# A COMPARATIVE STUDY OF ECONOMIC LOAD DISPATCH BY USING CONVENTIONAL & NON-CONVENTIONAL METHOD.

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***Abstract*— Economic load dispatch is the one of the optimization problem in power system. In an interconnected system, it is necessary to minimise the expenses. The objective of the economic dispatch problem(EDPs) of electric power generation is to schedule the committed generating units outputs so as to meet the required load demand at minimum operating cost while satisfying all the units and system equality & inequality constraints. In this paper we followed both the methods i.e. conventional & non-conventional method. Conventional methods are not applicable for different types of constraints .These methods are applicable only for some specified constraints such as equality & inequality constraints. When different types of constraints such as valve point effect. Rate limits are considered then the problem of ELD becomes nonsmooth. This paper presents a solution of ELD problem by using lambda – iteration method in conventional methods and genetic algorithm in non-conventional method by considering different types of cases i.e. 3 bus system & 6 bus system.**

***Keywords*— Economic load dispatch, lambda iteration method, genetic algorithm, mutation, crossover.**

## I. INTRODUCTION

Engineers always concern the cost of products of services. In a power system, minimising the operation cost is very important. ELD is the operation of generation facilities to produce energy at lowest cost to reliably solve consumers, recognising any operational limits of generation & transmission facilities. The input-output characteristics of modern generators are non-linear by nature because of valve point loadings and rate limits. The problem of ELD is multimodel discontinuous and highly non-linear. Global search techniques had been employed to solve the ELD problem. These techniques include evolutionary programming. Tabu search, and genetic algorithm.

Genetic algorithm(GA) is one of the global search technique which is based on the mechanics of natural selection & natural genetics. GA's have been developed by John Holland in 1960s. Some fundamental ideas have been borrowed from genetics and are artificially used to construct more robust algorithms requiring minimal problem information. unlike classical search & optimization methods GA starts its search with a random set of solutions, instead of single solution. In this paper a comparative result of lambda iteration method and genetic algorithm for economic load dispatch is proposed.

## II. ECONOMIC LOAD DISPATCH

The objective function & subjected constraints can be define as:

### *A. The problem formulation: objective function*

The objective of economic load dispatch for power system consisting of thermal generating units is to find the optimal combination of power generations that minimises the total generation cost while satisfying the specified equality & inequality constraints. The fuel cost function of generator is represented as a quadratic function of generator active powers.

Objective function=

$$Min \sum_{i=1}^{n} \quad Ci(Pgi)$$

Where the Ci(Pgi) is the operation fuel cost of generator i and n denotes the number of generators.

## III. CONSTRAINTS

The problem is subjected to to power balance constraints and generating capacity constraints as follows

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### *A. Power balance constraints-Equality constraints.*

$$Pd = \sum_{i=1}^{ng} P(gi) + Ploss$$

.

### *B. Inequality constraints-*

$$Pimin \leq Pi \leq Pimax$$

Where Pd is the load demand . Pgi is output power of ith generator , Ploss is the transmission loss. Pgmin and Pgmax are the maximum & minimum output powers of the ith generator respectively.

The operation fuel cost function with valve point loadings of generators is given by,

$$Ci(Pi) = ai(Pgi)^2 + bi(pgi) + ci + |\, ei * \sin\,(fi * (Pgimin - Pgi))\,|$$

## III. APPLIED METHODS

A. *Lambda-iteration method:* it gives the solution for all thermal, dispatching problem neglecting losses. Here we can approach the solution to the problem by considering graphical technique for solving the problem & then into the area of computer algorithms.
The lambda-iteration method procedure converges rapidly for a particular type of optimization problem. The actual computational procedure is slightly more complex since it is necessary to observe the operational limits on each of the nits during the course of the computation.

*Algorithm of lambda-iteration method:*
i) Initialize pg's and lambda.
ii) Calculate pg(i)by using exact coordination equation.
iii)Check the condition,

$$Pgi(k+1) - Pgi(k) \leq \varepsilon$$

iv) Check equality constraints.

$$h = \sum_{i=1}^{ng} Pgi - Pd - Pl$$

v) if h≤ε then

solution is obtained.

vi ) if h≥ε then,

lambda=lambda(old)+del lambda.

*B). Genetic algorithm.*GA offer a new and powerful approach to the optimization problems made possible by the increasing availability of high performance computers at relatively low costs. These algorithms have recently found extensive applications in solving global optimization searching problems when the closed form optimization techniques can not be applied. GA are parallel and global search toward the global solution because, it simultaneously, evaluates many points in the parameter space. It does not need to assume that the search space is differentiable or continuous.
*1. Procedure of genetic algorithm:*

i) Generate randomly a population of binary string
ii) Calculate the fitness for each string in the population.
iii) Create offspring through reproduction, crossover and mutation operation..
iv) Evaluate the new string and calculate the fitness for each generation.
v) If the search goal is .achieved, or an allowable generation is attained, return the best chromosome as the solution; otherwise go to step.

