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Power System Contingency Analysis Using Artificial Neural Network

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Abstract: Contingency analysis is the essential characteristic of the Power system security. The security evaluation is a crucial venture because it offers the statistics regarding the system state within the occasion of a contingency. Contingency analysis technique is being widely used to are expecting the result of outages like failures of kit, conductor etc, and to require essential movements to live the facility device cozy and dependable. The off line evaluation to expect the effect of contingency might be a dreary mission as an electricity device includes massive range of components. A choice of techniques of contingency analysis had been given in this paper and moreover the usage of artificial neural network for contingency analysis has been done.

Keywords: Artificial Neural Network, Power System Security, performance Index (PI).

I. INTRODUCTION

Nowadays complicated society's reliable, continuous deliver of electrical energy is vital. Contemporary years multiplied electricity intake and various varieties of obstructions to extension of existing transmission device reason energy systems driven to operate towards their limits. When strength gadget unfastened from danger or risks it's far stated to be cosy. A Security is potential of the system to withstand any individual of the pre-selected listing of contingencies with none consequences.

Power system security is the potential of power system to survive in looming disturbances conditions(contingencies), without hampering to the Security, reliability and customer service. Power system security refers to strength or robustness of any device to imminent disturbances and it depends on machine working conditions and additionally on contingent probable situations. While the system is of inadequate safety, it gets uncovered to catastrophic and gadget failure. So it is of paramount importance in having a secure, reliable, continuous and financial operating condition of power system.

Power framework security is the probability of system's operating conditions which must continue to be within the tolerable ranges. This thing performs an important position in factor of view its operations and planning. Following are few factors which make the electricity reliability and safety over a long run. Firstly, energy device ought to be well designed with taking protection as major situation. Secondly, normal tracking in the course of operation, preserving with suited stages is second maximum difficulty. Thirdly, true engineering is required to attain those desires which specifically rely on the use of equipment used for strength machine evaluation. The modifications that are occurring inside the surroundings have finely tuned the requirement of power device safety evaluation and its checks and have additionally changed the analysis equipment of electricity machine.

Power system includes several of electrical primarily based gadgets and is a complex network in itself. And failure of any of these devices in the course of operating situation hampers the continuity of operation, protection, protection and consequently results in outages, thus influencing security of electricity system. Thus electricity device safety is a crucial a part of power system. The maximum essential issue is evaluation of contingency, which leads to bus restriction violations, transmission line overloads in the course of the operating conditions. Vital contingencies should be recognized first off and speedy to make sure relaxed, dependable and continuous operation.

As a chief and important part of power system security, operational engineers need to look at the effect of outages and contingency on strength gadget in terms of severity. Strength float or load flows are crucial a part of this analysis Contingency selection or contingency screening is a system wherein probable and capacity vital contingencies are diagnosed for which it requires consideration of every line or generator outage. This technique is very time eating as it does no longer healthy real time requirement, as actual time structures are massive systems and requires lot of time for computation.

To remedy this hassle some of algorithms were developed which can be categorized into two methods. One of these approach is the performance Index (PI) which is based totally on calculation the PI values and ranking them as a consequence to quantify the severity for each case. The alternative approach is based on approximate energy waft which is used to get rid of the ones crucial contingencies. This technique is called screening approach. There is variety of techniques for evaluation of contingency of strength gadget. AC load glide and mathematical calculations are in general used in maximum of the techniques.

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For contingency screening several techniques were evolved. The most extensively used approach for calculation of the performance index is based at the traditional method called Newton Raphson load flow software. The contemporary electricity machine is a complex community and due to its complexity and large scale networks, contingency evaluation need to be powerful and computation should be speedy. The maximum critical factor for contingency or outage is that each one feasible outage does now not affect overload in lines and transformers, and does no longer have an effect on voltage drops in one-of-a-kind nodes of device. Therefore it isn't always required to recollect all viable outages for pc simulation cause. It's far vital to specify the outages that may motive the most of overloads and voltage drops in the gadget for contingency screening. Such essential and capability contingencies should be fast recognized for in addition assessment process in precise manner.

Thus contingency selection is defined as the process of identifying these critical contingencies. Thus contingency selection/screening or contingency ranking is projected so in order to rank those outages which will violate the normal operating condition. Contingency selection methods are based on Performance Index (PI) that may represent a line overloading or bus voltage drop limit violation. Then sorting of performance index is done in such a way contingencies are ranked according to their severity. In these last few years, a lot of work has been done in this part which consists of selection of the potential contingencies cases by using ranking methods or screening methods. Bounding methods Distribution methods Expert and new method for contingency selection, Neural Network and other latest mathematical techniques have been used in the indirect calculation of MW flow violation ranking. The recent developments using Artificial Neural Network have brought lot of advancement in the speed of contingency screening.

