International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 02 Issue: 03 | June-2015 www.irjet.net p-ISSN: 2395-0072

DETECTION OF FAULT LOCATION BY PHASOR MEASUREMENT UNITS

Mushir Uddin*1 Hurpade Santosh Namdeorao*2 Datkhile Sagar.Namdev.*3

[1] PG Student, Dept. of Electrical Engineering ,SND College of Engineering & RC,Yeola Nashik, Maharashtra

[2] PG student , Dept. of Electrical Engineering, RKDF college of engineering, Bhopal,MP

[3] PG Student, Dept. of Electrical Engineering, S.N.D. College of Engineering & RC, Yeola Nashik, Maharashtra

---

Abstract - This document presents the fault detection and classification of power electronic systems using Vector Measurement Units (PMU). PMU detects the fault in less than seconds, and it also gives a time synchronized the values of voltage and current in digital form and gives Data Hub local Vector (PDC). When the large-scale disturbances such as blackouts are, the protection and control of the actions taken against the degradation of the power system , which in turn system restore to a normal state and minimize the impact of the disturbance. System Wide Area measurement (WAMS) is now becoming day for the surveillance and control of operations of the system of power. The frequency is measured by the frequency and method of monitoring that depends on vector synchronized with technology for measuring speed and system of communication time transfer Global Positioning System (GPS). The proposed method has been validated in bus systems IEEE-9 using Matlab Simulink model.

Keywords: Phasor Measurement Units, Time Synchronization, Overloading, Digital protection.

I. INTRODUCTION

The distance relays that are widely applied in the protection today and to the determination of impedance achieve operating times of the order of a period of the power system frequency [1]. The distance of the relay is designed to work only for failures that occur between the location of the relays and the reach to point, and is stable for all failures outside of the region or area.

The resistance of the arc fault takes the outside of the characteristic impedance of shot of relay , by what does not detect this condition. On the other hand, is only picked up by zone 2 or 3 in which case it will be an activation too delayed [6]. The distance relays are based on independent decision, while each relay operates independently according to three different areas of operation [2]. The malfunctioning or non-travel protection is determined as one of the sources to raise and disseminate large power system disturbances. A vast majority of relay mal-operations is unwanted trips and have been shown to propagate major disturbances.

Backup protections in fault clearance system is to operate only when the primary protection does not work or when the primary protection is temporarily out of operation [3] - [5]. The latest complexity and expansion of power systems makes it difficult to coordinate operation times and when including relays. In areas of power system automation and substation automation, there are two different trends: centralization and decentralization. More and more dynamic features moving from local and regional control centers against central or national control centers [7]. At the same time we also observe more "intelligence" and "decision power" moves closer to the actual power substations. Greater functional integration are encapsulated in substation hardware. In the view of the global security of power systems, action algorithms for conventional backup protections may not be the best choice because operation of some relays are hardly coordinated each other. Therefore, principle of protection design needs innovation to overcome over the problem. Modern protection devices have sufficient computing and communication so that the implementation of many novel sophisticated protection principles. Therefore, a novel wide area backup protection system is reported in this report. This system is able to act as a replacement for conventional distributed backup protections substation [8]. To ensure quick responsibility for such a system of evolving events, communication requirements are discussed as well. Conclusively, the proposed system is designed by two ways. First, in substation, concentrate some conventional backup protection functions to an intelligent processing system; second, concentrate the coordinated and optimized processing and controlling arithmetic of all backup protection in a region into a regional processing unit.

Communication of data between them is performed via optical fiber networks. The relay's decision is based on collected and shared data through communication networks [9]. The proposed technique meets high standards of reliability and stability, while it is based on shared decision rather than to be alone decision [10]. The proposed technique can see all power system area and can handle with transmission lines as the unit for protection. The primary purpose of these systems is to improve interference monitoring and system event analysis. These measurements have been is sited to the monitor generates large areas, large transmission paths and significant sites. Synchronized phasor measurements provide all significant state measurements including voltage magnitude, voltage phase angle, and frequency.

In this paper, fault detection and classification is discussed. Phasor and synchrophasor basics are covered in section II. Nature, in Wide Area monitoring and control is reviewed in section III. Section IV considers a possible approach to error identification and classification. Section V summarizes the key points presented in this document.

II. PHASOR MEASUREMENT UNITS

Synchronized Phasor Measurement Units (PMUs) was first introduced at the beginning of the 1980s, and since then has become a mature technology with many applications that are under development around the world.