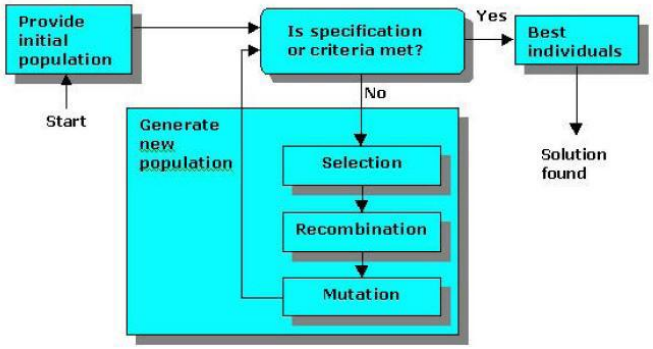


Figure1.schematic outline of GA

## IV. RESULT & ANALYSIS

In this section GA goes through the ELD problem and the result will be compared with lambda-iteration method. The proposed method was applied to IEEE 3 and 6 bus systems.

Case study1: For solving the ELD problem of a IEEE 3 bus system. The cost coefficient datas and generators operating limits are shown in table 1.

The fuel cost curves for the system and the solution of economic dispatch of the IEEE 3 bus systems are given in figure2 and table 2

TABLE I

| | Gen1 | Gen2 | Gen3 |
|---|---|---|---|
| P(max) | 600 | 300 | 650 |
| P(min) | 100 | 60 | 300 |
| a | 400 | 600 | 650 |
| b | 8.4 | 8.93 | 6.78 |

| | | | |
|---|---|---|---|
| c | .006 | .0042 | .004 |

| load | Gen1(mw) | Gen2(mw) | Gen3(mw) | Incremental fuel cost | Total cost |
|---|---|---|---|---|---|
| 550 | 104.5152 | 86.2121 | 359.2727 | 9.65 | 6346.70 |
| 820 | 173.2424 | 184.3939 | 462.3636 | 10.47 | 9064.70 |
| 1500 | 550 | 300 | 650 | 15 | 17239 |

Table2 : solution from lambda iteration method

| load | Gen1(mw) | Gen2(mw) | Gen3(mw) | Total cost |
|---|---|---|---|---|
| 550 | 190.57 | 60.62 | 300.77 | 6299.0 |
| 820 | 211.30 | 88.82 | 519.88 | 9000.60 |
| 1500 | 560 | 290 | 650 | 17178 |

Table3:solution from genetic algorithm method.

DISSCUSSION: In this work, the formulation and implementation of solution methods to obtain the optimum solution of economic load dispatch problem using lambda iteration and genetic algorithm is carried out. The result of lambda iteration method and genetic algorithm for three bus system are given in table 2 and table 3 respectively. GA can be used to many of the same kinds of problems as lambda iteration. This optimization technique does not suffer, however, from some of lambda iteration difficulties.

Case study2: For the solution of Economic dispatch of IEEE 6bus system, the cost function data and generator operating limits are given in table 4. Then the economic dispatch with secure constraints was performed. The result obtained is given in figure2 and table 5.

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| | Gen1 | Gen2 | Gen | Gen4 | Gen5 | Gen6 |
|---|---|---|---|---|---|---|
| P(max) | 100 | 50 | 80 | 50 | 50 | 50 |
| P(min) | 500 | 200 | 300 | 150 | 220 | 120 |
| a | 240 | 200 | 220 | 200 | 220 | 190 |
| b | 7 | 10 | 8.5 | 11.0 | 10.5 | 12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| c | .0070 | .0095 | .0090 | .0090 | .0080 | .0075 |

Table4: values of 6 bus system

RESULT FOR 6 BUS SYSTEM.

| S.no. | load | Gen1 | Gen2 | Gen3 |
|---|---|---|---|---|
| 1. | 700 | 105.36 | 122.24 | 119.42 |
| 2. | 900 | 146.96 | 184.55 | 159.90 |
| 3. | 1100 | 210.583 | 200 | 233.51 |

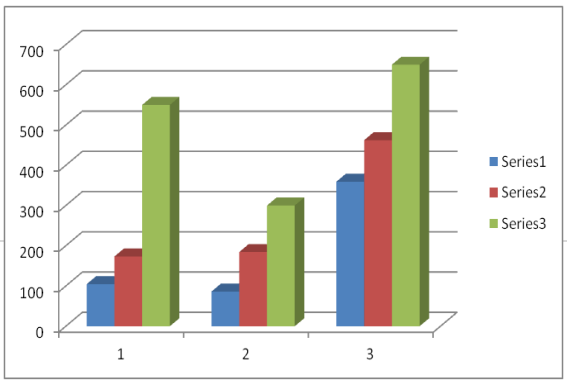
Table5: solution for genetic algorithm for 6 bus system.

| Gen4 | Gen5 | Gen6 | losses | Total cost |
|---|---|---|---|---|
| 127.26 | 119.83 | 120 | 14.1326 | 8330.7 |
| 150 | 161.49 | 120 | 22.9150 | 13833.9 |
| 150 | 220 | 120 | 34.1005 | 22330 |

Table6: solution from genetic algorithm for 6 bus system

DISSCUSSION: For the solution of Economic dispatch of 6 bus system , the generator operating limits and cost function data are given in table 4. The solution for this Economic dispatch is given in table 5 and 6. This table shows the total losses for generation and transmission and total generation cost for six buses. We can seen that the generation for different generators are with in the limits as given in table 4.

