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Research Article

Optimized DG Installation using PSO Technique

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Abstract:
Installation of Distributed generations (DG's) offers many advantages to the grid such as reduced transmission and distribution resources, better power quality, increased reliability etc.,. The small generations with low or medium voltage systems have significant importance in power systems as variety of consumers is required at various levels of demand. This paper exhibits different Distributed generations like solar, wind, Biomass power plants and locating these DG's by using multi objective Particle Swarm Optimization (PSO) technique. The selected PSO for identifying DGs for the case study showed with minimal losses. This in turn would benefit the system with lower Investment & Operating costs, and Improve voltage profile at the point of DG penetration.

Keywords: DG's, Optimization, PSO, Power Loss.

I. INTRODUCTION

Integrated DG demonstrates generation of little units which is straight forwardly associated with an appropriation network. The power is produced and in some cases shared and associated with network, it is named as DG. The distributed generation depends on the various kinds of fuel sources utilized for the power generation [1]. It is predominantly by utilizing sustainable power sources. DG's are advancement based feasible power sources, like, Solar, wind, Bio- mass, and Tidal, wave energy, geothermal energy etc. Because of increasing the demand of power, expansion of distribution system planning is vital; this can be accomplished by connecting DG to the network [2]. As such, the objective

of power system planning is to depict the efficiency of the network system to satisfy the demand of power with good power quality and reliable cost. By using DG technology reliability of the electrical system is increased, emergent supply of power, reduction of peak power requirements, provides ancillary services, improves power quality thus there is a increased efficiency. Some of the problems occur by installation of DG's are effect of voltage rise, power quality issues, stability & protection problems [3]. But these issues can be controlled or reduced by using advanced technologies.

II. RES BASED DG INTEGRATION

The incorporation of RES based sun and wind powered generation in distribution networks are expected to arrive the demand. In the current situation, appropriated System required the proficient and strong getting ready for smooth activity of the network. By considering the information of solar power plants in Karnataka it is conceivable know the specific area with power rating and furthermore gives thought regarding the establishment of new sun based plant. The proposed sunlight based plants which can be included in deferent districts of Karnataka is about 25MW (MNRE 2018). The complete expense for the proposed new sunlight based power plant establishment in Karnataka is 113 crore for 25MW of power. Through the survey of wind power plants in Karnataka, the new wind plants to be added at different places in Karnataka with the total power of 62MW (MNRE 2018). The total cost for the proposed wind power plant installation is 940crore for 62MW. And biomass installation to be added in some places is about 31 MW (MNRE 2018). The cost to be required for the installation is 155 crore for 31 MW of power. So as to arrive at the interest of power the expansion planning is required. By surveyed information solar n powered, wind and Biomass extension is required. To extend the network some non direct definitions are thought of. For example, cost, Active power loss, voltage stability. By considering these boundaries a Multi stage Distribution Expansion Planning improvement is utilized.

III. OPTIMIZATION METHODS

The main aim of the optimization is to reduce the some parameters like power loss, costs and to improve voltage profile etc. this can be done by using optimization methods. Some optimization methods are

(i) Artificial Neural Network
(ii) Fuzzy logic
(iii) Expert system
(iv) Genetic Algorithm
(v) Particle swarm optimization

Artificial Neural Network: Artificial Neural Networks are organically roused frameworks which convert a bunch of contributions to a bunch of yields by an organization of neurons, where every neuron produces one yield as a component of data sources.

Fuzzy logic: Fuzzification gives predominant expressive force, higher over-simplification and an improved ability to display complex issues at low or moderate arrangement cost. Fuzzy logic permits a specific degree of ambiguity all through an examination. Since this uncertainty can indicate accessible data and limit issue intricacy, Fuzzy logic is helpful in numerous applications.

