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DG Location Optimization of 33 bus system Using Artificial Intelligence

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ABSTRACT- *The fundamentals of distribution grid for load flow analysis many method are improvement of system optimization stability index. But recently used deep learning and machine learning technique improvement of optimization accuracy parameters. In this paper proposed of LM training algorithm based Artificial neural network in 33 bus system power loss, DG size and DG location optimization. ANN improvement of all system model Accuracy with reduction of MSE with respect to Ideal standard IEEE data. Now different simulation curve to perform MATLAB 2015a Software. Result and analysis part of paper indicate 18 bus system lower stability index as compare to other buses.*

Keywords: DG, load flow analysis, accuracy, MSE, line data, bus data.

1. INTRODUCTION

In load flow analysis several method to used NF (newton Raphson), GA (genetic algorithm) and GS (gauss seidel) etc. These are work as different criteria of mathematical expression.

One other hand Modern technology are improvement of all system performance and reduction of analysis time. For solving of iteration problem are load flow analysis in 33 bus system consume lot of time and complex programming and testing approach.

Now some problem occur tradition methods of used 33 bus system load flow analysis are-

1. Lower number of titration.

2. Software limitations.

3. Complex programming concept.

4. Lower accuracy.

5. Consume lot of time etc.

Figure 1.1 is shows classification of methods are indicates in

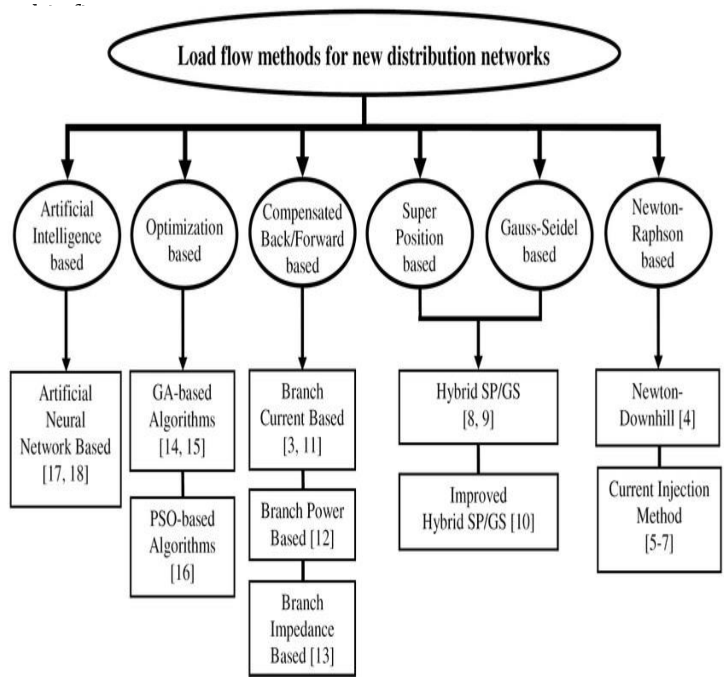

Figure 1.1 classification Load flow analysis method.

2. PROBLEM FORMULATION

Neural network based analysis of 33 bus system DG size and location optimization improvement all over system performance because ANN gives several iteration and lower optimization error. Now we focus in this paper to analyzing of 33 bus system Line data and Bus data based optimal DG size and location with condition of Faulty distribution grid.

3. OBJECTIVES

In this paper are follow some main objectives are given blow-

1. To observation of DG optimal size.

2. To identification of DG location.

3. Improvement of optimization accuracy.

4. To observation of Voltage stability index.

5. Implementation of lower complex ANN and LM based load flow analysis algorithm.

4. PROPOSED METHODOLOGY

4.1 Artificial Intelligence (AI) Methods

Fundamental of neural network:

Artificial neural network are part of artificial intelligence. These are classify between different type of based of application as given blow-

1. ANN optimization (time series) method.

2. ANN pattern reorganization method.

3. ANN-SOM (Self Organization mapping) Method.

4. ANN fitness cluster method.

Now neural network are consist of hidden layer, outer layer, neuron and input layer. In this layering system model calibration of input data with respect our outcomes result like as MSE and accuracy. Our proposed work based on ANN time series optimization method improvement of accuracy to selected input layer data. Figure shows ANN architecture model and best selection approach in layered frame.

