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USING THE BACKWARD/FORWARD SWEEP APPROACH, POWER FLOW ANALYSIS FOR RADIAL DISTRIBUTION SYSTEMS

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ABSTRACT

The voltage at each node, starting from the reference node through the end nodes, is calculated using the forward sweep. The voltage is maintained constant during the backward sweep, and the current or power value is maintained constant during the forward sweep. The convergence of the power flow is verified after each iteration. An enhanced load flow technique for a contemporary distribution system is presented in this research. The typical backward/forward sweep approach serves as the basis for the suggested load flow technique. The suggested method avoids matrix multiplication by using Kirchhoff's laws-based linear equations.

In order to avoid complicated renumbering of branches and nodes, the approach may handle changes in network topology reconfiguration by involving the parent-children relationship between nodes. The process is iterative. Considered is the flat voltage (1pu) starting at the substation and going to each end-node. After each subsequent iteration, the voltage magnitude and angle are updated, and the voltage drops are then calculated using the revised voltage magnitude and angle data. One of the best ways for the load-flow analysis of the radial distribution system, the proposed method gives a load flow research using the backward/forward sweep method. This method can be used to calculate voltage magnitudes at each bus node as well as power losses for each bus branch. The forward-backward algorithm is so-called because the first pass moves time forward while the second move it backward. Any method that belongs to the broad class of forward-backward algorithms that work on sequence models is also referred to as a forward-backward algorithm.

Keywords—*Backward/Forward sweep method; Distribution system; Load flow analysis.*

INTRODUCTION

Because of changing power request different issue emerges like voltage unbalance, line over-burdening, power misfortunes, influence cogging/surplus and so on. To adapt up to the future power request an enormous number of foundation and framework rebuilding expected for age, transmission and dispersion to limit the bungle among age and request. However, having new concentrate age each time is certainly not a possible way from both practical too natural perspective. A stage towards decentralize age drives us to focus towards the misfortune minimization and remuneration. To decide misfortunes and to further develop voltage profile load stream can be utilized, the introduced paper portrays forward and in reverse scope strategy for load stream examination in spiral distribution[1].

Load stream examination is a vital errand in power frameworks control as it helps in the calculation of voltages at every hub and ebbs and flows at each branch [1]. The heap stream technique results convey significant data about the power framework; numerous investigation wouldn't be imaginable without it. Uses of burden stream techniques decrease the requirements for extra interests in sensors and correspondence framework in power frameworks. Load stream results are remembered for different devices which screen, break down and control the power framework. Load stream examination is straightforwardly or in a roundabout way utilized in different power framework applications, for example, disseminated generator and capacitor positions [2,3,4], monetary dispatch [5, 6], power quality enhancements, network reconfiguration and administration rebuilding efforts [5] power frameworks improvement and different applications. Different burden stream strategies have been conceived for power stream examination in both appropriation organizations and transmission organization. The power stream examination regularly utilized in dispersion networks incorporates in reverse/forward clear (BFS) and direct burden stream (DLF) strategies. Newton Raphson technique [9], Gauss [10] and quick decoupled strategies [1] are for the most part utilized in power transmission frameworks.

The heap stream strategies utilized in a power transmission organization may not work productively in that frame of mind because of the great obstruction (R) to reactance (X) proportion. Hardly any specialists have attempted to further develop the Newton-Raphson strategy for the dispersion networks applications; notwithstanding, it has a high calculation time [2]. The regressive/forward clear proposed by [5] is effective for power dispersion frameworks; nonetheless, it requires hub or branch renumbering when applied in activities that include networks with dynamic geography structures (e.g., network reconfiguration issues) [5]. Such methods function admirably for static organizations where the organization geography doesn't change, for example, ideal conveyed age situation or capacitor position in an outspread circulation network [6]. Direct burden stream technique at first proposed by [7] depends on the calculation of two frameworks, in particular branch infusion branch current (BIBC) and branch current transport voltage (BCBV) lastly calculation of DLF network, which is the duplication of BIBC and BCBV. The DLF brings about quicker computational time when contrasted with the BFS strategy, yet it likewise requires network renumbering during network reconfiguration.

Not at all like which includes two networks for changing transport infusion current over completely to branch current in the regressive breadth and transformation of branch current to transport voltages in the forward clear, the review done by [8] proposed a procedure that utilizes a solitary burden current to transport voltage (LCBV) lattice to perform both in reverse and forward clears load stream computations in a solitary step. The utilization of LCBV presents adaptability, bringing about a heap stream strategy that obliges any adjustment of organization structure because of reconfiguration. Be that as it may, its application in huge frameworks may not be productive because of the utilization of grids number juggling. Huge endeavors have likewise been made to work on the BFS and kill the requirement for network renumbering because of the expanded number of hubs from the first organization. A concentrate by [1] proposed a methodology in view of BFS in which the organization renumbering is disposed of by recognizing normal hubs, terminal hubs and halfway hubs followed by the development of fundamental and subsidiary frameworks.

