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Electric Distribution Network Multi objective Design Using Problem Specific Genetic Algorithm

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Abstract:- A multiobjective approach is used for design of a new electrical distribution network or resizing of existing distribution network by adding some nodes in system. A multiobjective approach is used, considering the following: i) the financial costs and ii) the costs that are incurred due to system faults. In designing stage of the electrical distribution network the important consideration is the issue of system reliability. The true Pareto- optimal solutions are found with a multiobjective genetic algorithm Results based on 21 is presented. The information gained from the Pareto-optimal solution set is shown to be useful for the decision-making stage of distribution network evolution planning.

Keywords:- Decision-making, energy distribution networks, genetic algorithms (GAs), multiobjective optimization, networktopology optimization.

I. INTRODUCTION

OPTIMIZATION techniques should be employed for the design of engineering systems, allowing for the best allocation of the limited financial resources. In electrical energy systems, most of the electrical energy losses occur in the distribution systems. Most of the energy supply interruptions also occur due to faults in this subsystem. Due to its large extension, the designer of the distribution system often tries to keep its installation cost as low as possible, which often leads to lossy and unreliable systems. Moreover, the nature of a distribution system expansion, which is done inherently by small incremental steps which occur at the same time in different geographical locations, and at the same location at different times, does not favor the application of efficient design methodologies. Particularly, if the expansion is performed in small fragments of the system, the overall combinatorial possibilities of network topologies may not be fully considered, which can result in a system that is more expensive, less reliable, and more lossy than a globally designed one. This paper presents a tool that can be used both for the design of a new distribution system and for the resizing of an existing system, occasionally adding some new nodes. A multiobjective approach is used, considering the following: i) the financial costs that appear due to system installation, system maintenance, and energy losses; and ii) the costs that are incurred due to system faults (undelivered energy and restarting procedures).The importance of considering, in the design stage, the issue ofsystem reliability is discussed in [1] and [2]. Those references consider, as the objective to be minimized, a weighted sum of the financial costs and the fault costs.

II. PROBLEM IDENTIFICATION

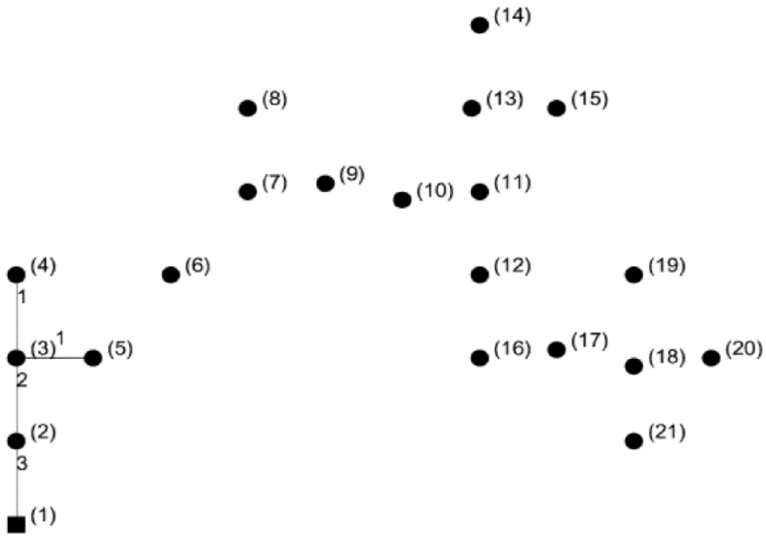
In electrical energy systems, most of the electrical energy losses occur in the distribution systems. Most of the energy supply disturbances also occur due to faults in this subsystem. Due to its large extension, the designer of the distribution system often tries to keep its installation cost as low as possible, which often leads to faulty and unreliable systems. If the expansion of distribution system is performed in small portions of the system, the overall combinatorial possibilities of network topologies may not be fully considered, which can result in a system that is more expensive, less reliable, and lossier than a globally designed one.

III. OBJECTIVE FUNCTION

The most relevant aspects to be considered in distribution network optimization can be mixed in two objective functions.

1. The financial costs that appear due to system installation, system maintenance, and energy losses;and
2. The costs that are incurred due to system faults. In designing stage of the electrical distribution network the important consideration is the issue of system reliability.

