Multi objective Economic and Emission Dispatch in Multi Machine System Using Modified Particle Swarm Optimization

Rakesh Kumar and Shuchi Shukla
"M.Tech (Scholar) Department of Power System Engineering ,Regional College of Education Research And Technology,Sitapura Jaipur ,Rajasthan Technical University ,Kota,INDIA
"Assistant Professor ,Department of Electrical Engineering Regional College of Education Research And Technology,Sitapura Jaipur ,Rajasthan Technical University ,Kota,INDIA

Abstract: **-The ELD is a tool that can dispatch the gen set output to operate the power system most economically according to specified load requirements. In other words, we can say that the main goal of economic load scheduling is to optimize all system constraints. At the same time, various generator sets are distributed at the lowest possible operating cost. The input/output characteristics of modern units are inherently highly non-linear (with valve point effects, rate limiting, etc.) and have multiple local minimum points in the cost function. In this regard, random search algorithms such as (GA), (ES), (EP), (PSO) can prove that (SA) is very effective in solving highly nonlinear ELD problems, and the shape is not limited. Cost curve. (GA) is a soft computing technique used to find exact or approximate solutions to optimization and search problems. Genetic algorithms are classified as global search heuristics. An algorithm to get the best solution to the optimization problem. The individual's performance is evaluated by the fitness function (ie, the objective function) and the problem is minimized, in which case particles with lower values have higher performance. The best experience for each particle in the iteration is stored in its memory, called Personal Best (Pbest). The best value of Pbest (minimum) in the iteration determines the global best value (Gbest).**

Keywords- Economic Load Dispatch (ELD),Genetic algorithms (GA), Evolutionary strategies (ES), Evolutionary programming (EP), Particle swarm optimization (PSO)

1. INTRODUCTION

We can define the economic load programming (ELD) as the process of assigning load levels to the generator sets so that the loads of the system are delivered completely and economically. In interconnected energy systems, costs must be minimized. The production level of each generator set is defined by the economic load distribution, so the total cost of generating and transmitting electricity is the least likely for a given load plan. The purpose of economic charge programming is to minimize the total cost of generating electricity. The situation is complicated when utility companies attempt to address the losses in transmission lines and the seasonal fluctuations associated with hydroelectric plants. There are a number of conventional techniques that can be used to address problems of economic load distribution, such as Lambda, Newton-Raphson iterations and Lagrangian multipliers. The entire interconnection network is controlled by the freight forwarding center. MW power generation for each network is assigned by the freight dispatch center, depending on the primary MW demand for that area. The work of the load control center is to maintain the exchange of energy between different regions and frequencies of the system in the required values. There are many alternatives to generating schedules. In interconnected energy systems, the main objective is to find the actual and reactive energy plans for each individual power plant in a way that minimizes operating costs. This is known as the problem of "economic charge programming" (ELD). The objective function is also called the cost function. These objective functions can bring economic costs, system security or other objectives. The loss factor is called the factor B. The main objective of the problem of programming the economic burden is to minimize the total cost of generating real energy.[2][4]

The components that make up the operating costs include fuel costs, labor costs, maintenance costs and supplies. The throttling loss is great when the valve has just opened, and the throttle flow is small when it is fully open.

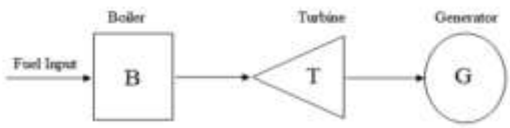


Figure 1.1 Simple Model of Fossil Plant

Figure 1.1 shows a simple model of the purpose of fossil plant programming. The cost is usually approximated by one or more secondary segments. The operating costs of the plant are shown in Figure 3.2. Therefore, the fuel cost curve in the generation of active energy has the form of a quadratic curve, as follows:

$$F(P_{gi}) = a_i P_{gi}^2 + b_i P_{gi} + c_i Rs/hr \quad (3.1)$$

Wherea_i, b_i, c_i is the cost factor of the i-th unitF (P_{gi}) is the total cost of generationP_{gi} is the generation of the i-generation plant.