This paper proposes a better BFS approach for power stream examination in an outspread dispersion organization. The strength of the proposed approach lies in its effortlessness to carry out and its autonomy on hub renumbering and network reconfiguration. The proposed calculation has mitigated hub numbering reliance by exploiting the construction of a spiral conveyance organization and the utilization of profundity search ideas. Network reconfiguration is related with the expansion or evacuation of hubs or association of various organization fragments. In such cases, a system for rebuilding one of the interfacing networks without renumbering its hubs has been proposed and highlighted in the proposed load stream technique to deal with network reconfiguration issues.

BACKWARD/ FORWARD SWEEP METHOD

Let's have a look at a radial network. The backward/forward sweep method is an iterative method that performs two computing phases throughout each iteration: Two sets of recursive equations can be used to iteratively solve the load flow of a single source network. The initial set of equations used to calculate the power flow across the branches, starting at the furthest branch and working backwards towards the root node. The second set of equations is used to determine each node's voltage magnitude and angle, beginning at the root node and moving ahead to the last node.

A. Forward Sweep

A voltage drop computation with potential updates to the current or power flow is essentially what the forward sweep is. Nodal voltages are updated in a forward sweep, moving from first-layer branches to last-layer branches. Calculating the voltages at each node starting at the feeder source node is the goal of forward propagation. The voltage of the feeder substation is set to its real value. The effective power in each branch is maintained constant to the value attained in the backward walk during the forward propagation.

B. Backward Sweep

In essence, the backward sweep is a solution for current or power flow with potential voltage adjustments. Beginning with the branches in the most recent layer, it moves in the direction of the branches joined to the root node.The backward propagation computation uses the node voltages from the previous iteration to determine the updated effective power flows in each branch. It entails

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that updated power flows in each branch are transferred backward via the feeder utilizing the backward way, while the voltage values obtained in the forward path are maintained constant during the backward propagation. This shows that the backward propagation moves from the source node to the very end node. It is well known that there exist three main variants of the forward/backward sweep method that differ from each other based on the type of electric quantities that at each iteration, starting from the terminal nodes and going up to the source node (backward sweep), are calculated.

1. The current summation method, in which the branch currents are evaluated;
2. The power summation method, in which the power flows in the branches are evaluated;
3. The admittance summation method, in which, node by node, the driving point admittances are evaluated.

In other terms, the three variants of the B/F method simulate the loads within each iteration, with a constant current, a constant power and a constant admittance model. In the forward phase, the three variants are identical since, based on quantities calculated in the backward phase, the bus voltages are calculated starting from the source node and going towards the ending nodes. Voltages are then used to update, based on the dependency of loads on the voltage, the quantities used in the backward sweep in order to proceed to iteration. The process stops when a convergence criterion is verified.

RADIAL DISTRIBUTION FUNCTION

"Structure" suggests that the situating of particles is ordinary and unsurprising. This is conceivable in a liquid somewhat while thinking about the short-range position and pressing of particles. The neighborhood molecule thickness variety ought to show some design in a genuinely found the middle value of sense. Structure requires a reference point, and on account of a liquid we pick a solitary molecule as the reference and depict the situating of different particles comparative with that. Since every molecule of a liquid encounters an alternate neighborhood climate, this data should be measurably found the middle value of, which is our most memorable illustration of a connection capability. For distances longer than a "connection length", we ought to lose the capacity to foresee the overall place of a particular sets of particles. On this more drawn out length scale, the liquid is homogeneous.

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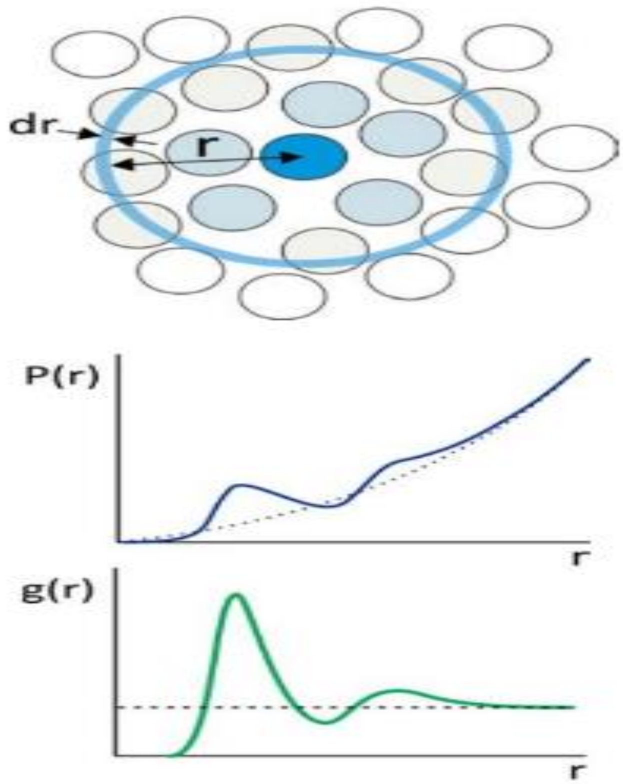

The most practical way to describe the "structure" of a fluid at molecule length scales is the radial distribution function, or g(r). The term "fluid" refers to any dense, disordered system that has local change in the positions of its constituent particles but is macroscopically isotropic, despite the fact that it evokes a continuum description. By defining the typical distribution of particles around a central reference particle, g(r) provides a statistical description of the local packing and particle density of the system.