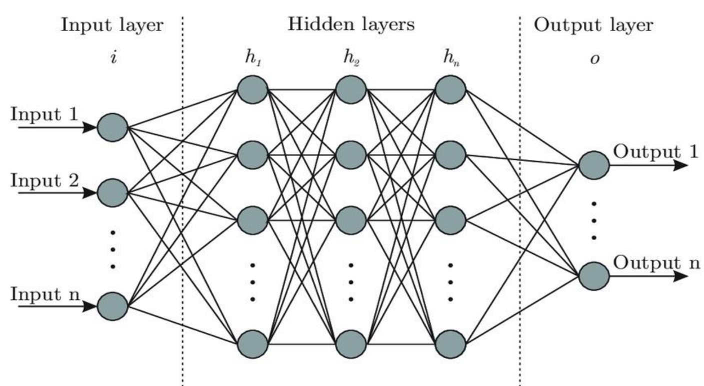

Figure 4.1: ANN architecture.

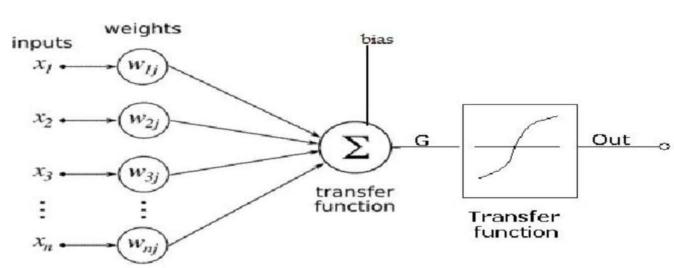

Figure 4.2: ANN output calibration.

Levenberg- Marquardt (LM) algorithm Training method:

LM method solving of problem of iteration. This method are gives multiple iteration as compare to other conventional algorithm. The main property of these method lower time consume to obtain the best result for solving of weights function problem. Now these process flow are shows in figure

4.2. For observation of power loss find lower stability then also identify non linearity with respect to input and output. Hence LM approach calibration if R^2 values and reducing of Optimization error like MSE.

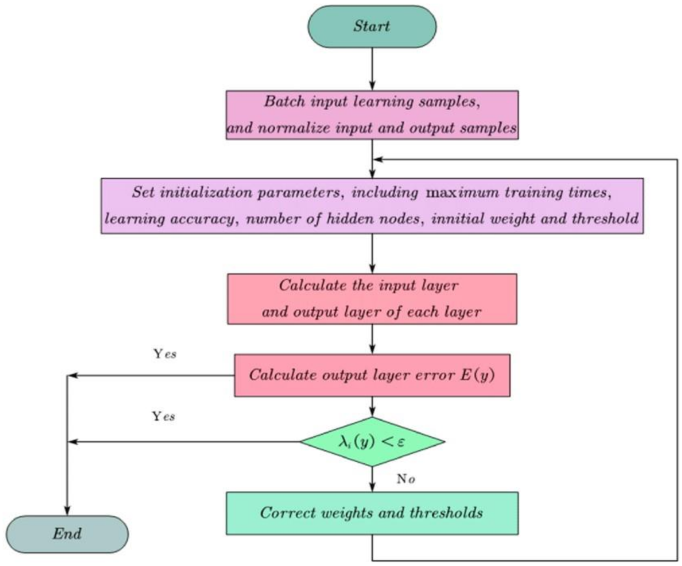

Figure 4.3: ***Levenberg- Marquardt (LM) algorithm process flow.***

4.2 Proposed method algorithm steps-

Proposed system model are as follow some points given blow-

Step-1: **Load all data file like as line data and bus data.**

Step -2: *In this step generate a complex number for given line data and bus data.*

Step-3: *These complex number based line parameters are observation of line voltage and current.*

Step-4: *Identification system model power and voltage/current stability criteria in terms of pu.*

Step-5: *calculating of power loss in this system model with and without faulty condition for each bus.*

Step-6: *these power values are generating random number of input layer and weighting factor.*