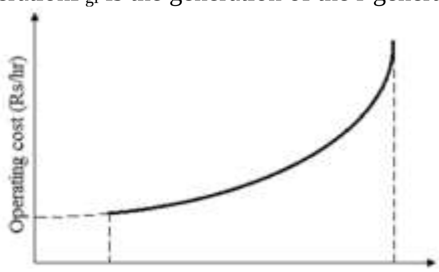


Figure 1.2 Operating Cost of Fossil Fired Plant

The fuel cost curve has many discontinuities, which occur when the output power is extended by the use of additional boilers, steam condensers or other equipment. It is the minimum load limit below which the operating device is not economical (or technically not feasible) and is the maximum output limit due to its classification.[5][8]

II. ECONOMIC LOAD DISPATCH

Assuming that there is an N_G generator in a station and there is an active energy load demand, the actual amount of energy generated by each generator must be allocated to minimize the total cost. Therefore, the optimization problem can be expressed as:

Minimize:

$$F(P_{gi}) = \sum_{i=1}^{NG} F_i(P_{gi}) \quad (2.2a)$$

Subject to the energy balance equation

$$\sum_{i=1}^{NG} P_{gi} = P_D \quad (2.2b)$$

the inequality constraints

$$P_{gi}^{\min} \le P_{gi} \le P_{gi}^{\max} \quad i = 1, 2,,, NG \quad (2.2c)$$

Where, P_{gi} is the decision variable, that is, the actual power generation $P_d$is the real power demand NG is the number of power plants $P_{gi}^{\min}$ Is the lower limit of the actual power generation, $P_{gi}^{\max}$ Is the allowable upper limit of actual power generation, F*i* (P_{gi}) is the operating fuel cost of the i-th plant, given by the quadratic equation

$$F(P_{gi}) = a_i P_{gi}^2 + b_i P_{gi} + c_i Rs/hr \quad (2.2d)$$

The above problem is a restricted optimization problem. Use a Lagrangian multiplier where the function is minimized (or maximized) using this method; The improvement function is defined as

$$L(P_{gi}, \lambda) = F(P_{gi}) + \lambda(P_D - \sum_{i-1}^{NG} P_{gi}) \quad (2.3)$$

Where λ is Lagrange multiplier, The partial derivative of the Lagrangian function defined by L=L (Pgi, λ) must be zero for each parameter.

$$\frac{\partial L(P_{gi}, \lambda)}{\partial P_{gi}} = \frac{\partial F(P_{gi})}{\partial P_{gi}} - \lambda = 0 \quad (i= 1, 2,,,.. NG) \quad (2.4)$$

And

$$\frac{\partial L(P_{gi}, \lambda)}{\partial P_{gi}} = P_D - \sum_{i=1}^{NG} P_{gi} = 0 \quad (2.5)$$

From equation 3.4 we get,

$$\frac{\partial F(P_{gi})}{\partial P_{gi}} = \lambda \quad (i=1, 2,,.. NG) \quad (2.6)$$

Where $\partial F(P_{gi}) / \partial P_{gi}$ is the incremental fuel cost of the *i*th generator.

$$\frac{\partial F(P_{gi})}{\partial P_{gi}} = 2a_i P_{gi} + b_i \quad (2.7)$$

Substituting the increment cost in (2.6) this equations becomes

$$2a_i P_{gi} + b_i = \lambda \quad (2.8)$$

Rearranging equation (2.8) to get P_{gi}

$$P_{gi} = \frac{\lambda - b_i}{2a_i} \quad (2.9)$$

Substituting the value of Pgi in eq. (2.5), we get

$$\sum_{i=1}^{NG} \frac{\lambda - b_i}{2a_i} = P_D$$

or

$$\lambda = \frac{P_D + \sum_{i-1}^{NG} \frac{b_i}{2a_i}}{\sum_{i-1}^{NG} \frac{1}{2a_i}} \quad (2.10)$$

With the economic load scheduling problem with transmission power loss PL, the objective function is therefore expressed as:

Minimize

$$F(P_{gi}) = \sum_{i=1}^{NG} F_i(P_{gi}) \quad (2.11a)$$

$$F_i(P_{gi}) = a_i P_{gi}^2 + b_i P_{gi} + c_i Rs/hr \quad (2.11b)$$

Subject to (i) the energy balance equation

$$\sum_{i=1}^{NG} P_{gi} = P_D + P_L \quad (2.11c)$$

$$P_{gi}^{\min} \le P_{gi} \le P_{gi}^{\max} \quad (i= 1, 2,,....... NG) \quad (2.11d)$$