DISTRIBUTION STRATEGIES TYPES

Let's quickly review the various sorts of distribution strategies now that we have persuaded you of the necessity of having one and help you decide which one will work best for your business.

Direct delivery

Direct distribution refers to the manufacturer accepting orders and delivering its goods to the customer directly. There are fewer middlemen, which can lead to larger profit margins as well as access to more information about your customers and target market.

Unreliable distribution

Working with middlemen to distribute your items is known as indirect distribution. Depending on your demands, these might be retailers, wholesalers, franchisors, or distributors. Retailers buy things directly from manufacturers to sell in their physical stores, online, or through other channels, whereas wholesalers buy products in bulk for a discounted price.

A distributor aids in moving goods from producers to retailers, and a franchisor is a person who has bought the rights to a good or service and the brand name from the manufacturer, who retains some amount of control.

Intensive distribution

This method of distribution is putting your goods in as many retail stores as you can, but it only really works for low-cost items that consumers frequently buy.

Selective distribution

This distribution technique entails sending your goods to numerous retailers while being extremely picky about the ones you choose to partner with.

Exclusive distribution

An exclusive distribution strategy, last but not least, entails selling your goods to a single retailer, or just via your own website or physical shops.

CONCLUSION

The effectiveness of radial networks' backward/forward sweep approach has been demonstrated. The distribution power flow is carried by the iterative equation for backward and forward propagation. The power of each branch has been determined using backward propagation. In forward propagation, the voltage magnitudes at each node are determined. Due to its distinctive features, the power flow mechanism used in distribution systems presents particular difficulties. To produce a straightforward, quick, and accurate outcome, a number of techniques have been devised. Backward-Forward Sweep (BFS), one of the methods, can be easily implemented in radial distribution systems. A new data structure was used to enhance the approach, which was then applied to an imbalanced load with different model iterations.

REFERENCES

[1]. Murthy, K. Krushna, and SV Jaya Ram Kumar. "Three-phase unbalanced radial distribution load flow method." International Refereed Journal of Engineering and Science (IRJES) 1.1 (2012).

[2]. Balamurugan, K., and Dipti Srinivasan. "Review of power flow studies on distribution network with distributed generation." 2011 IEEE Ninth International Conference on Power Electronics and Drive Systems. IEEE, 2011.

[3]. Bhujel, D., B. Adhikary, and A. K. Mishra. "A load flow algorithm for radial distribution system with distributed generation." 2012 IEEE Third International Conference on Sustainable Energy Technologies (ICSET). IEEE, 2012.

[4]. Kocar, Ilhan, and Jean-Sébastien Lacroix. "Implementation of a modified augmented nodal analysis based transformer model into the backward forward sweep solver." IEEE Transactions on Power Systems 27.2 (2011): 663-670.

[5]. Memaripour, Ahmad. "Power flow in distribution system with consideration of distributed generation." Int. J. Acad. Res. Appl. Sci 1.3 (2012): 60-97.

[6]. Janecek, Eduard, and Daniel Georgiev. "Probabilistic extension of the backward/forward load flow analysis method." IEEE transactions on Power Systems 27.2 (2011): 695-704.

[7]. Martinez, Juan A., and Jean Mahseredjian. "Load flow calculations in distribution systems with distributed resources. A review." 2011 IEEE power and energy society general meeting. IEEE, 2011.

[8]. Sandhya, K., A. Jaya Laxmi, and M. P. Soni. "Optimal Placement of Distribution Generation in Radial Distribution System."

[9]. Srihari, P., and G. Srinivasa Rao. "Load Flow Analysis of Distribution System Including Wind Turbine Generating System Models." International Journal of Computational Engineering Research (ijceronline. com) Vo2. 2 Issue 5.

[10]. Aly, Mohamed M., and Mamdouh Abdel-Akher. "A continuation power-flow for distribution systems voltage stability analysis." 2012 IEEE International Conference on Power and Energy (PECon). IEEE, 2012.

[11]. Elsaiah, S., M. Ben-Idris, and J. Mitra. "Power flow analysis of radial and weakly meshed distribution networks." 2012 IEEE Power and Energy Society General Meeting. IEEE, 2012.

[12]. Demirok, Erhan, et al. "Three-phase unbalanced load flow tool for distribution networks." Proceedings of the 2nd International Workshop on Integration of Solar Power Systems. Energynautics GmbH, 2012.