Step-7: *For analysis of ANN to calibration of input layer with respect to number of neuron.*

Step-8: *Now LM method select best value when to observe lower error. This selected value gives lower stability criteria.*

Step-9: *ANN output parameters observe each bus power loss and MSE.*

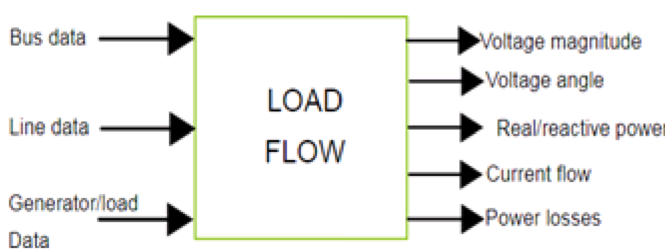

Figure 4.4 Load flow data input and output system model.

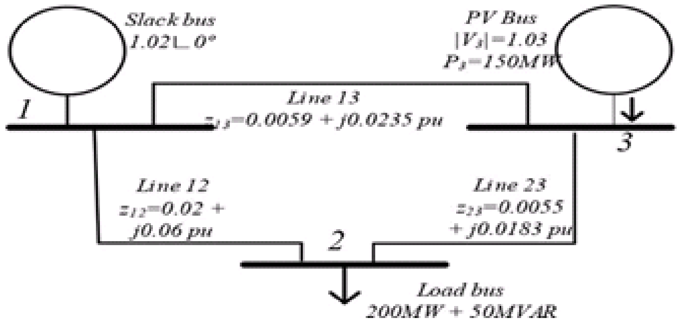

Figure 4.5 Slack bus and generation bus based load bus flow parameters.

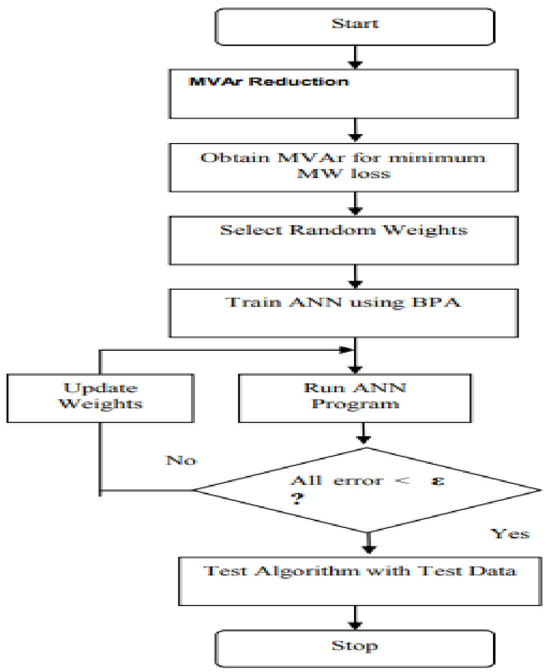

Figure 4.6 Proposed method flow chart.

5. FAULT DETECTION BASED ON EXTRACTED FEATURES

Generally speaking, the mission of fault detection is finished previous to fault-type and fault location. When an impartial approach is used for fault detection, the classifier and the locator are brought on after a fault is securely detected. This may be finished without difficulty via way of means of putting a few thresholds for the extracted features. Moreover, with inside the case wherein the classifier or the locator is able to distinguishing among defective and non-defective states, there's no want to put into effect extra fault detection methods.

6. FAULT LOCATION

A considerable variety of research have targeted on fault region in that correct region of faults in transmission traces and distribution structures can substantially lessen the time to recovery. A complete evaluate of fault region in strength structures is supplied in [12]. In [1], wherein a clever fault region approach changed into proposed, the historical past understanding for fault region changed into additionally supplied. Thus, on this paper, on the idea of present evaluate research, we gift the basics and a few new development in fault region techniques. For transmission traces, conventional fault region strategies may be divided into impedance targeted strategies (phasor or time-area primarily based totally) and visiting wave primarily based totally strategies. For distribution structures, strategies the use of superimposed additives and strength first-rate statistics may additionally be considered [1]. Depending at the supply of statistics, fault region strategies can also additionally be in addition classified as single-quit strategies, double-quit strategies, multi-quit strategies and widevicinity strategies. In this paper, however, we gift fault region strategies in a unique way as we handiest recognition on a few special quantities of them.