The occurrence of major blackouts in many major power systems around the world has given a new impetus for large-scale implementation of Wide- Area Measurement Systems (WAMS) using PMUs and Phasor Data Concentrators (PDCs) in a hierarchical structure [11]. According to data provided by the PMUs, is a very precise and the system to enable analysts, in order to determine the sequence of events, which is faint and helps to analyze sequence of events, which helps to pinpoint the exact reasons and faults , which can contribute to catastrophic failure electricity system. As experience shows, the experience gained WAMS is only natural that other uses phasor measurements will be established. In particular, the high literature already exists, which deals with the phasor measurements, supervision of the system, the protection and management.

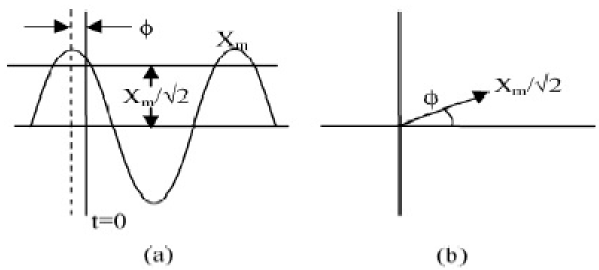

Fig 1: Phasor measurement of sinusoidal unit

(a) Sinusoidal signal. (b) Phasor representation.

A pure sinusoidal waveform can be represented by a unique complex number known as a phasor.
Consider a sinusoidal signal

$$x(t) = XmCos(\omega t + \varphi) \qquad (1)$$

The phasor representation of this sinusoid is given by

$$X \equiv \frac{X_m}{\sqrt{2}} \varepsilon^{j\phi} = \frac{X_m}{\sqrt{2}} (\cos \phi + j\sin \phi). \qquad (2)$$

Please note, that the signal frequency W is not explicitly stated in the phasor representation. Phasor scale, is the rms value 2 √sinusoidės /, and its phase angle is ϕ phase angle, the signal (1). That a sinusoidal signal and its phasor representation, (1) and (2) is shown in Figure 1 note that the positive phase angles are measured clockwise from the real axis. Whereas a sinusoid frequency, this is what obliges to phasor definition, it is obvious that the phasors, which are included in the one phasor scheme must be of the same frequency. a sinusoid Phasor representation means that signal remains rigid all the time, a constant phasor representation. This concept has to be changed , while in practice phasor measurements must be carried out when input signals are constant and their frequency can be varied. Although constant phasor means a stationary sine wave form, in practice, it is necessary to deal with phasor measurements, the input signal final data window. In many PMUs data window, is one of the basic frequency input signal. If the power system frequency is equal to its nominal value (it is rarely used), frequency tracking uses and, therefore, calculations, the fundamental frequency component before phasor. It is obvious that input signal can be encrypted harmonic depiction coded THD or components. Group's task is to separate the fundamental frequency component and find your phasor representation. Synchrophasor is phasor described which has been known as a flash time mark, synchrophasor.

To enable simultaneous measurement of phasors over a wide area of the power supply, it is necessary to synchronize the tag, so that all of the same time tag phasor measurements are actually simultaneously. The mark t=0 in Fig. 1 Is the tag of the measurement. The PMUS must then the phasor by (2) using the measured data from the input signal. Please note that anti aliasing filters in the entrance of the PMU, which a phase delay depending on the filter characteristic. Also, this delay is a function of the frequency of the signal. The responsibility of the PMU to compensate for the delay to the fact that the data in the sample shall be taken after the anti aliasing delay in the filter. This is illustrated in Fig. 2.

The synchronization is achieved by a sampling clock phase-locked in the one pulse- per second is provided by a GPS receiver . The receiver can be built in the PMU, or can be installed in the substation and the synchronization pulse distributed to the PMUS and any other devices that requires it. The tags are at intervals which are multiples of a period of the power system frequency.