In general form the loss formula using B-coefficient is

$$P_L = \sum_{i=1}^{NG} \sum_{j=1}^{NG} P_{gi} B_{ij} P_{gi} \quad (2.12)$$

WhereP_{gi} and $P_{gj}$are the real power generation of the i-*th* and j-*th* buses, respectively. B_{ij} is the loss factor or B coefficientAt Eq. (2.12) the transmission loss formula is called the George formula.

$$L(P_{gi}, \lambda) = F(P_{gi}) + \lambda(P_D + P_L - \sum_{i-1}^{NG} P_{gi}) \quad (2.13)$$

Used for minimize enhancements,

$$\frac{\partial L(P_{gi}, \lambda)}{\partial P_{gi}} = 0 \quad (2.14a)$$

$$\frac{\partial L(P_{gi}, \lambda)}{\partial \lambda} = 0 \quad (2.14b)$$

$$\frac{\partial F_i(P_{gi})}{\partial P_{gi}} = \frac{\partial F(P_{gi})}{\partial P_{gi}} \quad (i=1,2,......NG) \quad (2.15)$$

The condition given by (2.14), results as

$$\frac{\partial L(P_{gi}, \lambda)}{\partial P_{gi}} = \frac{\partial F(P_{gi})}{\partial P_{gi}} + \lambda\left(\frac{\partial P_L}{\partial P_{gi}} - 1\right) = 0$$

$$\frac{\partial F(P_{gi})}{\partial P_{gi}} = \lambda\left(1 - \frac{\partial P_L}{\partial P_{gi}}\right) \quad (i=1,2,,,,NG) \quad (2.17)$$

We can say that

$$\frac{\partial F(P_{gi})}{\partial P_{gi}} + \lambda\left(\frac{\partial P_L}{\partial P_{gi}}\right) = \lambda \quad (2.18)$$

Where $\frac{\partial F(P_{gi})}{\partial P_{gi}}$ is increment fuel cost (IC) $\frac{\partial P_L}{\partial P_{gi}}$ is called incremental transmission loss (ITL) i and is associated with the ith generation unit. Rearrange (2.18) results

$$\frac{\frac{\partial F(P_g)}{\partial P_g}}{1-\frac{\partial P_L}{\partial P_{gi}}} = \lambda \quad \text{(i=1,2,,,,NG)} \qquad (2.19)$$

$$\left(\frac{1}{1-\frac{\partial P_L}{\partial P_{gi}}}\right)\frac{\partial F(P_{gi})}{\partial P_{gi}} = \lambda \quad \text{(i=1,2,,,,NG)} \qquad (2.20)$$

$$L_i\left(\frac{\partial F(P_{gi})}{\partial P_{gi}}\right) = \lambda \quad \text{(i=1,2,,,,NG)} \qquad (2.21)$$

L*i* is called the penalty factor for the i-*th* plant.

$$L_i = \frac{1}{1-\frac{\partial P_L}{\partial P_{gi}}} \qquad (2.22)$$

The equation shows that the minimum cost can be obtained when the incremental cost of each plant is multiplied by its penalty factor for all plants. Equation (2.20) is also written in another form

$$(IC) = \lambda[1-ITL]_i \quad \text{(i=1,2,,,,NG)} \qquad (2.23)$$

This equation is called the exact coordination equation. Therefore, it can be clearly seen in the formula (2.23) that to solve the problem of economic burden distribution. The factor B of this method is sufficient to deal with the coordination of losses in the economic dispatch of loads between plants. The general form of the loss formula using factor B is given in (2.22) the formula simplified identification