7. RESULTS AND DISCUSSION

Data Preparation:

Right now collect 33 bus system data , the information separated in past stage are sorted out and pre-handled for additional stages. Right now all the information is duplicated in single exceed expectations sheet, with every section speaking to estimation of each info parameter. Presently after that embed two more section for weekday and working day esteems. These two parameters are presented on the grounds that heap is subject to the day of the seven day stretch of perception and climate the day is working day or it's an occasion. Thus, we have spoken to every day by a regarded number like Sunday by 1 and Tuesday by 2. Also, we have checked working day by 0 and occasion by 1

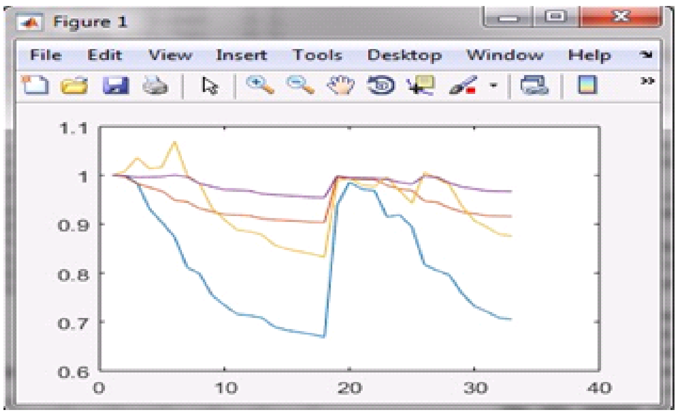

Figure 7.1: Power loss variation.

Table 7.1 line data.

Branch number	From bus	To bus	R	X	U	U'
1	1	2	0.0922	0.0470	0.8000	0.1000
2	2	3	0.4930	0.2512	0.4000	0.0100
3	3	4	0.3661	0.1864	0.1000	0.0600
4	4	5	0.3811	0.1941	0.5000	0.0600
5	5	6	0.8190	0.7070	0.2000	0.0200
6	6	7	0.1872	0.6188	1.0000	0.0300
7	7	8	0.7115	0.2351	1.0000	0.0100
8	8	9	1.0299	0.7400	0.8000	0.0200
9	9	10	1.0440	0.7400	0.7000	0.0200
10	10	11	0.1967	0.0651	0.4000	0.0200
11	11	12	0.3744	0.1298	0.1000	0.0300
12	12	13	1.4680	1.1549	0.3000	0.0400
13	13	14	0.5416	0.7129	0.5000	0.0100
14	14	15	0.5909	0.5260	0.2000	0.0500
15	15	16	0.7462	0.5449	0.6000	0.0900
16	16	17	1.2889	1.7210	0.2000	0.0900
17	17	18	0.7320	0.5739	0.6000	0.1000
18	2	19	0.1640	0.1565	0.7000	0.1000
19	19	20	1.5042	1.3555	0.9000	0.0200
20	20	21	0.4095	0.4784	0.5000	0.0800
21	21	22	0.7089	0.9373	0.1000	0.0700
22	3	23	0.4512	0.3084	0.5000	0.0400
23	23	24	0.8980	0.7091	0.4000	0.0200
24	24	25	0.8959	0.7071	0.3000	0.0700
25	6	26	0.2031	0.1034	0.8000	0.0900
26	26	27	0.2842	0.1447	0.2000	0.0600
27	27	28	1.0589	0.9338	0.8000	0.0500
28	28	29	0.8043	0.7006	0.8000	0.0200
29	29	30	0.5074	0.2585	0.7000	0.0200
30	30	31	0.9745	0.9629	0.5000	0.0400
31	31	32	0.3105	0.3619	0.1000	0.0600
32	32	33	0.3411	0.5302	0.4000	0.0200

Table 7.2 Bus data.

