

Fault Analysis in Distributed Generation for Optimal Location & Sizing using Artificial Intelligence Technique

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Abstract: Distributing power generation are small generating units usually installed close to load centres and additionally avoiding the requirement to expand the network so as to hide new load areas or to uphold the raised energy transfers that will be necessary for satisfying the consumer's demand. This study addresses the problem of dg location and size. the thing of the study is to assess the performances of two process strategies for dg the sizing allocation problem, global optimisation, and genetic algorithms yet on study the importance of optimum dg allocation. The study develops IEEE 33bus distribution system using AI technique in MATLAB to spot short circuit faults with distributed generation.

KEYWORDS: Distributing generation, fault analysis, Optimization location and sizing, 33bus system, AI technique



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INTRODUCTION

The electric energy that's localized to the lattice from several decentralised areas, as an example, from wind ranches and sunlight-based board institutions is thought as Distributed Generation. taken over Generation assets have enlarged drastically in Bharat owing to the arrangements known with interconnection as an example new energy metering plans, even as owing to the comes known with dynamic the connection of propelling and clean energy. In any case, these methodologies need vital financial speculation and might build ecological considerations. Overall transmission and dispersion power misfortune in 2014 was eight.12% of absolutely the created influence of two.72 terawatts (TW). Further, sizeable of upper activity flows, power misfortune in appropriation systems is around double that of transmission systems. Limiting force misfortune in appropriation systems builds the stacking limit of the lines and limits the warming impact in influence system links. after, utilities will fulfil increasing power wants while not golf stroke resources into new generation or transmission foundation by decreasing force misfortunes notably in appropriation system.

Conveyed generation, is in addition the distributed energy, on this generation, or locale/decentralized energy, is electrical generation and capability performed by an assortment of very little, lattice associated or circulation system associated gadgets alluded to as taken over energy assets. ancient power stations, as an example, coal-terminated, gas, and atomic fuelled plants, even as hydroelectric dams and large scope sunlight-based power stations, are unified and frequently need electrical energy to be communicated over vital distances. Conversely, DER systems are suburbanised, particular, and additional flexible innovations that are found close to the heap they serve, although having limits of simply 10 megawatts (MW) or less.

These systems will contain various generation and capability segments, during this case, they are alluded to as half-breed power systems. A matrix-associated convenience for power repositing will likewise be delegated a DER system and is frequently known as a distributed energy repositing system. It makes the stock interest connections astonishingly impressive, and

needs befuddled improvement instruments to regulate the organization, and it squeezes the transmission organization, and it would cause switch power stream from the distribution system to the transmission. Microgrids are current, limited, restricted scope systems, con to the customary, brought along power lattice. Microgrids will degeneration from the brought along matrix and work severally, rein power lattice flexibility, and facilitate moderate system aggravations. they're frequently low-voltage AC networks, oftentimes use diesel generators, and are introduced by the native space they serve. Microgrids increasingly utilize a mixture of varied disseminated energy assets, like sunlight-based 0.5 and 0.5 power systems, that primarily diminish the live of carbon produced.

FAULTS ON ELECTRICAL DISTRIBUTION POWER SYSTEM

An electrical fault is that the deviation of voltages and currents from nominal values or states. under traditional in operation conditions, grid equipment or lines carry traditional voltages and currents which results in safer operation of the system.

Types of Faults in electrical power Systems

Symmetrical Faults:

These are very severe faults and occur infrequently within the power systems. These are known as balanced faults and are of 2 types particularly line to line to ground (L-L-L-G) and line to line (L-L-L). The symmetrical faults are classified into 2 types

a. L – L – L Fault: These kinds of faults are balanced which implies the system remains balanced when the fault happens. therefore this fault rarely happens, though it's the tough kind of fault that holds the most important current. therefore, this current is employed to see the rating of the CB.

b. L – L – L – G Fault: The 3-phase L – G fault mainly contains all the 3- part of the system. This fault principally happens among the 3-phases similarly as the ground terminal of the system. So, there's a two to three of chance to occur the fault.