$B_{ij}=B_{ji}$,

$$\frac{\partial P_L}{\partial P_{gi}} = \sum_{i=1}^{NG} 2B_{ij}P_{gi} \qquad (2.24)$$

$$\frac{dF_i(P_{gi})}{dP_{gi}} = 2a_iP_{gi} + b_i \qquad (2.25)$$

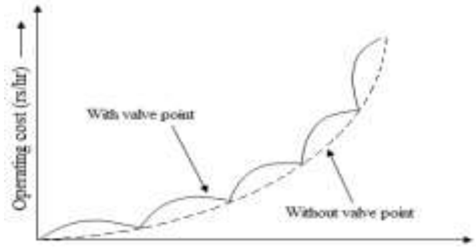
$$2a_iP_{gi} + b_i + \lambda\sum_{i=1}^{NG} 2B_{ij}P_{gi} = \lambda \quad \text{(i=1,2,,,,NG)} \qquad (2.26)$$

$$(2a_i + 2\lambda B_{gi})P_{gi} = -\lambda\sum_{\substack{i=1\\ j\neq i}}^{NG} 2B_{ij}P_{gi} - b_i + \lambda \quad \text{(i=1,2,,,,NG)(2.27)}$$

$$P_{gi} = \frac{1-\frac{b_i}{\lambda} - \sum\sum_{\substack{i=1\\ j\neq i}}^{NG} 2B_{ij}P_{gi}}{\frac{2a_i}{\lambda} + 2B_{ij}} \quad \text{(i=1,2,,,,NG)} \qquad (2.28)$$

$$F(P_i) = \sum_{i=1}^{NG}(a_iP_i^2 + b_iP_i + c_i + d_i * \sin\{e_i * (P_i^{\min} - P_i)\}) \qquad (2.29)$$

For any particular value of λ, the above equation can be solved iteratively assuming the initial value of Pgi. It is considered that ELD is one of the key functions of the functioning of the energy system. However, due to the point loading of the valve in the fossil fuel combustion equipment, the real input-output characteristics show non-linearities and high-order discontinuities. The loading effect of the valve point has been modeled as a repetitive sinusoidal rectifier function, as shown in Figure 2.3.[11]



Power Output *Pi*

Figure 1.3 Operating Cost Characteristics with Valve Point Load

The valve point effect introduces undulation in the heat curve. Mathematically, the problem of programming the economic load considering the load of the valve point is defined as:

Minimize operating costs

$$F(P_i) = \sum_{i=1}^{NG}(a_iP_i^2 + b_iP_i + c_i + d_i * \sin\{e_i * (P_i^{\min} - P_i)\}) \qquad (2.29)$$

Where a*i*, b*i*, c*i*, d*i*, e are the cost coefficients of the first unit.

Subject to: (i) the energy balance equation is given by the equation. (2.11c) and (ii) the inequality constraint is given by the equation. (2.11d)

III. COMBINED ECONOMIC EMISSION DISPATCH

The function of fuel cost is simulated and approximated as a Cubic curve, whose total expression ($ / h) is for a period of time T and many generators N are given by: [11]

$minF_T = \sum_{i=1}^{n} F_i(P_i)$ The economic dispatch problem can be defined mathematically as an objective with two constraints:

$$F_{ci}(P_i) = a_iP_i^3 + b_iP_i^3 + c_iP_i + d_i$$

Subject to the two constraints:

$$\sum_{i=1}^{N} P_i = D + L$$

$$P_{imin} \leq P_i \leq P_{imax}$$

Where Pi: output power (MW) of the i-th generator; FT: Total cost of fuel ($ / h); Fi (Pi): fuel cost per unit i ($ / h); D: Total demand (MW); L: transmission loss (MW); Pimin, high power limit Pimax of unit i (MW); and N: total number of service units. Toxic gases released by the thermal units. The burning of fossil fuel sources such as sulfur dioxide, nitrogen oxides and carbon dioxide can help minimize the world alone. The emissions pass:

$$E_{SO2i}(P_i) = a_{SO2i}P_i^3 + b_{SO2i}P_i^2 + c_{SO2i}P_i + d_{SO2i}$$

$$E_{NOxi}(P_i) = a_{NOxi}P_i^3 + b_{NOxi}P_i^2 + c_{NOxi}P_i + d_{NOxi}$$

$$E_{CO2i}(P_i) = a_{CO2i}P_i^3 + b_{CO2i}P_i^2 + c_{CO2i}P_i + d_{CO2i}$$

In this work, we integrated the price penalty factor hi (maximum fuel cost / maximum emissions per gas) Emission equation $[F_{Ti}(P_i) = F_{ci}(P_i) + h_{SO2i}E_{SO2i}(P_i) + \cdots h_{NOxi}E_{NOxi}(P_i) + h_{CO2i}E_{CO2i}(P_i)$

