# Reconfiguration of distributed systems With Distributed Generators

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**Abstract:** Network configuration in distribution networks in order to reduce losses, increase network reliability and power quality improvement in network. Is replenished. Key to open and close the power distribution system reconfiguration for changing the network topology, followed by a shift in the power flow. Many studies in the field of distribution network reconfiguration and lack of presence of distributed generation sources with different goals such as reducing losses and increasing stability. Taken. In this paper, the distribution network reconfiguration presence and absence of dispersed sources using Ant Colony optimization algorithm (ACO) aims to achieve load balancing factor on minimizing the power losses increase and improve the implementation of a network of bus 33. Simulation results have been compared with Genetic Algorithm.

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## 1. Introduction

The three sections of the generation, transmission and distribution systems, power distribution systems account for the largest share of the losses. In addition to losses in the distribution network costs due to energy loss, other expenses such as occupation lines and transformer capacity, the need to invest power and capacity are followed. One of the methods for distribution network reconfiguration for loss reduction is presented. An annular distribution networks were designed and put the key back to normal operation as Vnrmal depending on radius. It could be due to the load curve, the optimal configuration can be determined in such a way that will minimize losses.

Reconfiguration was first discussed by Merlin [1] was introduced in 1975. Various methods have been proposed for reconfiguration started with simple ways and complex ways Trchvn, particle swarm optimization [2] (PSO), genetic algorithm, [3] (GA) and frogs [4] improved.

Thread rearrangement in the presence of DG in distribution networks has been discussed for some time. Technique is used ant colony [5]. Also in [6-8] rearrangement coincides with the capacitor in distribution networks have done. In reference [9] rearrangement coincides with the capacitor in the presence of dispersed dispatch networks have done. In this article we try using Ant Colony optimization algorithm discussed for loss reduction using radial distribution systems with reconfiguration techniques can be evaluated The method may well be able to optimize our objective function.

## 2. Maneuvering areas

Usually the number of points in each grid exercise (Tai switch) is the first of them is used to eliminate errors and enhance the reliability. But our goal is to change the structure of the network so that we have the least losses. It begins with the closing of the network Manvrdr but should be back for the radial mode structure of the network should have a close button again Rabaznmvd key fact, one of the points of our new maneuver. To access the new drill sites, the load voltage back branches that are normally calculated and the maximum voltage difference is that branch is closed. It has been shown that charge transfer from the low voltage section of a feeder network losses are reduced when voltage is higher. So after the closure of the branch, a branch of which passes through the lower opening and maintaining the network will be radial. The executive branch of the limitations of the exercise is to create the directory are removed from the list of candidate points.

**Constraints governing the network and in this case include**

1 - radius of the new network

2 - New network to encompass all buses.

3 - The amount of times and the amount of network capacity is not exceeded.

4 - Voltage buses and networking equipment is the limit.

5 - flowing lines and network equipment is allowable.

Considering all these problems will cause reconfiguration of the network to a nonlinear optimization problem becomes complicated.

## 3. Effect of DG on distribution networks.

Connecting DG to the distribution network is not a feeding location and distribution pattern of changes in the overall network. Dispersed set of effects on various aspects such as load flow calculations, planning distribution networks, voltage quality, network security, network losses, system reliability, voltage profile rubber etc. are applied to the distribution system.

## 4. The mathematical expression

Rearrangement of the issues in this article, the three objective functions are considered to be two to two-and triple simultaneous optimization algorithm are proposed. The first objective of radioactive waste feeder distribution network, which is expressed as follows.

$$minP_{loss} = \sum_{i=1}^{nb} R_i \frac{P_i^2 + Q_i^2}{V_i^2} \qquad (1)$$

In this regard, the resistance R of each line. And $Q_i$ can be drawn from each line and each line is a voltage $V_i$ and $n_b$ are the total number of branches.The objective function is the domain of load balance, which is expressed as follows.

$$LBI = \sum_{i=1}^{nb} \left(\frac{S_i}{S_i^{Max}}\right)^2 = \sum_{i=1}^{nb} \frac{P_i^2 + Q_i^2}{(S_i^{Max})^2} \qquad (2)$$

In this respect, and active and reactive power flow of line i, Qi, $S_{imax}$ maximum complex power transmission line i.

The third objective of minimizing the deviation from the nominal bus voltage, which is expressed as follows.

$$d_{Voltage} = Max\ [\ |1 - V_{min}|\ and\ [1 - V_{max}]\ ] \qquad (3)$$

In relation to the above: Maximum value $V_{max}$. $V_{min}$ bus voltage and bus voltage is minimum.