Unsymmetrical Faults:

These are very common and less severe than symmetrical faults. There are principally three types particularly line to ground (L-G), line to line (L-L), and double line to ground (LL-G) faults. The unsymmetrical faults are classified into 2 sorts

a. Single L – G Fault: This single L – G fault principally happens once a single conductor falls toward the bottom terminal. therefore around seventy to eighty you look after the fault within the facility system is that the single L – G fault.

b. L – L Fault: This L– L fault principally happens once 2 conductors are short-circuited and additionally due to serious wind. therefore the line conductors may be touched due to serious wind, they will bit with one another and causes short-circuit. So, fifteen – two hundredth of the faults will occur more or less.

c. Double L – G Fault: in this quite fault, each the 2 lines get involved with one another through the ground. So, there's a 10th chance for faults.

Open Circuit Fault:

The open circuit deficiency chiefly happens due to the disappointment of a couple of conductors. The open circuit shortcoming happens in arrangement with the line, and along these lines, it is additionally called the arrangement deficiency. Such kinds of faults influence the unwavering quality of the system. The open circuit shortcoming is arranged as

- Open Conductor Fault
- Two conductors Open Fault
- Three conductors Open Fault

Short Circuit Fault:

In this sort of fault, the conductors of the various stages come into contact with one another with an electrical cable, power transformer or some other circuit component because of which the enormous flow stream in a couple of periods of the system. The short out fault is partitioned into the even and unsymmetrical deficiency.

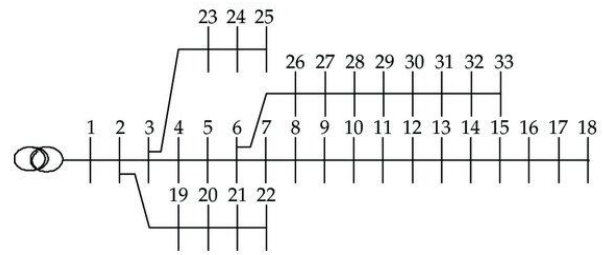


Fig. 1. Single line diagram of distributed power system

ARTIFICIAL INTELLIGENCE TECHNIQUES

In a grid, there are a substantial range of territories wherever a specialist framework is crucial. This master framework is that the one which will perform undertakings like dynamic, grappling problems by thinking, documenting info. it's on the grounds that sometimes, a large amount of data should be ready in an especially transient span. Expect systems are only pc programs. Also, to compose codes for these comes is additional agreeable than to appraise and calculate the extent of boundaries like age, transmission, and conveyance. in addition, creating changes to the code once the arrange is easier on the grounds that they're just some laptop programs.

Neural Network: The expression "Neural organizations" may be a suggestive one. It proposes machines that are something like cerebrums and conceivably loaded down with the science beingness on implications of the Frankenstein mythos. one in all the mama n errands of this book is to clear up neural organizations and show however, while they, in reality, have one thing to try and do with cerebrums, their investigation likewise connects with totally different components of science, designing, and arithmetic. The plans to try and do this in as non-specialized away as may well be expected, albeit some numerical documentation is key for indicating sure tips, systems, and designs quantitatively. By and by, all pictures and articulations are processed as they emerge so, ideally, this ought to not hinder the basics: that's, concepts and thoughts which may be delineated in words. This half is planned for direction. we tend to endeavour to grant basic portrayals of what organizations are and why we tend to might think about them. on these lines, we've one thing as a high priority directly from the start, albeit the

complete of this book is, obviously, dedicated to responding to those inquiries fully.

Feed-Forward Neural Network: A Feed Forward Neural Network may be a faux neural organization wherever the associations between hubs do not form a cycle. one thing contrary to a feed-forward neural organization is an intermittent neural organization, whereby sure pathways ar cycled. The feed-forward model is that the least complicated form of neural organization as knowledge is simply ready a technique. whereas the data might go through various secret hubs, it generally moves one method and ne'er in reverse follow in below fig (2).

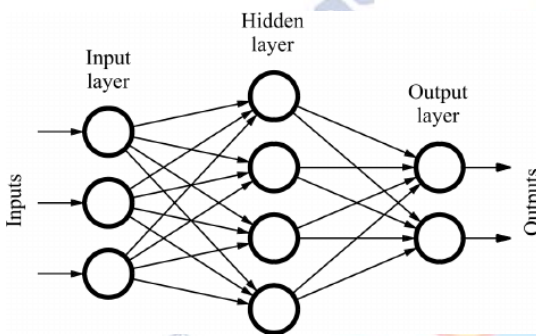


Fig.2. Feed forward network architecture

Backpropagation: Back-propagation is that the embodiment of neural net getting ready. it's the technique for adjusting the masses of a neural web passionate about the error rate got here the past age (i.e., emphasis). applicable standardization of the masses permits you to diminish blunder rates and to create the model solid by expanding its speculation.

