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Use Of Load Dispatch Scheduling For Generation Cost Reduction In Thermal Power Plant

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Abstract

Economic load dispatch is an important optimization task in power system operation for allocating generation among the committed units such that the constraints imposed are satisfied and the energy requirement in terms of different variance .In this paper I try to reduce fuel costs for the power generation by proper load dispatch schedule. So the overall costing of operation of power system can be reduced. Minimum generation costs are achieved by economic scheduling of different generating plant of power system by their maximum and minimum capacity and load demand. By economic load scheduling we mean to find the generation of the different generators or plants so that the total fuel cost is minimum and at the same time the total losses and demand at any instant must be the total generation. MATLAB program is used to achieve above requirement and arrange generation plant according to the program output for the efficient operation of the power system.

Keywords: Economic load dispatch, Load Scheduling, Load dispatch.

1. Introduction

However, economic load dispatch is not so important in the beginning when there were small power generating plants for each locality, such as urban power system, but now with the growth in the power demand and at the same time guarantee regarding the continuity of the power supply to the consumer under normal condition have forced the power system engineers to developed grid system. For such system the economic load dispatch problem has become increasingly important. The definition of economic dispatch provided. The conventional economic load dispatch (ELD) problem of power generation involves allocation of power generation to different thermal units to minimize the operating cost subject to diverse equality and inequality constraints of the power system. This makes the ELD problem a large-scale highly nonlinear constrained optimization problem. Allocation of generation output should be made on economic basis and must be made instantly when load changes.

2. Problem Formulation

Total power output must be equal to the load requirement and loss occurring during transmission for the reliable operation of the power system.

$$\Sigma Pi = P_D + P_{LOSS} \quad (1)$$

Where P_D is total demand on power system. Now minimum and maximum limitation of power plant

$$Pi_{Min} < Pi < Pi_{Max} \quad (2)$$

Where Pi min is the minimum generation limit of unit I Pi max is the maximum generation limit of unit i

The power output of the fossil plant is increased sequentially by opening a set of valves at the inlet of steam turbine. The throttling losses in a valve are large when it is just opened and small when it is fully opened.

As a result, the operating cost of the plant is usually approximated by one or more quadratic segments. So, the fuel cost curve is modelled as a quadratic in the active power generation.

$$F_1 = \sum_{i=1}^{NG} \left(a_i Pg_i^{\,2} + b_i Pg_i + c_i \right) \text{ Kg./h} \quad (3)$$

Where ai, bi and ci are coal coefficients and NG is the number of generators and F1 is total coal require for the each thermal power unit. Our requirement is to minimize the value for the F1 for the each plant at given. For reduce the generation cost we have to reduce F1 for the given load condition.

3. Methodology

There are so many method used for the solving load dispatch optimization some of them are as per given.

3.1 Classical approach

In this method our first approach is for the graphical technique and the develop computer program for this graphical presentation. Suppose we have a three generating units and we want to find the optimal economic operating point, then we have to plot the incremental cost characteristics for each of these three units on the same graph. By using this graph we can find the optimum generating cost from the graph and all gearing units by selecting optimum point. Now we have

to assume an incremental cost rate λ and find the individual power outputs of each generating unit for this value of incremental cost. Now calculate the generation and compared with the total demand we can rapidly find the optimum operating point for the given load. We can also generate table for the total power supply for different incremental cost of generating units.

3.2 Weighted method

Weighted method used for the multi objective optimization requirement. In this method all individual objectives are transfer in to one objective and then solve the problem. Generate weight for each objective of the system. Each objective optimize on their weight as per selected value. This selection is on random base. Weight select manually so error can be occurred in this method. Accuracy of this method is low compare to new advance computerized optimization technique. For more accuracy change the weight of each objective and then summarized this as single output.

3.3 Genetic algorithms

Mixed continuous–discrete variables, and discontinuous and non convex design Characterized so many practical optimization design problems. If standard nonlinear programming techniques are used for this type of problem they will be inefficient, computationally expensive, and, in most cases, find a relative optimum that is closest to the starting point. Natural Selection and natural genetics are the basics of genetic algorithms. The basic elements of natural genetics reproduction, crossover, and mutation are used in the genetic search procedure. GAs differs from the traditional methods of optimization. Population of points is used for starting the procedure instead of a single design point in genetic algorithms. If the number of design variables is n, then the size of the population is taken as 2n to 4n. Since several points are used as candidate solutions, Genetic algorithms are less likely to get trapped in a local optimum.

3.4 Evolutionary algorithm

Evolutionary algorithms are population based met heuristic optimization algorithms that use biology inspired mechanisms like mutation, crossover, natural selection, and survival of the fittest in order to refine a set of solution candidates iteratively. Advantage of evolutionary algorithms compared to other optimization methods is their black box character that makes only a few assumptions for fundamental objective functions. Furthermore, the definition of objective functions usually requires lesser insight to the structure of the problem space than the manual construction. In many different problem categories, EAs perform consistently well. The individuals of a species posse great fertility and produce more offspring than can grow into adulthood with EA.