As a consequence contingency choice is defined because the system of identifying those crucial contingencies. As a consequence contingency selection/screening or contingency rating is projected so that you can rank those outages to be able to violate the everyday running situation. Contingency selection strategies are based totally on overall performance Index (PI) that can represent a line overloading or bus voltage drop restrict violation.
Then sorting of performance index is performed in the sort of manner contingencies are ranked consistent with their severity. In those previous few years, quite a few paintings has been finished in this component which consists of selection of the capability contingencies instances by way of the use of ranking techniques or screening methods. Bounding strategies Distribution methods professional and new method for contingency choice, Neural Network and other today's mathematical strategies were used inside the oblique calculation of MW go with the flow violation ranking. The latest tendencies using Artificial Neural Network have brought lot of development inside the speed of contingency screening.

Artificial Neural Networks (ANNs) concerned many researchers and engineers from power device region to look for the solutions to some of complicated issues to improve the speed in security degree. It has been proved that those ANNs are able to learning from raw information and that they can be used to become aware of internal dating within raw statistics no longer explicitly given or even recognized by means of human specialists and there may be no want to assume any linear relationship among information. This approach is preferred as it calls for no calculation based on mathematical model. Most current ANNs used for fixing strength gadget problems have been designed using actual numbers. In energy engineering packages which includes load go with the flow, contingency evaluation, evaluation, signal and photo processing involves complex statistics to be processed. However, the utility of ANN approach in processing of complex values continues to be an open problem. The very best solution could be to do not forget a conventional real-valued community wherein the complicated input and output indicators are replaced by using pairs of impartial actual-valued alerts.

II. CONTINGENCY ANALYSIS USING NEWTON RAPHSON METHOD

A clean way to conform to the conference paper formatting requirements is to use this file as a template and surely kind your text into it. Here on this chapter algorithm for Newton Raphson technique, contingency ranking the use of NR technique has been discussed. This traditional technique had been proposed on IEEE buses, five Bus. The outcomes received using this approach have been used similarly in determine the overall performance indices, lively power overall performance index and voltage energy overall performance index. After obtaining the overall performance indices, the contingency rating is carried out with the overall performance index which is the summation of those two overall performance indices. The one with higher basic overall performance index is ranked first and is arranged in descending order quantifying the severity of contingency

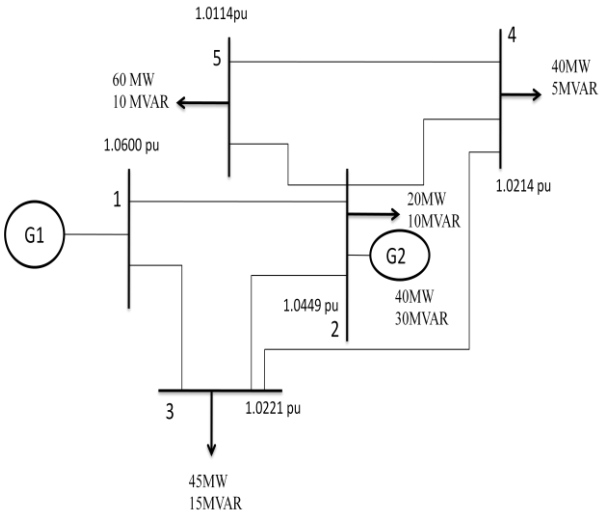

Fig. 1 IEEE 5-Bus System

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TABLE I PERFORMANCE INDICES & CONTINGENCY RANKING USING NR METHOD FOR IEEE 5-BUS SYSTEM

Line outage number	PIp	PIv	OPI	Ranking
1-2	0.2800	3.1916	3.4716	1
1-3	0.3619	0.2699	0.6318	6
2-3	0.3377	0.6557	0.9934	4
2-4	0.3790	0.6173	0.9963	5
2-5	0.4221	0.2653	0.6874	7
3-4	0.2995	0.8599	1.1594	3
4-5	0.3036	0.8799	1.1899	2