## 5. Ant Colony optimization algorithm (ACO)

Ants are creatures that are able to find the shortest way between the nest and food through the labor of a substance called pheromones to leave behind, they do. As in Figure (1) can be seen ants on a direct path of the object is not to Ghzavsl will move when an obstacle is encountered on their way, cutting off the path and seek a solution to discovery to solve their problems are.

Ants that are located above the obstacle can not find Msyrhrkt they have lost the pheromone pathway why this is likely to move to the right or left, But ants have chosen the shorter route than by accident, they may make the connection between pheromones, So the shorter path can be filled faster and ant pheromones to further his kill ants communicate through pheromones, and their behavior based on the position that.

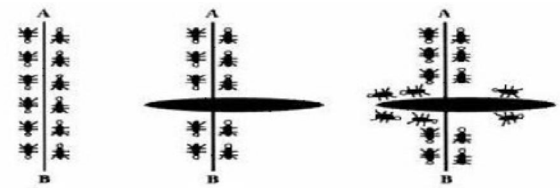

Fig. 1. Behavior of ants.

The full procedures of the ACo algorithm can be summarized as follows:

Step1 (start):First, a graph of the paths of movement of food to be considered and an amount of pheromone on each of the sides to seek to draw attributed to the pheromone in each branch as constant $\tau_{(0)}$ =c and empowerment to following the extraction of the pheromone$\Delta\tau_{ij}$= 0 be considered.

Step 2 (moving ants) Ants as possible to the next point on the law likely will move. Law of probability for ant K've Drnqth i is as would be the case, the probability of j as the destination or the another way to select a replacement ij from equation (4) is obtained:

$$P_{ij}^{k} = \begin{cases} \dfrac{\tau_{ij}^{\alpha}(t)\,\eta_{ij}^{\beta}(t)}{\sum_{x \in j_k(t)} \tau_{ix}^{\alpha}(t)\,\eta_{ix}^{\beta}(t)} & if\ j \in j_k(t) \\ 0 & otherwise \end{cases} \qquad (4)$$

In this respect, $\tau_{ij}(t)$ at time t ij is the pheromone republics Drmsyrjabjayy j_k (i) and vertices that have not been seen by ant k ηij represents the displacement along the competency level and the value of equation (5) is obtained

$$\eta_{ij} = \frac{1}{d_{ij}} \qquad (5)$$

The values of α and β are parameters that influence the likelihood of weight and distance pheromones are identified

$d_{ij}$ the distance between two points ij, we show that the equation (1) is observed, ants pheromone of the routes that are longer and have less distance

Step 3) to evaluate the objective function (the next step, we examined the ant to move in the optimization problem should be best.

Step 4) Legal update: (pheromones evaporate over time to be on an edge, why pheromones should be updated., When a solution of the optimization problem in network construction, the ants' paths inspects their pheromone level by applying the update will change.

$$\tau_{ij}(t+1) = p.\tau_{ij}(t) + \Delta\tau_{ij}(t) \qquad (6)$$

P is a parameter that indicates the amount of evaporation failing to prevent the accumulation of high pheromone case is used, which is between zero and one. Look for enhancement includes a retractable pull ant pheromones that each produces, in the form of equation

(4) can be expressed as

$\Delta\tau_{ij}^{k}$ Pheromone rate by the k-th ant at time t is left to equation (7) can be expressed as:

$$\Delta\tau_{ij}^{k}(t) = \begin{cases} \frac{Q}{L_K} & use\ path\ i\ j\ in\ its\ tour \\ 0 & otherwise \end{cases} \quad (7)$$

In this respect, the fixed Q algorithm and the ant K closed the gap in the path $L_K$ of my travels.

Step 5 (end of algorithm): At the end of the process if all the ants chose the same direction is persuasive process, otherwise the process is repeated. The number of ants and experimentation to determine if all path ways assessed by ants Drhrtkrar and in the process found a better way to go this route next will be saved.

## 6. Implementation of the proposed method

Attempts reconfiguration method to reduce losses and also improve voltage profile and capacity to observe, such restrictions are lines. In addition, losses can be calculated with the flow passing through the feeder can also be calculated and if the power is out Mjazsh the feeder, the feeder with a transfer is possible the other balancing the load feeder.According to equation (8) in the simulation performed between initial mortality and mortality caused by τ and η is proportional to the image toll.

$$\eta_{ij} = \frac{1}{PLOSS_{ij}} \quad (8).$$

## 7. Test case

33-bus radial distribution system is studied in this paper, which is a standard network 32 Sectionalizing Switch and 5 Tie Switch in Figure 2 is shown. The table displays an installed capacity of DG place.