Figure2: Generation levels for lambda-iteration method



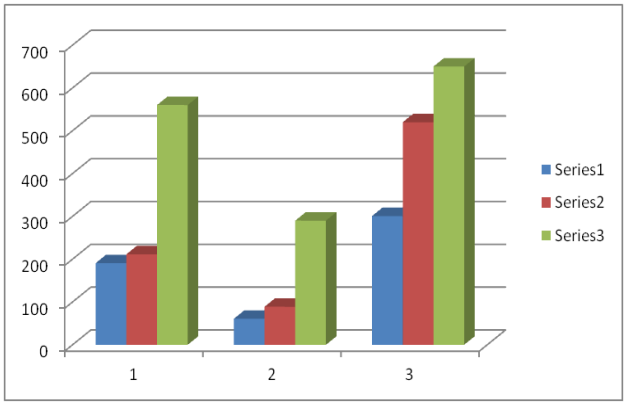



Figure3:

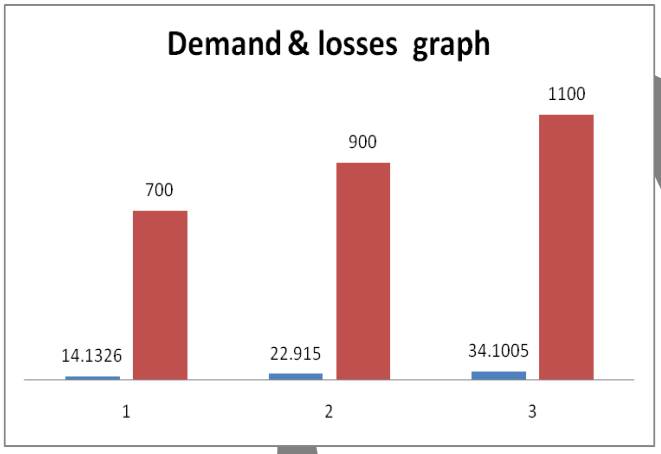



Figure4:

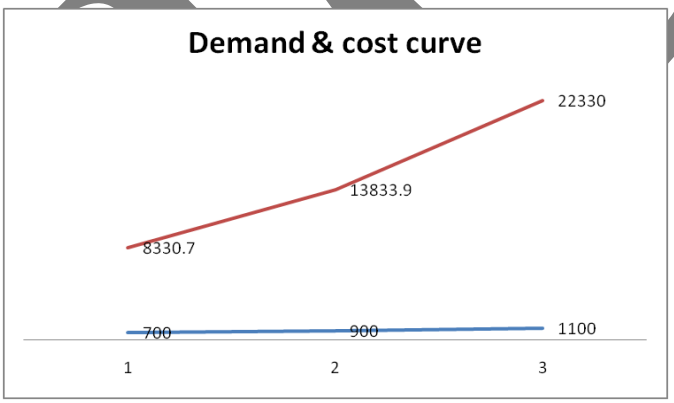



Figure5:

The figure2 shows the generation levels of three bus System for lambda iteration method. The blue area Shows the generation for generator1 to generator 3 For the demand of 550mw and red area shows the ge -neration of power for generator 1 to generator 3 for The demand of 820mw & green area shows the gene -ration f three bus system for the demand of 1500mw. The figure3 shows the generation level of three Generators for genetic algorithm.

The figure 4 shows losses and demand graph for 6 bus System & figure5 shows the demand and cost curve.

## V.CONCLUSION

The validity of the proposed method is illustrated on a sample system comprising 3 therrnal generating units. The operating cost of thermal generating units are de -picted in table 3. The B- coefficients for the calculate- ion of transmission losses are given matlab code is de -veloped to perform entire calculations and to generate the table. Here it is demonstrated that the entire calcul -ations for the first time interval with 550mw power d -mand. The non inferior solutions are obtained for the various load conditions and corresponding generation schedules are obtained. A program has been develope -d in matlab platform based upon the proposed algorit -hm. The novelty of this work is that the transmission losses has also been taken into consideration in econo -mic load dispatchmatlab platform based upon the pro -posed algorithm. The novelty of this work is that the transmission losseshas also been taken into considera -tion in economic load dispatch program. This is beca -use we have observe thetransmission loss depends up on the power profile of different buses which directly depends upon the powergeneration of different genera -tors. The results has beenobserve to be different for different expressions offitness functions, different m -ethodologies of parentselection, mutation process an -d crossover limit etc. Here effort has been made to get a better rythm amongest the above terms or functions.

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