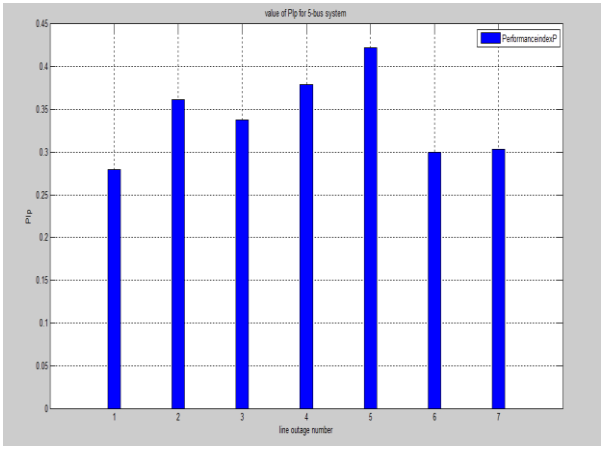

Fig. 2 Graphical representation of PIp using NR method

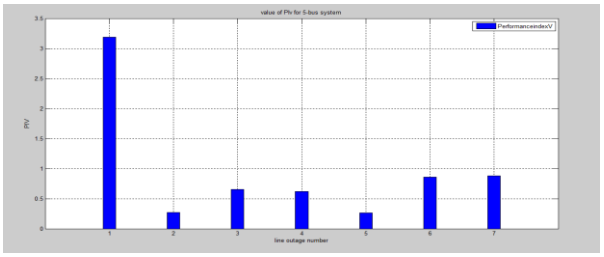

Fig. 3 Graphical representation of PIp using NR method

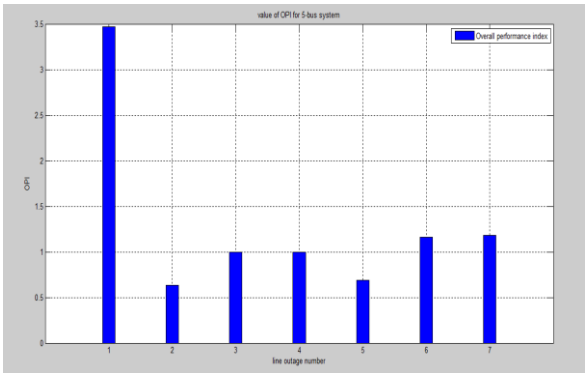

Fig. 4 Graphical representation of OPI using NR method

III.CONTINGENCY ANALYSIS USING ARTIFICIAL NEURAL NETWORK

On this section, the effects of contingency analysis problem the use of lower back Propagation neural community have been supplied. The algorithms are carried out in MATLAB for the above. The main objective is to decide the energetic and reactive power overall performance indices which form a critical part of contingency evaluation for IEE five-bus systems.

The results of energetic power performance index PIp and reactive power performance indices PIv for the base case loading situation of 1650 MW is obtained via using the lower back Propagation neural community has been given in table II.

TABLE III PERFORMANCE INDICES & CONTINGENCY RANKING USING BACK PROPAGATION METHOD FOR IEEE 5-BUS SYSTEM

Line outage number	PIp	PIv	OPI	Ranking
1-2	0.2908	3.7433	4.0341	1
1-3	0.3755	0.2773	0.6528	7
2-3	0.3302	0.6739	1.0041	5
2-4	0.3926	0.7281	1.1207	4
2-5	0.4149	0.3945	0.8094	6
3-4	0.3021	0.9203	1.224	2
4-5	0.3047	0.8791	1.1838	3

