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DISTRIBUTION LOSS REDUCTION USING NEURAL NETWORK ALGORITHM

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ABSTRACT

Obviously, it is very important to examine power loss. There exist various techniques for this purpose. In this paper, artificial neural networks are considered as the best and most appropriate ways to improve network topology. The aim of this paper is to control power switches and decrease sudden changes of the network as well as reduce damages due to power interruption. Results have shown that the use of perceptron neural network algorithm in order to control power networks' topology can improve drops due to power shortage by 91%. Thus, it seems that this new algorithm can resolve some of the problems. In addition, implementation of this algorithm is cost-effective for utilities because there are no fundamental changes in the network configuration.

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KEY WORDS

power networks, electricity market, power loss, artificial neural network, network configuration

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INTRODUCTION

Power networks comprises of three parts: generation, transmission and distribution. The generated power is finally delivered to the consumers. For some reasons, this energy has some power losses through its route to the consumers. Research has shown that approximately 13% of generated power is lost in the route between power plants and consumers. The studies on power loss have long been addressed and this issue is a very old discussion. However, what make this issue be on top research topics is costs incurred due to this issue [1].

It is evident that power loss due to energy transmission is unavoidable [2]. However, attempts to obtain a reliable network with the least consumer service interruption and development of devices in transmission and sub-transmission networks as a continuous task in power industry may reduce power losses. Transmission power loss results in million dollars of countries capital. Thus, the issue of "who should pay this financial loss?" is popularized and fair sharing of operational costs among all utilities and participants of the market has been a key issue. Power loss issue is of great importance, particularly, in distribution section. In general, distribution systems have the highest share of power losses in power networks because of their vastness and high number of devices in these systems along with other features such as single phase loads and lower voltage level [8]. Different methods exist to reduce power loss in distribution systems, including:

1) Compensation for power loss reduction due to reactive power;
2) Distribution systems' automation;
3) System voltage optimization and current balance of each phases;
4) Low power loss transformers;
5) Distributed generations' storage;
6) Automatic reading and billing

Unfortunately, power loss is defined as a non-linear function of line current and accurate determination of the power losses due to each elements of the system such as generator, load, and transmission line is impossible. A number of power loss assignment plans have been addressed in which system power losses are assigned to generators and loads in a shared electricity market or

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individual trades in bilateral markets. However, each of which are both theoretical and inefficient or need fundamental changes in the network [3-6].

MATERIALS AND METHODS

First, power network is simulated by artificial neural network and, then, it is implemented using MATLAB and the outputs of interest are derived.

Perceptron network is selected and evaluated since linear combination is required in this paper and appropriate selection of the number of layers and neural cells are the requirements of this work.

Artificial neural network comprises of four blocks. The first block of the program for area load measurement is done through simple mathematical operation with measured data. And, the calculation results are transformed as an input for artificial neural networks. Second and third blocks represent artificial neural network operations in corresponding objectives. In the first phase, top neural networks evaluate load level of each area with active/reactive power and transfer of estimated load for neural network is low. Based on area load level, lower neural networks determine load current and define satisfactory system topology of the objective function. The result is that block 4 is used as an input to determine control strategy. Block 4 determines the control strategy with system topology for previous load pattern and novel determined load pattern proposed by artificial neural networks.

This control strategy defines control sequence of switches in order to prevent unexpected faults during load transfer process. Generally, artificial neural networks are very efficient in pattern detection; while, typical computers are efficient in numerical process. Thus, for hardware development, blocks 1 and 4 are designed as a typical calculation principle and blocks 2 and 3 are designed as artificial neural networks in order to adopt a combined structure.

RESULTS AND DISCUSSION

Load data is placed in a remote measured line current in each line. Therefore, area load can be obtained by the following relationship through simple mathematical operations:

Area load relationship:

$$ZL_i = LP_i - \sum_{j=1}^{k} LP_{ij} \text{for} \qquad i = 1, 2, \ldots m$$

Where m is the number of areas, and $ZLi$and LPi are load current and source-side line for area i, respectively. LPi is the jth line current from load side for area i, and k is the number of line sections from the load side for area i.

Since this paper focuses on distribution networks and the outputs of interest are related to this part of the network, it should be noted that the final diagram validated and used is illustrated in **[Figure-1].**

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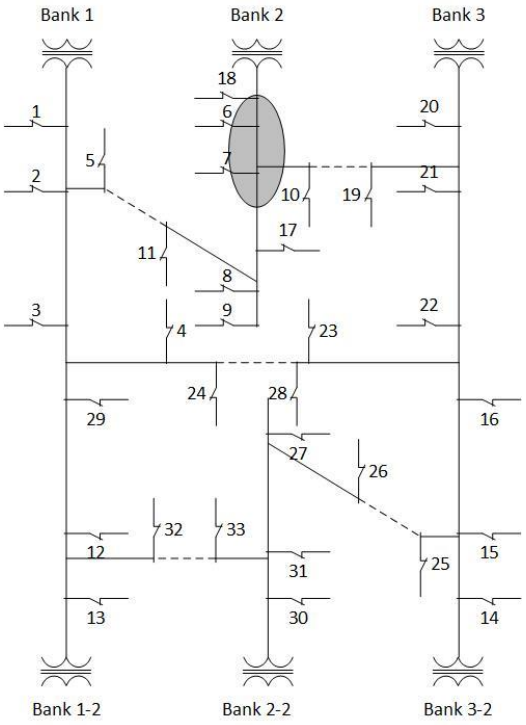

Fig: 1. Applied distribution system

Process used in this paper is completed in two different modes. One mode is when distribution system is switched without artificial neural network. The other mode is when artificial neural networks arrangement is used.