Backpropagation may be a short structure for "in reverse propagation of blunders." it's a regular technique for getting ready counterfeit neural organizations. this method assists with calculation the slope of a misfortune work regarding each one of the masses within the organization follow in below fig (3).

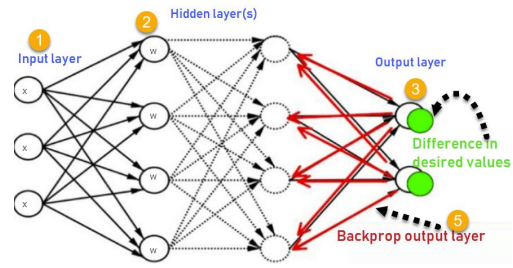


Fig. 3. Back Propagation architecture

Genetic Algorithm:

The hereditary calculation depends on the hereditary construction and conduct of the body of the public. The related to things area unit the establishment of hereditary calculations.

- Each body shows a possible arrangement. per the public is an assortment of chromosomes.
- A well-being work portrays every one within the public. additional distinguished well-being higher is that the arrangement.
- Out of the accessible people within the public, the most effective folk's area unit used to imitate the cutting-edge offspring.
- The posterity delivered can have highlights of each the guardians arean aftereffect of modification. could be a very little change within the quality style.

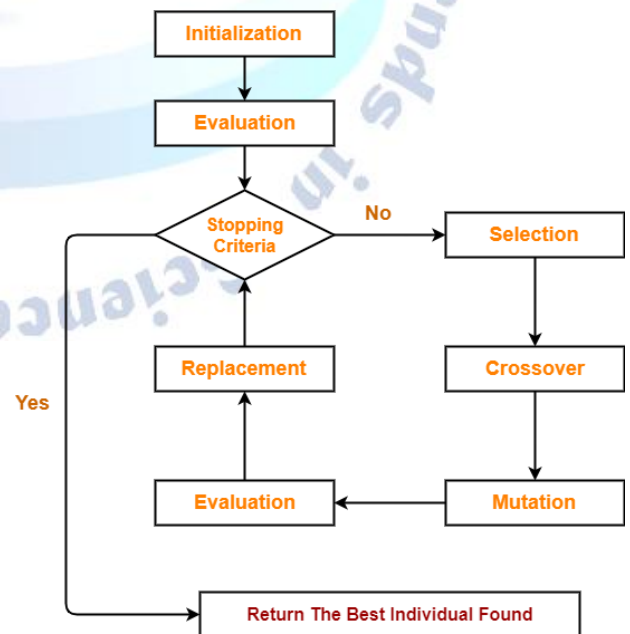


Fig (4) -genetic algorithm flowchart

Genetic algorithm works in the following steps:

- Randomly generate a collection of possible solutions to a problem.
- Represent every answer as a set length character string.
- Using a fitness operate, check every possible answer against the matter to evaluate them.
- Keep the simplest solutions.
- Use best solutions to get new possible solutions.
- Repeat the previous 2 steps until.
- Either a suitable answer is found.
- Until the algorithm has completed its iterations through a given number of cycles / generations.

SIMULATION RESULTS

Simulation of Distribution System: The Simulation of 33buses MATHLAB Distribution Network Show in below fig (5):

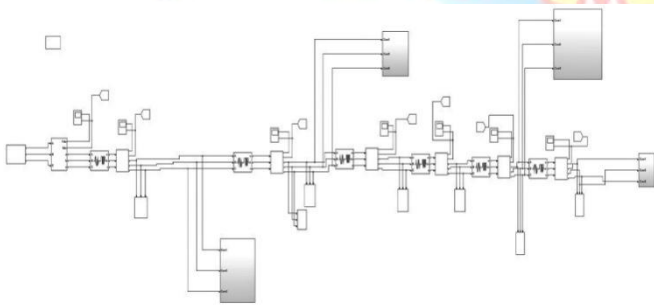


Fig 5 - Simulation of 33bus distribution system

The major blocks of 33bus distribution given as:

1. 3-phase source:

Three-phase voltage supply in series with RL branch. For a composite three-phase port, the Through variable may be a three-element current, and the Across variable may be a three-element voltage. very cheap circuit uses a Voltage supply block with expanded electrical conserving ports a, b, and c. In every circuit, the fast part voltages and currents are an equivalent.