Load	Location (Bus Bar)	Real Load (kW)	Reactive Load (kVAR)
L2	2	100	60
L3	3	90	40
L4	4	120	80
L5	5	60	30
L6	6	60	20
L7	7	200	100
L8	8	200	100
L9	9	60	20
L10	10	60	20
L11	11	45	30
L12	12	60	35
L13	13	60	35
L14	14	120	80
L15	15	60	10
L16	16	60	20
L17	17	60	20
L18	18	90	40
L19	19	90	40
L20	20	90	40
L21	21	90	40
L22	22	90	40
L23	23	90	50
L24	24	420	200
L25	25	420	200
L26	26	60	25
L27	27	60	25
L28	28	60	20
L29	29	120	70
L30	30	200	600
L31	31	150	70
L32	32	210	100
L33	33	60	40
Total load		3715	2300

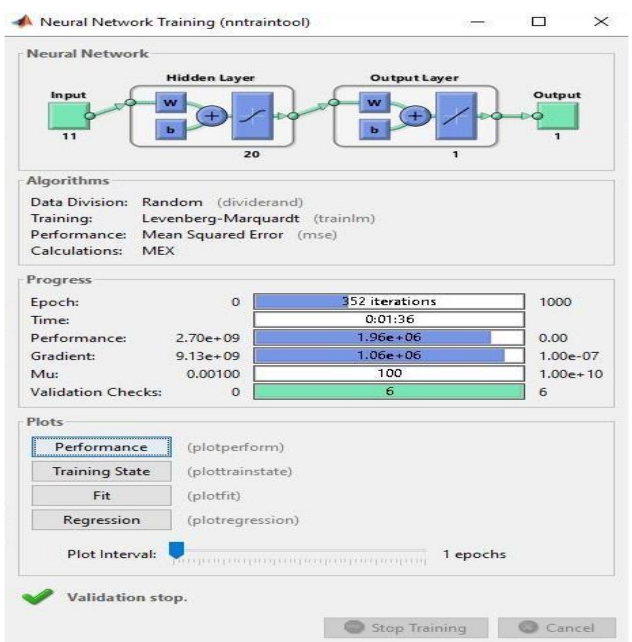

Figure 7.2: Graphical Diagram of the Proposed Neural Network for LM Training.

Table 7.3 ANN outcomes Results and Stability index.

Bus No	Vbus__2 pu	STABILITYINDEX sizedg	del ang	Pd KW	Qd KVar	Sdgi_2dg KVA
1	1.0000	1.0000	0.0000	0.000	0.000	1419.822
2	0.9991	1.0075	0.0000	100.000	60.000	1423.483
3	0.9958	1.0363	0.0001	90.000	40.000	988.259
4	0.9964	1.0135	0.0001	120.000	80.000	519.255
5	0.9974	1.0172	0.0001	60.000	30.000	263.289
6	1.0004	1.0701	-0.0005	60.000	20.000	2564.070
7	0.9969	1.0005	0.0033	200.000	100.000	19.561
8	0.9832	0.9830	0.0060	200.000	100.000	345.441
9	0.9768	0.9326	0.0073	60.000	20.000	407.270
10	0.9709	0.9089	0.0085	60.000	20.000	438.944
11	0.9701	0.8885	0.0084	45.000	30.000	445.170
12	0.9685	0.8851	0.0082	60.000	35.000	452.595
13	0.9623	0.8785	0.0098	60.000	35.000	443.331
14	0.9600	0.8572	0.0112	120.000	80.000	428.005
15	0.9586	0.8492	0.0118	60.000	10.000	411.531
16	0.9572	0.8442	0.0123	60.000	20.000	392.947
17	0.9552	0.8392	0.0136	60.000	20.000	352.674
18	0.9546	0.8323	0.0138	90.000	40.000	335.290
19	0.9985	0.9888	0.0002	90.000	40.000	762.161
20	0.9949	0.9940	0.0014	90.000	40.000	360.159
21	0.9942	0.9799	0.0017	90.000	40.000	328.165
22	0.9936	0.9771	0.0021	90.000	40.000	270.519
23	0.9922	0.9963	0.0006	90.000	50.000	996.957
24	0.9855	0.9686	0.0022	420.000	200.000	941.660
25	0.9822	0.9430	0.0030	420.000	200.000	778.897
26	0.9985	1.0065	-0.0012	60.000	25.000	126.581
27	0.9959	0.9931	-0.0021	60.000	20.000	249.741
28	0.9844	0.9801	-0.0036	60.000	20.000	