Expert system: An expert system gets the information on a human expert in a thin indicated space into a machine implementable structure. Expert system is PC programs which have capability and fitness in a specific field [2]. This information is stored away independently from the program's procedural part and might be put away in one of the numerous structures, similar to rules, choice trees, models, and edges. They are moreover called as information based structures or rule based systems. Expert systems utilize the interface instrument and information to tackle issues which can't be or hard to be illuminated by human aptitude and intelligence.

Genetic Algorithm: GA is a global search method dependent on mechanics of normal determination and genetics qualities. It is a broadly useful enhancement calculation that is recognized from ordinary improvement strategies by the utilization of ideas of population genetics qualities to control the streamlining search. Particle swarm optimization: Swarm intelligence is a man-made reasoning procedure including the investigation of aggregate conduct in decentralized system, which is made up by populaces of basic people associating locally with one another and with outer climate. These methods are employed for the power system applications. AI methods will give accurate results with less error; each method has its own role. Therefore for the expansion planning to locate the DG and sizing of DG genetic algorithm, PSO and combination of the methods are adopted to improve the performance parameters of the system.

IV. PARTICLE SWARM OPTIMIZATION

The program flow of PSO as shown in Fig. 1. The first step in PSO is set the parameters of the power System. Next is initialize the velocity & weight of the particle, then evaluate the fitness function to update the velocity. Like this loop as continued till the best location has found to place the DG. The case study is carried out for the 30 bus system by applying PSO to locate the DG’s in power system. The outcomes are gotten utilizing PSO programming code in mat lab for ideal position and location are determined.

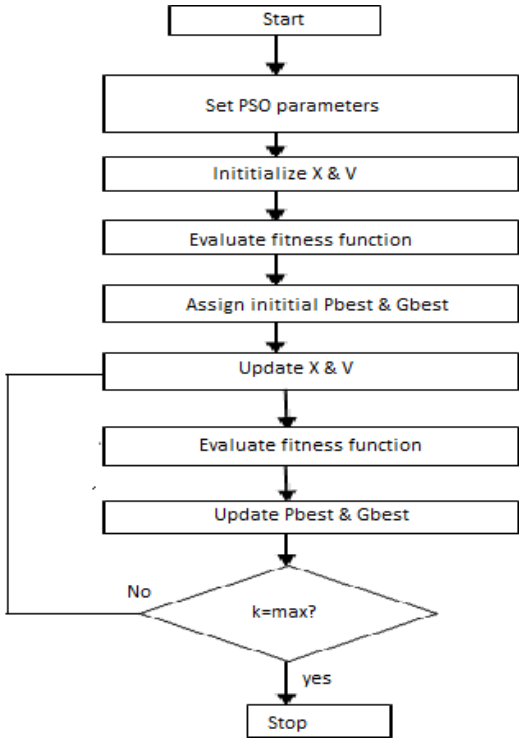

Fig 1: Program Flow of PSO

V. SIMULATION RESULTS & DISCUSSIONS

The method is tested on real time 30 bus real time distribution system in Karnataka. The algorithm is developed in MATLAB to find out the power loss and optimal location of DG. The single line diagram of real time 30 bus distribution system before & after the placement of DG as shown in Fig.2 and Fig.3.

