. Lai and F. Z. Peng, " Multilevel converters- a new breed of power converters," IEEE Transaction on Industry Applications, Vol.32,No.3, pp. 509- 517.(1996)

[3] L. M. Tolbert, F. Z. Peng, and T. G. Habeltler, "Multilevel converter for large electric drives," IEEE Transacction on Industry Applications, Vol. 35, No.1, pp. 36-44.(1999)

[4] Weiqiang chen and Ali Bazzi, "Logic-based methods for intelligent fault diagnosis and recovery in power electronics," IEEE Transactions on Power Electronics, Vol.PP, No.99, pp.1-1.(2016)

[5] Shaoyong Yang, Angus Bryant,Philip Mawby, Dawei Xiang, Li Ran, PeterTavner, "An industry-based survey of reliability in power electronic converters," IEEE Energy Conversion Congress and Exposition, pp. 3151 3157.(2009)

[6] Shaoyong Yang, Angus Bryant,Philip Mawby, Dawei Xiang, Li Ran, Peter Tavner, "Condition Monitoring for Device Reliability in Power Electronic Converters: A Review,"IEEE Transaction on Power Electronics, Vol.25, No.11, pp-2734-2752.(2010)

[7] Madhukar Rao. A, K.Sivakumar, "A fault tolerant single-phase five level inverter for grid-independent PV Systems," IEEE Tansactions on Industrial Electronics, Vol.62,No.12, pp- 7569-7577.(2015)

[8] Justin Jhon, Jenson Jose, "A new three phase step up multilevel inverter topology for renewable energy applications," International Conference on Circuit, Power and Computing Technologies, August (2016).

[9] Jiangbiao He, Nabeel A.O. Demerdash, Nathan Weise and Ramin Katebi, "A Fast On-Line Diagnostic Method for Open-Circuit Switch Faults in SiCMOSFET Based T-Type Multilevel Inverters," IEEE Transaction on Industry Application, Vol.PP, No.99, pp 1-1.(2017)