Where h_{SO2}, h_{NOx} and h_{CO2} are price penalties SO_2, NO_x and CO_2 are mixed with emissions Cost and normal fuel costs.

$$h_{SO2i} = \frac{F_{Ci}(P_{Maxi})}{E_{SO2i}(P_{MAXi})}$$

$$h_{NOxi} = \frac{F_{Ci}(P_{MAXi})}{E_{NOxi}(P_{MAXi})}$$

$h_{CO2i} = \frac{F_{Ci}(P_{MAXi})}{E_{CO2i}(P_{MAXi})}$The integral problem of the programming of economic emissions is a problem Combination of the programming of the economic burden and the problems of dispatching emissions. In this document, the cubic criterion function is to use CEED instead of a quadratic function to represent the CEED problem. It has been found that standard cube functions more effectively resist the non-linearity of the real power system. The problems of economic programming can be defined as:

$F(P) = \sum_{i=1}^{n} a_i P_i^3 + b_i P_i^2 + c_i P_i + d_i$ Where F (Pi) is the cost of power generation of the power output of the generator set ($ / hour) is Pi; ai, bi, ci and di are costs Generate the coefficient i of the unit. Emission programming problems can also be defined as cubes. Standard functions with four transmission coefficients such as:

$$E(P) = \sum_{i=1}^{n} e_i P_i^3 + f_i P_i^2 + g_i P_i + h_i$$

Where E (Pi) is the emission (in kilograms per hour) and Pi is the power generated by unit i, and ei, fi, gi and hi are the transmission coefficients. Minimize the goal of generating electricity costs. Pollutant emissions can be converted into a single use. Use the objective of the price penalty factor. It was considered that the maximum / maximum penalty factors in this study address CEED problems. The CEED problem with the maximum / maximum penalty factor can be described as

$OF = F_T = \sum_{i=1}^{n} F(P_i) + \sum_{i=1}^{n} h_{iMAX/MIN} E(P_i)$

Where OF represents the objective function (CEED) and FT refers to Total cost and $h_{imax/min}$ are maximum/maximum penalty factors Generator set can define maximum/maximum penalty factor Such as

$$h_{imax/min} = \sum_{i=1}^{n} F(P_{imax}) / \sum_{i=1}^{n} E(P_{imax})$$

Where $P_{i,\ max}$ refers to the maximum power (in MW) can be generated by the generating unit i. The goal of this paper is to minimize power generation costs.The emission of polluting gases, that is, the total cost Comply with all other restrictions. In the power generation system, there must be many equal and unequal restrictions considered to optimize the real situation system. The power balance and the generator limit restrictions, the two most important restrictions are considered here in the works. The total output power (megawatts) must be met. Total load demand (in megawatts) Therefore, the total output power must be equal to the sum of the total load demand and the total load power loss (MW). It can be defined as[12]

$$P = \sum_{i-1}^{n} P_i = P_D + P_L$$

Where $P_{i,}$ P_D and P_L are total generated power, total load demand and total loss, respectively.Each power generation unit in the power generation system has its upper and lower limits. Generate unit output Must be within this limit to work properly. This one Constraint can be defined as[14]

$$P_{imin} \leq P_i \leq P_{imax}$$

Where P_{imin} and P_{imax} denote the minimum and maximum limits, respectively, of generating unit i.