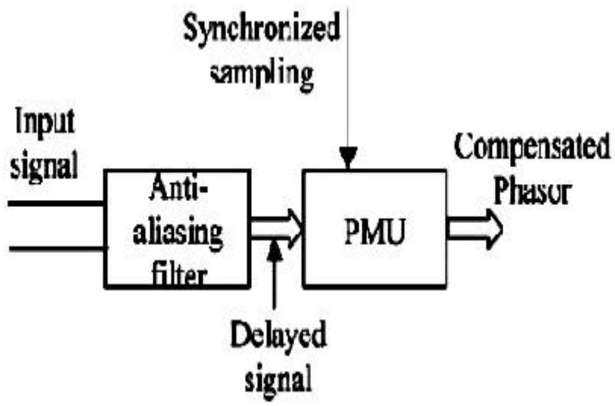

Fig.2. Time delay signal

III. WIDE AREA MONITORING AND CONTROL

PMUS snap a picture with the stability of the nodes in the monitored area. THE PMU's take this figure at the same time. With real-time information of PMUS and automated checks to predict, to identify and respond to problems ; a smart grid can automatically prevent or reduce power outages, power quality problems and supply disruptions. Normal control actions are associated with permanent control activities, that can separate, e.g. , tap changer and shunt devices, or continuously , as frequency control. Normal operation is defensive, that is to say, measures shall be taken to the operational conditions the current and foreseeable future likely situation.

Normal operation usually repeated, e.g. tap changer, reactive shunt devices, frequency control and AGC. The difference between the normal and emergency operation is the penalty for the system if the performance is not carried out.

As a normal, protective, the act is not carried out, there is an increased risk of the failure of the stability of the system that stability be lost if a serious disturbance occurs. If there is an emergency, corrective, operation is not carried out, the system is also perfect. The answer requirement (time and reliability) are normally higher for emergency measures than for normal operation.

Protections of the system, an emergency button contain corrective measures, i.e. measures are really needed for the component or system. Protection may very well be considered as binary (on/off) emergency button, but by custom protection is pretty accurate. Angle is more exactly as on the basis of program management. PMUS without power is an indirect method for the measurement and control of the corner. The measures are the same as for the flow control. THE PMU is a device for synchronized measurement of ac voltages and currents, with a common time (angle). The most common time is the GPS signal, which has an accuracy of better than 1 micro seconds. In this way, the ac quantities calculated can be converted to Phasor (complex numbers by their size and phase angles), and the time inculcated. The primary purpose of these systems is to avoid disturbance to improve and monitoring system. These measurements are situated on monitor generates large sites, large transmission paths, and important points. Synchronized phasor measurements provide all important state measurements such as voltage, voltage phase angles and frequency.

IV THE SOLUTION METHODOLOGY

The proposed technique is mainly based on two components to identify the faults on the trunks . The first component is the voltage due to malfunction. The second component is the current direction after fault. The phase angles is used to determine the direction of flow for a reference quantity. The ability to differentiate between a fault in one direction or the other is obtained by comparing the phase angles of the voltage and current . The voltage is usually used as reference polarizing quantity. The main idea of the proposed technique is to identify the area faillee. This can be done by comparing the measured values of the positive sequence voltage bus when the main magnitudes for each zone . This can cause the minimum voltage value which indicates the area closest to the incident. In addition, the absolute differences in the positive sequence current angles are calculated for all the connected lines with the zone faille. These absolute angles are compared to each other. The value of the angle difference absolute maximum is selected to identify the line faillee. These two keys of operation can be mathematically described as follows: Min { |V , V | ,… |V | ,… |V |} (3)

Where is the | |V voltage positive sequence variable measured by the PMU and located in the zone " 1 ", " 2 ", "3", … , "m", "n". For a fault has occurred on the grid, the output of (3) is the voltage of positive sequence minimum magnitude which indicates the area the nearest to the incident . Suppose that the area closest to the incident is indicated by the number "m". The next step is to compare the absolute differences in positive sequence current angles for all the lines connecting the area "m" with all the other surrounding regions, and then selecting the max one.