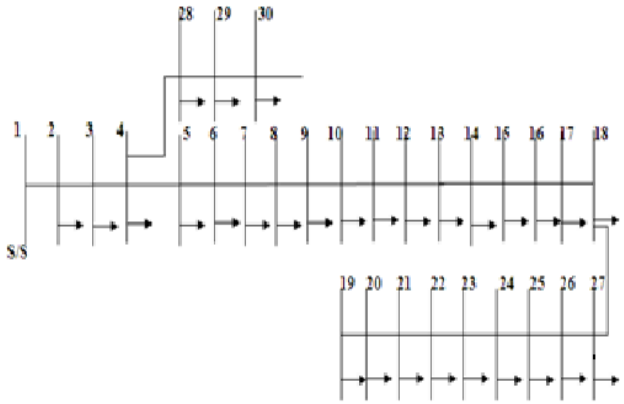

Fig. 2. Real time 30 bus distribution base system

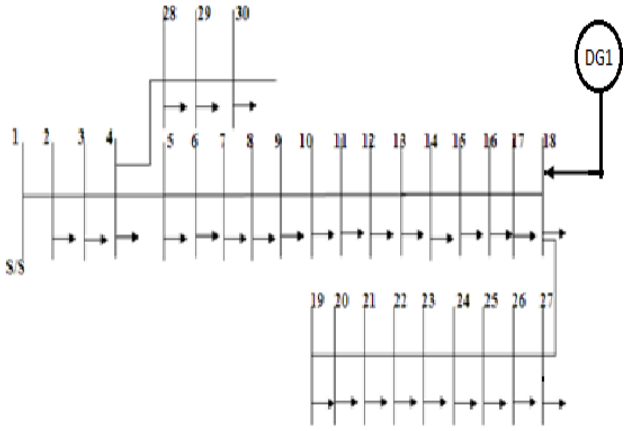

Fig. 3. Real time 30 bus distribution system after DG placement

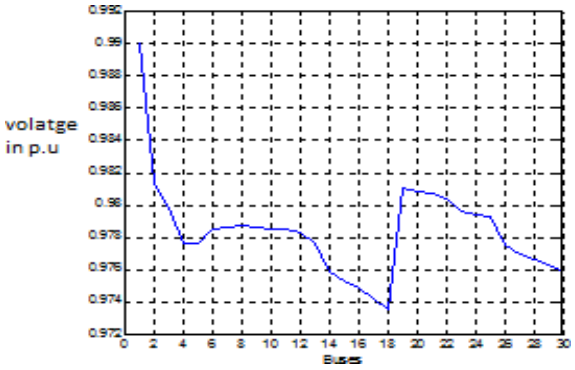

Fig. 4. Voltage variation at different busses

The results of MATLAB as shown in Table 1.The outcome which appeared in Table-1 shows the reduction in losses in some buses by the application of PSO. As the load varies at the distribution side the losses in individual bus is changed.

Table 1: Power losses before & after Application of PSO

Location of DG	Bus No.	Power Loss (KW)Before PSO	Power Loss (KW)After PSO
Base system	1	3123	3010
	2	1516	1158
	3	4402	827
	4	850	339
	5	1058	743

	6	539	148
	7	673	683
	8	165	79
	9	137	142
	10	61	107
	11	77	231
	12	128	66
	13	164	240
	14	131	168
	15	212	177
	16	320	187
	17	444	254
DG placement	18	1122	316
	19	281	149
	20	1043	1109
	21	215	137
	22	463	372
	23	385	335
	24	661	111
	25	415	345
	26	442	376
	27	153	109
	28	161	109
	29	177	105
	30	161	109

From Table 1 it is observed that some of the buses show minimum and maximum losses due to the variation of the loads and voltage. Therefore after applying optimization it calculate the minimum losses and voltage for the best location of DG. Hence the MATLAB result shows bus number 18 is the best location for the placement of DG. The current and voltage variations at different buses as shown in Fig.4. The case study has done for the 30 bus system for the placement of DG. Table I clearly states that the DG to be located at bus number 18 with the minimum losses. If any bus is selected by random to place DG, the losses will be more in that particular bus. But by using PSO program the loop is continued such that the losses will be minimum at particular bus. That bus is selected to place the DG. And also by applying optimization the voltage is stabilized.

VI. CONCLUSION

Distributed Generation has a correct track in harnessing different types of new and environmentally friendly power sources. This paper has introduced sustainable power source plants and DG units at better places. This assists with putting the new RES based DG for development arranging. According to the investigation the all out expense assessed to put in new RES based DG in Karnataka is around 1200Crores. By setting the new DG it is conceivable to satisfy the need of power & distribution system voltage profile have been considered. And presents basic power flow analysis is applied to calculate the losses for 30 bus network. In this paper PSO is applied to place the new DG at the busses, MAT lab results states that voltage profile is improved and losses are reduced.

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