IV. QUANTOM PSO BASED COMBINED DISPATCH

PSO provides a search program based on population, in which individuals are called partial changes, their position in time. In the PSO system, the particles fly in a multidimensional search space. Each particle adjusts its position according to it during the flight. Own experience and experience Adjacent particles, using the best position It is found by itself and its neighbors. Optimum in the multidimensional space that seeks a solution to move each particle of the group. Get the best point by adding the speed position. The velocity of the particle is affected by three components, namely inertia, cognitive and society. The inertial component simulates the inertial behavior of birds that fly in the previous direction. The cognitive components mimic the memory of the birds on their best location and the social component simulates the birds' memory, the best location in some of the trees. Movement of particles around the multidimensional search space until they find the best solution. The speed of modification of each one can use the current speed and the calculation agent. The distance to Pbest and Gbest is as follows.[15]

$$V_i^{k+1} = W \times V_i^k + C_1 \times r_1 \times (Pbest_i^k - X_i^k) + C_2 \times r_2 \times (Gbest^k - X_i^k)$$

Where, V_i^kThe speed of individual i when iterating k, X_i^k Individual i is in the position of iteration k, W inertial weight C1 , C2 acceleration factor, $Pbest_i^k$The best position of individual i in iteration k, $Gbest^k$ Group's best position until iteration k r1 , r2 Random number between 0 and 1. Accelerate during this speed update the coefficients C1, C2 and the inertia weight W are Predefined and r1, r2 are randomly generated uniformly The number is in the range [0, 1]. In general, inertia the weight W is set according to the following equation:

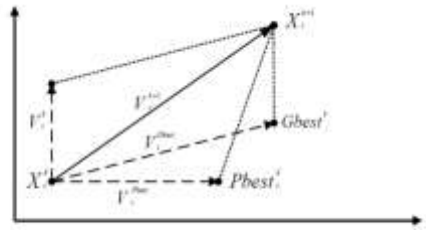


Fig 1.4 Search mechanism of PSO

The modified velocity equation (6) is given by:

$$V_i^{K+1} = K.\left(W.V_i^k + C_1 G_d()(Pbest_i^k - X_i^k) + C_2 C_d()(Gbest^k - X_i^k)\right)$$

$$K = \frac{2}{\left|2 - \varphi - \sqrt{\varphi^2 - 4\varphi}\right|}$$

Where $\varphi = C_1 + C_2, \varphi > 4$

The convergence characteristic of the system can be controlled by. The contraction factor (CFA) be method must be greater than 4.0 to guarantee stability. But as the φ Increase of the K factor is reduced, diversification is reduced, it produces a slower reaction. Usually, when contraction factors are used, φ is set to 4.1 (ie, C1, C2 = Therefore, the constant multiplier K is 0.729.QPSO, proposed and developed by Sun et al., Is the expansion of the PSO in the field of quantum computing The concept of qubits and revolving doors are here to present the improvement of demographic characteristics Diversity Qubit and angle Represents the state of the particle instead of the position and velocity of the particle completed in the Basic PSO Therefore, QPSO has powerful search capabilities and powerful search capabilities.Convergencefeature.The basic difference between a qubit bit and a classical bit is that the latter can remain at the same time Superposition of two different quantum states,

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$

In the above equation, $\alpha$and $\beta$are complex numbers that satisfy the equation

$$|\alpha|^2 + |\beta|^2 = 1$$

The rotation state is represented by | 0> and the rotation state is It is represented by | 1>. As can be seen from (1), a qubit is Represents two information states (| 0> and | 1>) simultaneously. This superposition state can also expressed as

$$|\psi\rangle = \sin\theta|0\rangle + \cos\theta\,|1\rangle$$

Where the phase of the qubit is represented by θ. the relation among α,β and θ. The relation among α,β and θ can be defined as the position of the particle in QPSO.[13]

IV. RESULTS

The research work carried out in this thesis is associated with the minimization of the cost of fuel and the release of emissions, while maintaining the restrictions of the network taking into account and without considering the effect of the point of the valve.

The problems addressed in this research work are the following:

• Formulation of economic load dispatch for different test systems.

• Implementation of the problem of economic load dispatch considering the effect of the valve point for different test systems.

• Implementation of the economic freight dispatch problem using the swarm optimization of modified particles for the valve point effect for different test systems.

• Implementation of combined emission and economic load dispatch using the improved cost function and optimization of swarm of quantum particles.

This system consists of 13 generating units and the input data of the system of 13 generators are given in the Table. To validate the proposed Modifed-PSO method, it is tested with a 13-unit system that has non-convex solution spaces. The 13-unit system consists of thirteen generators with load effects at the point of the valve and have a total load demand of 1800 MW and 2520 MW, respectively.