21- Node Bus Initial System



Controlled Greedy Encoding

- In the first step, the distance between all nodes is measured, and each node is assigned the mean distance between it and the other ones.
- Their mean distances in ascending order classify the nodes.
- The node with minimum mean distance can connect to the maximum nearest nodes, the node with maximum mean distance can connect only to the minimum nearest neighbors.
- The number of connection possibilities (between mnn and mxn) for the other nodes is defined by a linear interpolation (according to the node mean distance) followed by a rounding operation.
- For the 21-bus system that will be considered in the case study section, in which and, the number of variables is reduced from 208 to 62.

Simulation Result of Controlled greedy Encoding

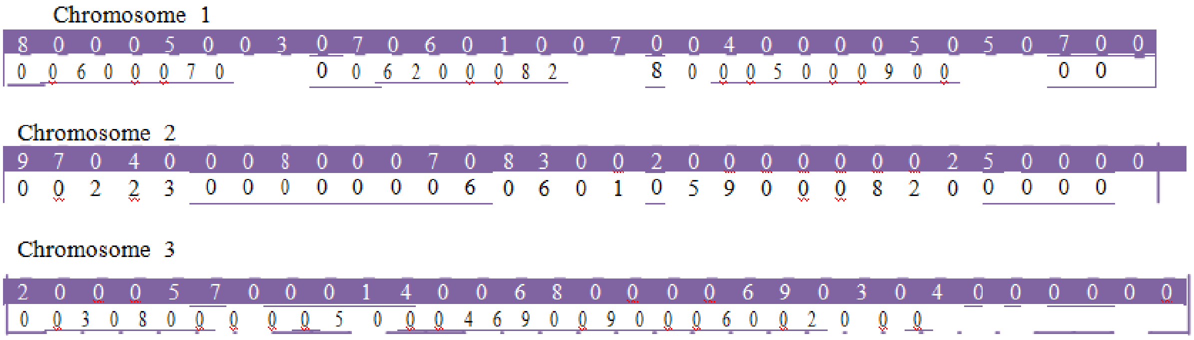
TABLE: 1

Controlled Greedy Node Data (Node To Node Connection)	
1	2
1	3
1	4
1	6
2	3
2	4
2	6
3	4
3	5

4	5
4	6
5	6
5	7
5	8
6	3
6	7
6	8
7	8
7	9
7	10
7	11
8	9
8	10
9	6
9	10
9	11
9	13
10	11
10	12
10	13
10	16
11	12
11	13
11	14
11	15
11	16
12	13
12	16
12	17

12	19
13	14
13	15
14	9
14	10
14	15
15	12
15	19
16	17
16	18
16	19
17	18
17	19
17	21
18	19
18	20
18	21

Simulation Result of Initial Population



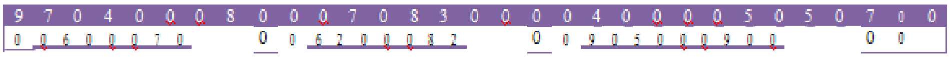
Simulation Result of Crossover and Mutation

Here there is only taking two chromosomes among the result of current population and describing the result of crossover and different mutation.

After Crossover

Chromosome 1

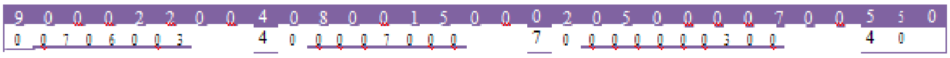
Chromosome 2



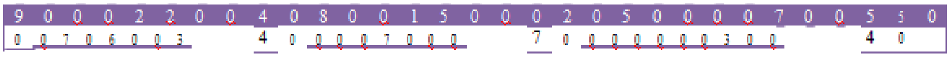
After Mutation

Mutation 1

Mutation 2



Mutation 3



CONCLUSION

Here the numbers mention except zero is the types of Conductor, which will be, connect between two nodes. Total types of Conductors are nine. [5]

A multiobjective GA, using problem-specific mutation and crossover operators and an efficient variable encoding scheme, which gives multi objective optimization and sets of feasible solution which will further used for pareto optimal curve for finding decision making stage of designing or resizing the electrical distribution network.

Future Work

Using NSGAII –Fast Non dominating Sorting Algorithm for selection operator and finding pareto optimal curve.

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