4. Implementation

The economic load dispatch (ELD) problem was solved using the differential evolution algorithm. The simulation was performed on the Np generators test system described as per equation no 1. The parameters used for the different system are decided as per their technical specification and their limits. And on the base of this we get the output for the Economic load dispatch problem. We arrange Mat lab programming for the calculation of the above system and try to evaluate whole system. Now we develop Flowchart and Algorithms for the programming of our system and calculation. From this flowchart and Algorithms we develop Matlab base programming. Now compare our programming with classical method of solution as discussed in the former chapter now we take one simple case for the comparison of system. Here we take Evolutionary method for the solution of Economic load dispatch problem.

Table:-1 Generator Data

No. of Generator	Generator rating in Mw.	Maximum Value in Mw.	Minimum Value in Mw.
1	210	240	90
2	210	238	85
3	120	100	20

Generator coefficient for the each three plants are as per given in table

Table:-2 Generator coefficient

Sr.No.	ai	bi	ci
1	0.00524	8.664	328.12
2	0.00608	10.05	136.92
3	0.00592	9.75	59.15

Loss coefficient of plant is as per given in table

Table:-3 Loss coefficient

Sr.No.	di	fi	gi
1	0.000134	0.0000176	0.000183
2	0.0000176	0.000153	0.000282
3	0.000183	0.000282	0.00162

4. Result

Calculate coal requirement for the 300MW generation with given constraint by modified evolutionary technique of 10 iteration. Result for the evolutionary technique with 10 number of iteration is given below.

Table:-4 Coal requirement for 300MW load

Sr. No.	Method	Coal require (Kg/hr.)
1	Evolutionary	160297
2	Genetic	172522
3	Wait age	169748
4	Classical	174552

In table 8.4 column 1 indicate coal requirement for the 300MW generation with different optimization technique. Evolutionary method requires less coal for the same generation compare to other method.

Table:-5 Coal requirement for 350MW load

Sr. No.	Method	Coal require (Kg/hr.)
1	Evolutionary	181324
2	Genetic	189657
3	Wait age	187698
4	Classical	190148

In table 5 column 1 indicate coal requirement for the 350MW generation with different optimization technique. Evolutionary method requires less coal for the same generation compare to other method.

Table:-6 Coal requirement for 400MW load

Sr. No.	Method	Coal require (Kg/hr.)
1	Evolutionary	205809
2	Genetic	221845
3	Wait age	219482
4	Classical	220159

In table 6 column 1 indicate coal requirement for the 400MW generation with different optimization technique. Evolutionary method requires less coal for the same generation compare to other method.

Table:-7 Coal requirement for 450MW load

Sr. No.	Method	Coal require (Kg/hr.)
1	Evolutionary	228694
2	Genetic	231823
3	Wait age	236459
4	Classical	238271

In table 7 column 1 indicate coal requirement for the 450MW generation with different optimization technique. Evolutionary method requires less coal for the same generation compare to other method.

Figure shows the graph for the change in coal requirement for different unit allotment

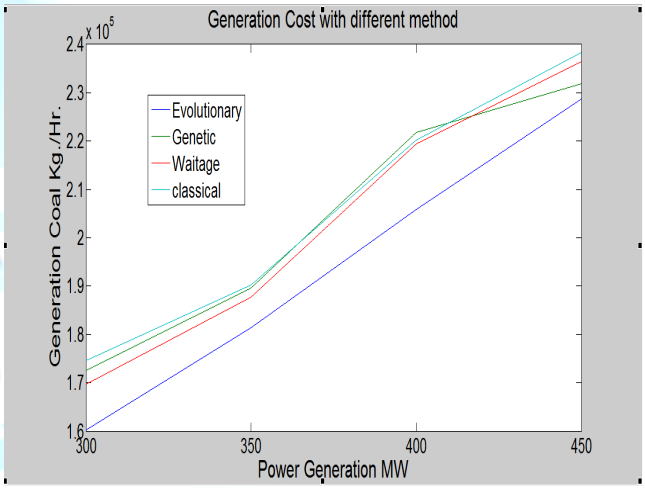

Fig. 1 Coal Requirement

5. CONCLUSION: -

Total generation coal requirement for the given load is reduce with increase in the iteration of program. Operating requirement is reducing in Evolutionary technique compare to other. Simulation results demonstrate the ability of the Evolutionary based technique to solve efficiently the economic load dispatch problem. At any load coal require for the generation is less with evolutionary approach. The approach was tested on the 3generators system.

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