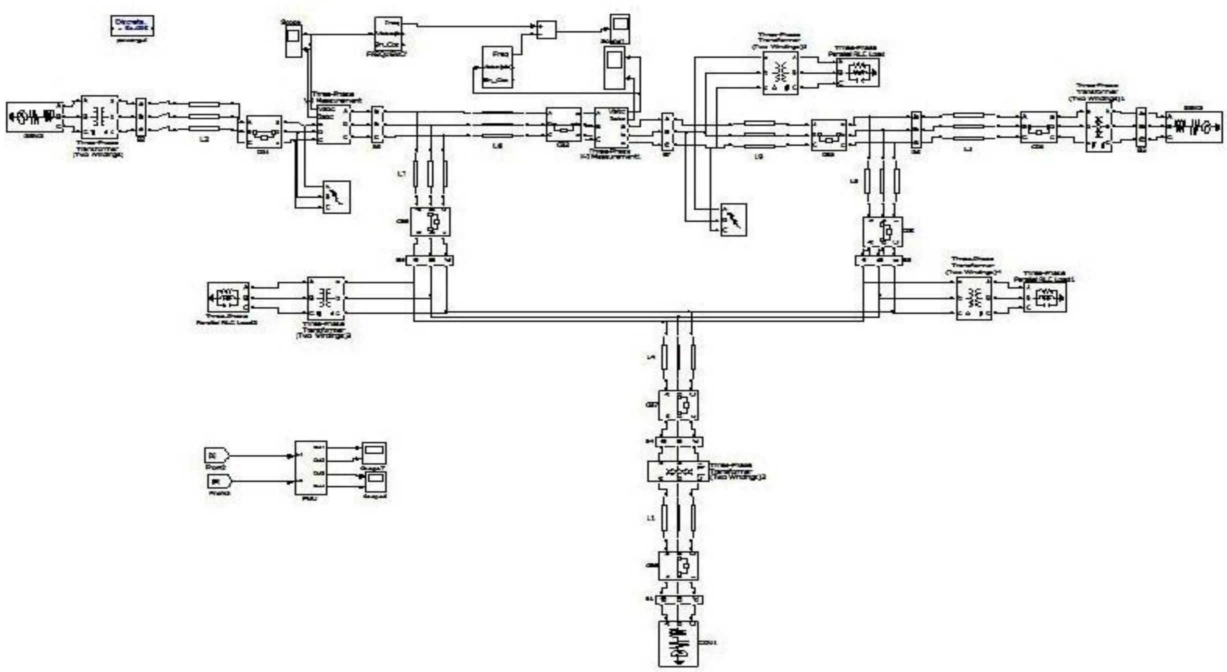

Fig.3.IEEE-9 Bus System Using PMU

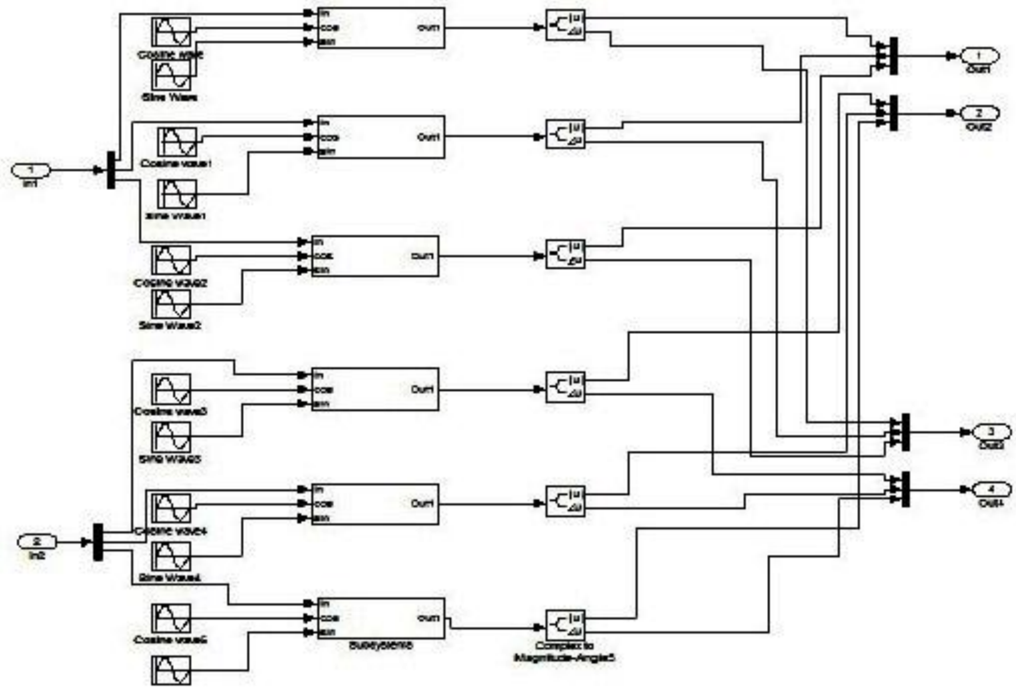

Fig.4. Block Diagram of Phasor Measurement Unit

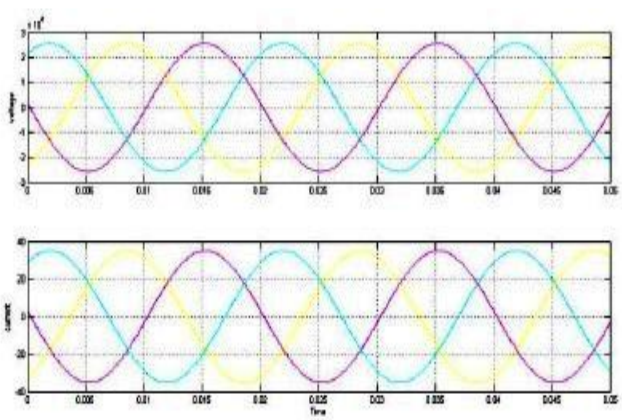

Fig.5. System Bus Voltage and current before fault

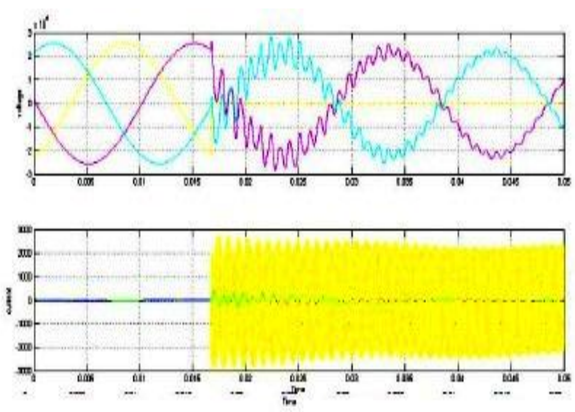

Fig.6. System Bus Voltage And Current Under LG Fault

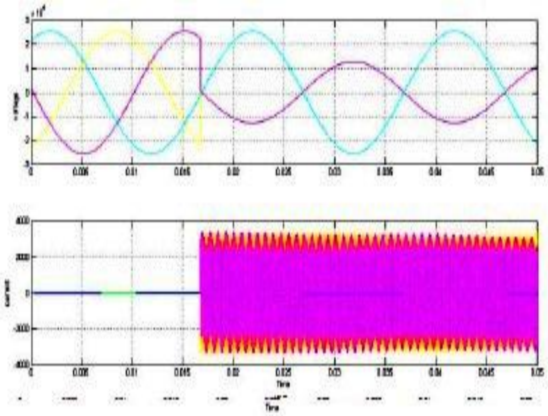

Fig.7. System Bus voltage and current under Line to Line Fault

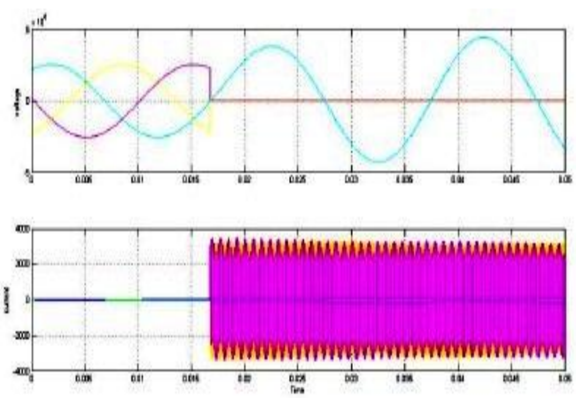

Fig.8. System Bus Voltage And Current Under Double Line

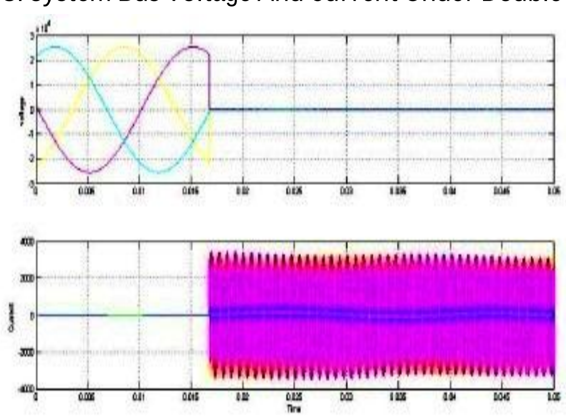

Fig. 9. System Bus Voltage and Current Und er symmetrical Fault

In fig.3 The output signal of the PMU is the voltage of positive sequence |V | and the currents of positive sequence |J | & respectively. For the proposed technique, only positive sequence voltage positive sequence of grandeur and current angles are selected. The phase angle of the voltages and currents are calculated. The fig.4 describes the blocks of the PMU and it gives the voltage and the output current for the area of failure. Fig. 5. Displays the system voltage and current to the bus2 before failure. In Fig 6. shows the voltage and current of the system under the fault line in the earth. In Fig 7. shows the bus system under the line for voltage and current of line fault. Current and voltage of the bus system under the double line to ground fault is shown in Fig 8. In Fig. 9. Current and voltage of the bus system under three fault. The fault current symmetrical is greater than to fault current asymmetric. The emergence of problem is more that the asymmetrical problem but the symmetrical fault is of very serious nature. In this proposed methodology the PMU is installed in the IEEE- 9 bus system and the fault analysis is performed. The different types of failure analysis are admitted, and the curve is obtained.