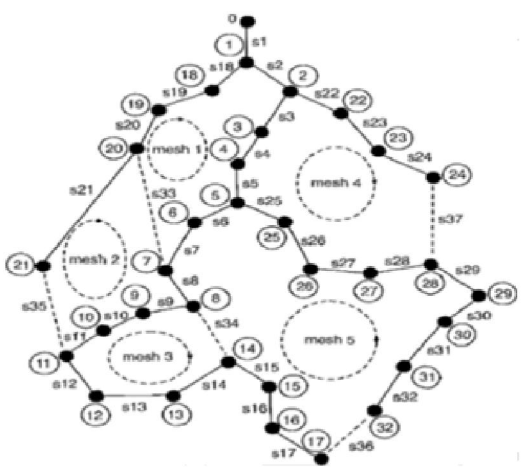

Fig. 2. 33-bus distribution system.

TABLE I - INSTALLATION NODE AND CAPACITY OF DG

| Capacity (KW/P.F) | node |
|---|---|
| 50/0.8 | 3 |
| 100/0.9 | 6 |
| 200/0.9 | 24 |
| 100/1 | 9 |

## 8. The simulation results

Here,to improve the operating conditions of the system reconfiguration has been used to study dispersed and dispersed installation and reconfiguration of the simulation results in Table (II-V) is shown.

The realignment of DG have done without the presence of a genetic algorithm have compared with the results in Table (II) and (III) have shown Ntaych.

TABLE II - 33-BUS SYSTEM WITHOUT DG

| | Switch open | P loss (kw) | Reduction (%) |
|---|---|---|---|
| Initial | $S_{33}$,$S_{34}$,$S_{35}$,$S_{36}$,$S_{37}$ | 199.3 | - |
| GA | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 137 | 31/259 |
| ACO | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 137 | 31/259 |

TABLE III - LOAD BALANCING INDEX & Minimization of Voltage Deviation WITH DG

| | Switch open | D Voltage [pu] | LBI | Reduction (%) |
|---|---|---|---|---|
| Initial | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 0.061203 | 148.16 | - |
| GA | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 0.06010 | 110 | 30.03 |
| ACO | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 0.0604266 | 105.83 | 28.57 |

According to these results it can be seen that if the realignment is the distribution of losses is reduced.

The reconfiguration is done in the presence of distributed generation sources, the results indicate that mortality has declined in the presence of DG. And better load balancing factor And Minimization of Voltage Deviation is that the results tables (IV) and (V) are shown.

TABLE IV -33-BUS SYSTEM WITH DG

| | Switch open | P loss(kw) | Reduction (%) |
|---|---|---|---|
| Initial | $S_{33}$,$S_{34}$,$S_{35}$,$S_{36}$,$S_{37}$ | 199.3 | - |
| GA | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 112 | 43.803 |
| ACO | $S_7$.$S_9$,$S_{14}$,$S_{28}$.$S_{32}$ | 110.26 | 44.626 |

TABLE V - LOAD BALANCING INDEX & Minimization of Voltage Deviation WITHOUT DG

| | Switch open | D Voltage [pu] | LBI | Reduction (%) |
|---|---|---|---|---|
| Initial | $S_7.S_9,S_{14},S_{28}.S_{32}$ | 0.061203 | 148.16 | - |
| GA | $S_7,S_{11},S_{14},S_{28},S_{32}$ | 0.059491 | 95 | 22.03 |
| ACO | $S_7,S_{11},S_{14},S_{28},S_{32}$ | 0.053972 | 83.86 | 29.49 |

## 9. Conclusions

This paper presents a useful method for optimal reconfiguration of distribution network in presence of distributed generation sources is discussed. For this purpose, the objective function to reduce losses and improve grid density was defined as leading to the selection of the optimum location of distributed generation sources may network, and the arrangement are.

In this paper, the ant algorithm to solve the optimization problem in different conditions are used. The results are also compared with genetic algorithms. This algorithm has been tested on a network of 33 bus distribution. The results confirmed that the correct installation of distributed generation sources simultaneously at optimal reconfiguration increased stability, further reducing losses and improving density is lines. It was also observed that the use of ant algorithm to solve the optimization problem due to the possibility of working with both discrete variables, high speed and also not to be found suitable solutions to local optimal points

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