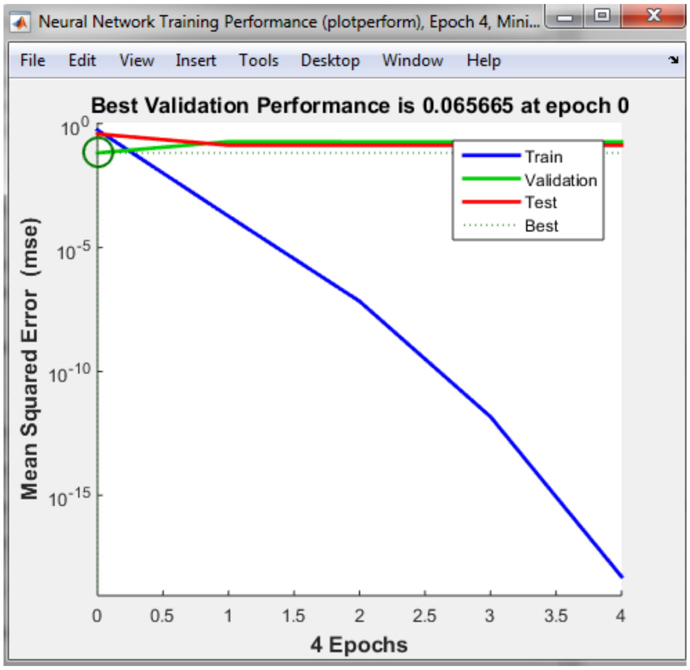

Figure 7.3: Neural network performance during training, testing & validation without WT.

The above plots show the forecasted load using proposed model and actual load collected from reference station. A plot of errors for all the samples is also plotted in figure 5.2 describing the difference between actual value and calculated value.

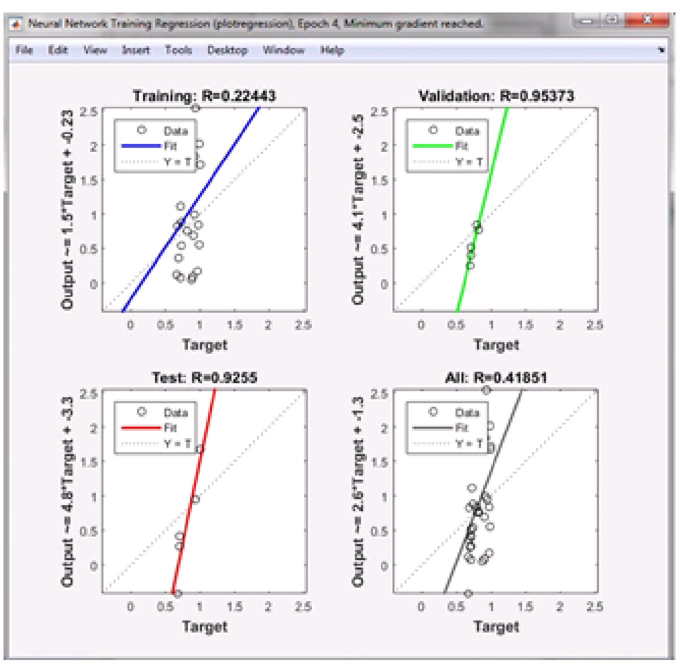

Figure 7.4: Regression plot during training, testing & validation for Proposed for Proposed Levenberg-Marquardt (LM) training algorithm without WT.

Regression 'R' values measure the correlation between the outputs and the targets. If the value of 'R' is 1, it means there exists a close relationship, and if it is 0, it signifies a random relationship.

Obtained results are summarized below:

Table 7.4 Concluding result Obtain in Optimization.