System output without neural network:

The test system has 33 different buses **[**shown in **Figure- 1]** without artificial neural network that controls oscillations shown in [**Figure-2**] in 20-unit time range. Conventional control without artificial neural network needs 20-unit time ranges to stabilize 33-bus system with employing disturbances. However, when artificial neural network is present, only 12-unit time range is required to reach stabilized condition.

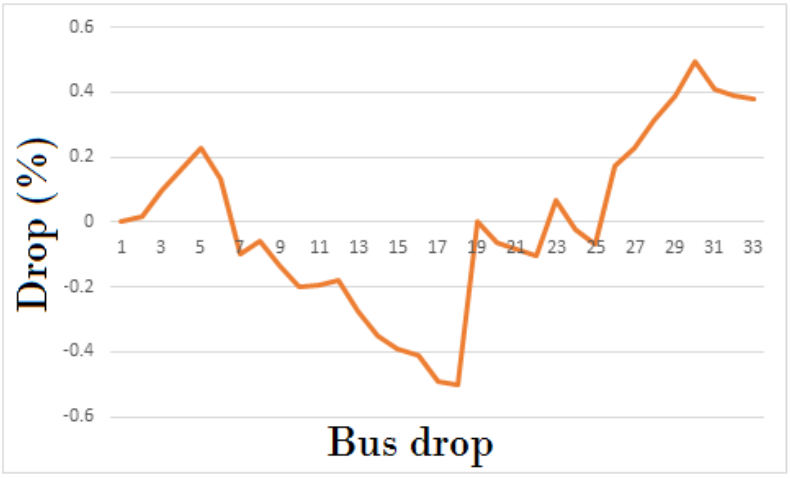

Fig: 2. Disturbances inserted into system for testing purpose

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Artificial neural networks not only have high speed, but also owe high accuracy. As seen in **[Figure- 3]**, the quality of controllers' performance is shown with ..?..

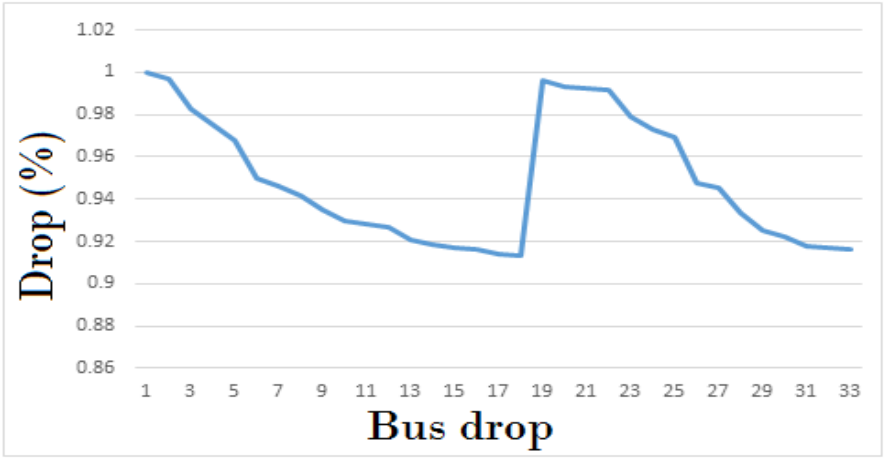

Fig: 3. Network quality on control of various buses

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Additionally, following results may be obtained when two general modes of conventional controls and neural networks are compared:

* Fixing of distribution system switching condition;
* Acceleration of distribution system stability;
* Enhancement of distribution system quality;
* Decrease of oscillations in distribution system;

CONCLUSION

* The proposed method is a practical technique to control power switches in power system;
* The amount of network changes is decreased remarkably due to the presence of high consumption devices;
* Damages resulting from electricity interruption on electric devices in household and industrial sectors are

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significantly reduced;
* The designed algorithm in this paper is greatly appropriate because it can reduce drops due to power shortage for power networks' topology.
* The method proposed in this paper can improve a number of serious issues in the system including power distribution system.
* Due to having no basic changes in network structures, implementation of the novel algorithm is cost-effective, easy to implement, and more convenient.

CONFLICT OF INTEREST
Authors declare no conflict of interest

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FINANCIAL DISCLOSURE
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REFERENCES

[1] Merlin A. Back G.[1975]search for minimum loss operational spanning tree configuration for an urbon power distribution system‹" *fifth power system confrance cambridge uni u.k* ‹

[2] Civanlar ‹B.[1988] Distribution feeder reconfiguration for loss reduction, *IEEE*

[3] Shirmohammadi D. [1989] Reconfiguration of electric distribution networks for resistive line losses reduction, *IEEE*

[4] Baran ME.[1989] Network reconfiguration of electric distribution networks for resistive line losses reduction‹" *IEEE*

[5] Nara K. [1992] Implemention of genetic algorithm for distribution systems loss‹" *IEEE*

[6] Felix WU. [1989] Configuration of power systems‹ *IEEE*