2. Bus system:

Each Bus Creator block groups the weather connected to its input port into a bus. A bus represents a collection

of parts, analogous to a bundle of wires tied along. as an example, the bus created by the Bus Creator block named Bus Creator one contains the signals sine and chirp, which are connected to its input ports.

3. Transmission line:

In electrical engineering, a transmission line may be a specialised cable or other structure designed to conduct electromagnetic waves during a contained manner. The term applies once the conductors are long enough that the wave nature of the transmission should be taken into account. Implements a three-phase series RLC branch. Use the 'Branch type' parameter to feature or remove parts from the branch.

4. Wind turbine:

Wind turbines employing a doubly-fed induction generator (DFIG) contains a wound rotor induction generator associate degreed an AC/DC/AC IGBT-based PWM convertor. The mechanical device winding is connected on to the sixty Hz grid whereas the rotor is fed at variable frequency through the AC/DC/AC convertor.

Implementation procedure for identify fault type:

- To identify the fault type it is considered as A, B, C, G code.
- The fault data from 28 buses are given as input to neural network.
- The remaining 5 buses data are considered for testing the neural network.
- Initially training is done for a practical neural network and testing will be done for the same neural network to obtain corresponding output.

Simulation of Distribution Generated: Integration of Distribution generated in the distribution network is done by using the genetic algorithm from the result of genetic algorithm it is clear that distribution generated as to be integrated at 30th bus in the consider 33buses distribution network. The genetic algorithm shows in below fig(5).

```

iter =
    1000
Elapsed time is 7.456315 seconds.
results =
    30.0000    1.0000    0.2131    0.1549

```

Fig (6) - Result Genetic Algorithm output

- Distribution Generated locatio-30th bus
- Distribution Generated Capacity-1 p.u.
- Losses without Distribution generated-0.213 p.u.
- Losses with Distribution generated-0.1549 p.u.

Result for fault type identification with Distribution Generated: Out of all 33 buses, 28 buses are used for training the neural network. By considering buses 5 data i.e., giving it as testing for the neural network, the output is as follows:

Output: BUS 5

```

[1 1 1 1;
 1 1 1 1;
 1 1 1 1;
 0.84413 0.84412 0.84413 0.84413]

```

Output: BUS 15

```

[1 1 1 1;
 1 1 1 1;
 0.0044659 0.0044659 0.0044659 0.0044659;
 0.99927 0.99927 0.99927 0.99927]

```

Output: BUS 23

```

[1 1 1 1;
 1 1 1 1;
 0.0044659 0.0044659 0.0044659 0.0044659;
 0.99927 0.99927 0.99927 0.99927]

```

Output: BUS 29

```

[1 1 1 1;
 1 1 1 1;
 0.049953 10.083841 0.047629;
 0.99538 0.99963 0.99567 0.99535]

```

Output: BUS 32

```

[1 1 1 1;
 1 1 1 1;
 1 1 1 1;
 7.9993e-07 2.9747e-05 7.9993e-07 0.00013079]

```

After testing the neural network, the corresponding output are obtained and their shown above.

CONCLUSION

In this article work, fault identification is done using neural network and Distribution power system integration is done using genetic algorithm out of all the 33 buses, 28 buses are considered for training and 5 buses for consider for neural network. Here fault consider as short fault system four different fault applied for the fault identification in system or circuit fault applied are LG(A-G), LL(A-B), LLG(A-B-G), LLL(A-B-C) after the integration of Distribution generated in the distribution network, the limit of voltages and current are deviated. Such deviated leads to power quality issue and cause many other problem distribution networks. After the integration of Distribution generated simulation is done and fault data is collected fault data is given has input to neural network and output for analysed as renewable energy system is existing in the distribution circuit neural output is assented with actual output. The neural network output is nearer to the actual values. For effective output signal processing and wavelets technique can be used.

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