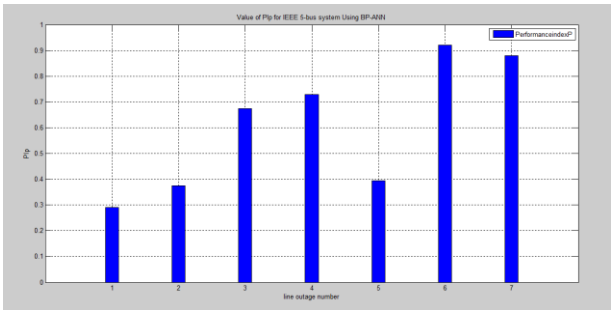

Fig. 5 Graphical representation of PIp using BP-ANN method

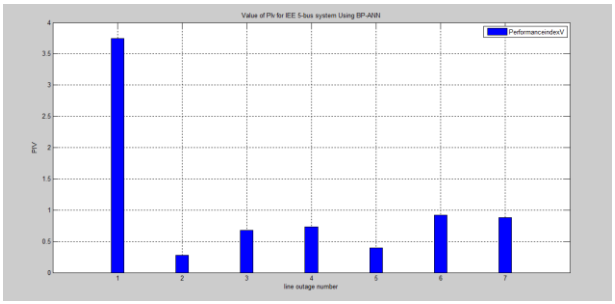

Fig. 6 Graphical representation of PIv using BP-ANN method

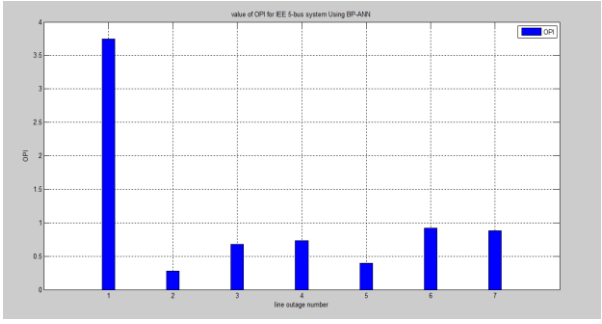

Fig. 7 Graphical representation of OPI using BP-ANN method

The load flow analysis is accomplished by considering the one line outage contingency at a time. The energetic and reactive energy overall performance indices also are calculated considering the outage of only one line sequentially and calculated indices are summarized in table II. The rating of the line outage contingency has been decoded on the premise of OPI. The higher the OPI vale shows better rank and higher degree of severity. From table II it can be inferred the outage of line 1 is the most susceptible one and its outage will result a fantastic effect at the entire gadget. Fig (5), Fig (6) and Fig (7) shows the graphical representation of these performance indices for each outage cases

IV. CONCLUSION

In this work, the contingency selection and rating which are vital for contingency analysis had been performed by evaluating two essential overall performance indices particularly; energetic and reactive power overall performance index (PIP & PIV). These indices were calculated for widespread 5 bus bus structures the use of the Newton raphson load go with the flow set of rules and additionally by using using again propagation Neural community in MATLAB environment. The following conclusions are drawn:

- The severity of a single line outage is correctly indicated by way of the numerical values of PIP and PIV respectively.
- The indices are predicted in off line way for a single loading situation by using NRLF. The calculation of those indices using NRLF set of rules proves to be time consuming.
- The contingency selection by using BP-ANN proves to be efficient in phrases of accuracy and time. It has the potential to calculate the performance indices following a contingency for any loading case once it is efficaciously educated

REFERENCES

[1] A.J. Wood and B.F. Wollenberg, Power Generatzon, Operatzon and **Control,** John Wiley &Sons Inc.,1984
[2] Vykuka, R.; Nohacova, L., "Sensitivity factors for contingency analysis," Electric Power Engineering (EPE), 2015 16th International Scientific Conference on, vol., no., pp.551,554, 20-22 May 2015
[3] Sekhar, P.; Mohanty, S., "Power system contingency ranking using Newton Raphson load flow method," India Conference (INDICON), 2013 Annual IEEE , vol., no., pp.1,4, 13-15 Dec. 2013
[4] Stott B.; Alsac, O., "Fast Decoupled Load Flow," Power Apparatus and Systems, IEEE Transactions on ,vol.PAS-93, no.3, pp.859,869, May 1974doi: 10.1109/TPAS.1974.293985
[5] Hussain, Zakir Zhe Chen Thogersen, P., "Fast and precise method of contingency ranking in modern power system," Applied Electrical Engineering and Computing Technologies (AEECT), 2011 IEEE Jordan Conference on , vol., no., pp.1,7, 6-8 Dec. 2011
[6] Lee, C.-Y.; Nanming Chen, "Distribution factors of reactive power flow in transmission line and transformer outage studies," in Power Systems, IEEE Transactions on , vol.7, no.1, pp.194-200, Feb 1992 doi: 10.1109/59.141703
[7] Sood, P.; Tylavsky, D.J.; Qi, Y., "Improved dc network model for contingency analysis," in North American Power Symposium (NAPS), 2014 ,
[8] Sachan, S.; Gupta, C.P., "Analysis of contingent conditions in power system," Engineering and Systems (SCES), 2014 Students Conference on, vol., no., pp.1,5, 28-30 May 2014
[9] Chicco, G.; Napoli, Roberto; Piglione, Federico, "Neural networks for fast voltage prediction in power systems," in Power Tech Proceedings, 2001 IEEE Porto , vol.2, no., pp.5 pp. vol.2-, 2001 doi: 10.1109/PTC.2001.964743
[10] Khazaei, Mohammad; Jadid, S., "Contingency ranking using neural networks by Radial Basis Function method," in Transmission and Distribution Conference and Exposition, 2008. T&D. IEEE/PES , vol., no., pp.1-4, 21-24 April 2008doi: 10.1109/TDC.2008.4517045
[11] A. Alessandri, S. Grillo, S. Massucco, F. Silvestro and G. VimercatiANN Application For On-Line Power System Security Assessment 9th International Conference on Probabilistic Methods Applied to Power Systems KTH, Stockholm, Sweden - June 11-15, 2006