V.CONCLUSION

This article presents a new technique for protection of transport networks using measurement technique synchronizes to phasor a wide area system. Using the system of protection zone wide the fault detection is very fast and that it is reliable. The protection scheme has correctly identified the line blame the whole system of interconnection. The relay has a detection time very fast. The relay is based on the sharing of data from all areas.

REFERENCES

[1] M. Eissa, M. Elshahat Masoud and M. Magdy Mohamed Elanwar, "A Novel Back Up Wide Area Protection Technique for Power Transmission Grids Using Phasor Measurement Unit" IEEE Trans. Power Del., Vol. 25, no. 1, Pp.270-278. Jan. 2010.

[2] Nabil H. Abbasy and Hanafy Mahmoud Ismail, "A Unified Approach for the Optimal PMU Location for Power System State Estimation" IEEE Trans. Power Sys, Vol. 24, no. 2, Pp.806-813, May. 2009.

[3] Mattias Jonsson and Jaap E. Daalder, "An Adaptive Scheme to Prevent Undesirable Distance Protection Operation During Voltage Instability" IEEE Trans. Power Del, Vol. 18, no. 4, , Pp.1174-1180, Oct. 2003.

[4] J. C. Tan, P. A. Crossley, P. G. McLaren, P. F. Gale, I. Hall and J. Farrell, "Application of a Wide Area Backup Protection Expert System to Prevent Cascading Outages" IEEE Trans. Power Del, Vol. 17, no. 2, Pp. 375-380,Apr. 2002.

[5] Zhenzhi Lin, Tao Xia, Yanzhu Ye, Ye Zhang, Lang Chen, Yilu Liu, Kevin Tomsovic, Terry Bilke and Fushuan Wen, "Application of Wide Area Measurement Systems to Islanding Detection of Bulk Power Systems" IEEE Trans. Power Sys, Vol. 28, no. 2, Pp.2006-2015, May 2013.

[6] Seong-Il Lim, Chen-Ching Liu, Seung-Jae Lee, Myeon-Song Choi and Seong-Jeong Rim, "Blocking of 3 Zone Relays to Prevent Cascaded Events" IEEE Trans. Power Sys, Vol. 23, no. 2 , Pp.747-754, May 2008.

[7] S. Azizi, G. B. Gharehpetian and A. Salehi Dobakhshari, "Optimal Integration of Phasor Measurement Units in Power Systems Considering Conventional Measurements" IEEE Trans. Smart Grid, Vol. 4, no. 2, Pp.1113-1121, Jun. 2013.

[8] Quanyuan Jiang, Xingpeng Li, Bo Wang and Haijiao Wang, "PMU-Based Fault Location Using Voltage Measurements in Large Transmission Networks"IEEE Trans. Power Del, vol. 27, no. 3, (JULY 2012), Pp.1644-1652.

[9] A. G. Phadke and Bogdan Kasztenny, "Synchronized Phasor and Frequency Measurement Under Transient Conditions" IEEE Trans. Power Del, Vol. 24, no. 1, Pp.89-93, Jan. 2009.

[10] Farrokh Aminifar, Amin Khodaei, Mahmud Fotuhi-Firuzabad and Mohammad Shahidehpour, "Contingency-Constrained PMU Placement in Power Networks" IEEE Trans. Power Sys, Vol. 25, no. 1, Pp.516-523.

[11] Kai-Ping Lien, Chih-Wen Liu,Chi-Shan Yu and Joe-Air Jiang (2006), "Transmission Network Fault Location Observability With Minimal PMU Placement" IEEE Trans. Power Del., Vol. 21, no. 3, Pp. 1128-1136.

[12] C.Anil Kumar, PG Scholar, K.S.Rangasamy College of Technology, Tiruchengode, Tamilnadu, India.

K.Lakshmi Associate Professor, K.S.Rangasamy College of Technology, Tiruchengode, Tamilnadu, India.