This system consists of 40 generating units and the system input data of 40 generators are given in the Table. To validate the proposed modified PSO method, it is tested with a 13-unit system that has non-convex solution spaces. The 40-unit system consists of thirteen generators with valve point loading effects and have a total load demand of 10500 MW and 20500 MW, respectively.

Table 1
Result for 13 Generator System Valve Point Effect

Unitpoweroutput	**NN-EPSO[20]**	**MPSO**
P 1	490.0000	269.263671702
P 2	189.0000	150.750185936
P 3	214.0000	224.858126186
P 4	160.0000	112.081379788
P 5	90.0000	157.271376553
P 6	120.0000	158.473867494
P 7	103.0000	106.176428015
P 8	88.0000	158.919165718
P 9	104.0000	159.451200806
P 10	13.0000	77.5031323538
P 11	58.0000	101.999849738
P 12	66.0000	92.4841327770
P 13	55.0000	92.7117782526
Total Power Output (MW)	1800	1800

Total Generation Cost ($/h)	18442.5931	**18100.145**

Table 2
Result for 40 Generator System Considering Valve Point Effect

Unitpoweroutput	**PSO[21]**	**MPSO**
P1(MW)	113.116	113.9971
P2(MW)	113.010	112.6517
P3(MW)	119.702	119.4255
P4(MW)	81.647	189.0000
P5(MW)	95.062	96.8711
P6(MW)	139.209	139.2798
P7(MW)	299.127	223.5924
P8(MW)	287.491	284.5803
P9(MW)	292.316	216.4333
P10(MW)	279.273	239.3357
P11(MW)	169.766	314.8734
P12(MW)	94.344	305.0565
P13(MW)	214.871	365.5429
P14(MW)	304.790	493.3729
P15(MW)	304.563	280.4326
P16(MW)	304.302	432.0717
P17(MW)	489.173	435.2428
P18(MW)	491.336	417.6958
P19(MW)	510.880	532.1877
P20(MW)	511.474	409.2053
P21(MW)	524.814	534.0629
P22(MW)	524.775	457.0962
P23(MW)	525.563	441.3634
P24(MW)	522.712	397.3617
P25(MW)	503.211	446.4181
P26(MW)	524.199	442.1164
P27(MW)	10.082	74.8622
P28(MW)	10.663	27.5430
P29(MW)	10.418	76.8314
P30(MW)	94.244	97.0000
P31(MW)	189.377	118.3775
P32(MW)	189.796	188.7517
P33(MW)	189.813	190.0000
P34(MW)	199.797	120.7029
P35(MW)	199.284	170.2403
P36(MW)	198.165	198.9897
P37(MW)	109.291	110.0000
P38(MW)	109.087	109.3405
P39(MW)	109.909	109.9243
P40(MW)	512.348	468.1694

Total generation cost ($/h)	122,323.97	**122,001.20**

Table 3
Result for 40 Generator System Considering Valve Point Effect

Power	Lagrange	SA	PSO	QPSO	MPSO
P1	50.65	50	50	50.00	50.00
P2	21.20	20.00	20	20.00	20.04
P3	15.46	15.00	15	15.00	15.057
P4	22.6846	20.61	22.11	22.9	22.208
P5	21.3002	22.49	20.6	20.04	22.63
P6	21.1181	21.89	22.31	22.03	20.06
Fuel Cost ($/h)	2734.21	2702.78	2701.796	2701.476	2058.5
Emission	2642.702	2607.46	2593.1844	2583.6485	2440.4

V. CONCLUSION

This research focuses on the calculation and stimulation of the economic load dispatch problem in different operating conditions. It also provided the solution that involved the effect of the valve point and the losses for different test systems. Therefore, three objectives were built. First, he built the mathematical model of economic dispatch and load emission with functions of cubic cost under effect of valve point and effect of non-valve point with and without losses. The second is to solve the numerical results of the economic load dispatch with the optimization of swarm of modified quantum particles. The third is the comparative analysis of the simulated results with the existing soft computing problems.

This research mainly studied the improved quantum PSO method. It is used to provide the solution that involves numerical analysis. The modified PSO method requires fewer iterations to achieve convergence, and is more accurate and not sensitive to factors.

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