Total reactive demand 2295.000
minimum voltage and bus bus 0.9036 18.0000
minimum voltage1 and bus bus1 0.9546 18.0000
minimum stability index and bus bus 0.6686 18.0000
maximum stability index1 and bus bus1 0.8323 18.0000
Total dg_1 placement 3016.533
Total dg_2 placement 685.656
Total dg_2 placement 2564.070
Total real power loss base case 0.503
Total real power loss index with 1_dg placement case 0.178 6.000
Total index power loss with 2_dg placement case 0.134 30.000

The proposed dynamic calculation results, delivered for the IEEE 33-bus outspread appropriation system, have been contrasted and results acquired from past approachs for a similar dissemination system. The examination has demonstrated that the proposed calculation is productive and can give great answers for the ideal size and situation of DG units in dispersion organizations. It ought to likewise be referenced that boundaries not been considered in the current work are the yearly burden fluctuation and monetary issues related with the DG unit establishment. Heaps of a dissemination network present impressive varieties during days, weeks, and months bringing about generous varieties in organization's capacity misfortunes and voltage profiles.

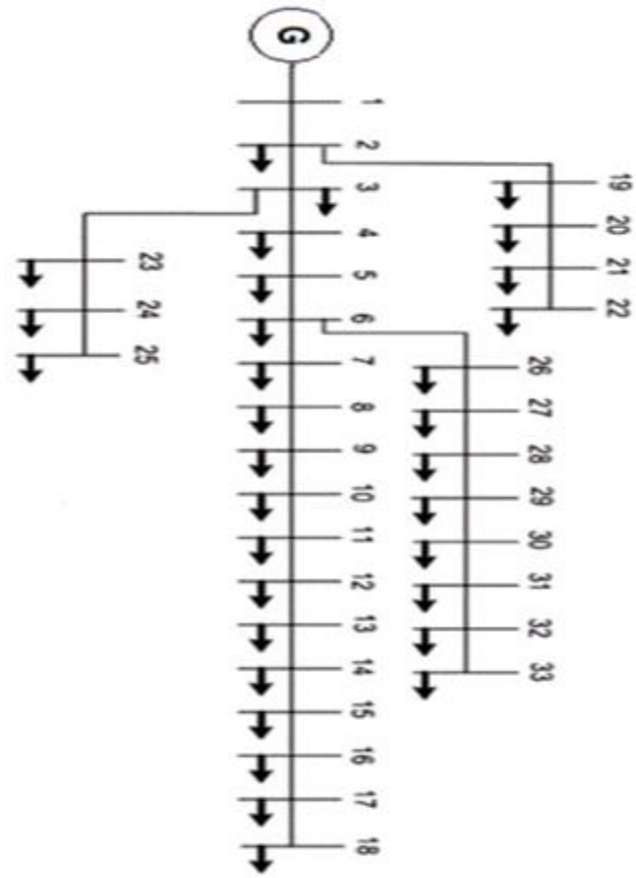

Figure 7.5: 33 Bus system Single Line diagram.

8. CONCLUSIONS

In this paper, a dynamic calculation has been created for the ideal size and arrangement of DG units in dissemination organizations. The proposed calculation has been tried on the IEEE 33-bus spiral conveyance framework and the got outcomes have been contrasted and those of before considers, demonstrating that the dynamic calculation is well working and has an adequate exactness. The calculation can help engineers, electric utilities, and conveyance network administrators in the more effective coordination of new DG units in the flow dispersion organizations. Future work will be the improvement of the proposed calculation thinking about both the DG establishment cost and the fluctuation of the heaps during the

year, just as the use of the calculation in a genuine dispersion organization. This paper presents an audit on the strategies utilized for shortcoming recognition, deficiency order and issue location in transmission lines and circulation system. An assortment of strategies are presented and agent works are introduced in detail. Preceding presenting the techniques straightforwardly utilized in the three points, we first give a general audit on the strategies utilized for highlight extraction, which establishes the framework for other shortcoming conclusion errands. Various kinds of changes just as dimensionality decrease strategies are introduced. We can see that data over the low-recurrence extents and high-recurrence ranges is completely misused, and specialists are more deliberate while picking the element extraction strategies just as choosing the separated highlights. Issue identification is introduced on head of the element extraction strategies, as the discovery procedures are exceptionally reliant on highlight extraction. In any case, some imperative viewpoints and recently created thoughts with respect to blame recognition are introduced.

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