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Economic Load Dispatch Falicitating Moderate Random Search Pso

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Abstract: This work proposes a new particle swarm optimization based on moderate random search. Economic load dispatch is the process of allocating generation among the committed units such that the constraints imposed are satisfied and the fuel cost is minimized Particle swarm optimization is a population based optimization technique that can be applied to a wide range of engineering problems. Particle swarm optimization with a moderate random search strategy called MRSPSO, enhances the ability of particles to explore the solution spaces more effectively and increases their convergence rates. The effectiveness and robustness of the proposed algorithm is demonstrated through six generator and forty systems with valve point loading effect and ramp rate limit constraints. The outcomes obtained by the considered technique are compared with other heuristic algorithms. The results show that MRSPSO technique is capable of producing better results.
Index Terms: Economic load dispatch, ramp rate limits, moderate random search particle (MRSPSO), particle swarm optimization (PSO), valve-point effect.

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I. INTRODUCTION

Electric utility systems are interconnected in such a way to achieve the benefits of minimum production cost, maximum reliability and better operating conditions. The economic scheduling is the on-line economic load dispatch, wherein it is required to distribute the load among the generating units which are actually paralleled with the system, in such a way as to minimize the total operating cost of generating units while satisfying system equality and inequality constraints. For any specified load condition, ELD determines the power output of each plant (and each generating unit within the plant) which will minimize the overall cost of fuel needed to serve the system load [1]. ELD is used in real-time energy management power system control by most programs to allocate the total generation among the available units.

Conventional classical as well as modern evolutionary techniques have been used for the solution of economic load dispatch problem employing different objective functions. Various conventional methods like lambda iteration method, gradient-based method, Bundle method [2], nonlinear programming [3], mixed integer linear programming [4], interior point method [5], linear programming methods [6], dynamic programming [7], Lagrangian relaxation and sequential quadratic programming [8], unit commitment [9], Lagrange relaxation method [10], Newton-based techniques [11], Improving an interior point based OPF [12-13], and reported in the literature are used to solve such problems. Conventional methods have many draw back such as nonlinear programming has algorithmic complexity. Linear programming methods are fast and reliable but require linearization of objective function as well as constraints with non-negative variables. Quadratic programming is a special form of nonlinear programming which has some disadvantages associated with piecewise quadratic cost approximation. Newton-based method has a drawback of the convergence characteristics that are sensitive to initial conditions. The interior point method is computationally efficient but suffers from bad initial termination and optimality criteria. Recently, different modern heuristic approaches have been proved to be effective with promising performance, such as evolutionary programming (EP) [14-15], simulated annealing (SA) [16], Tabu search (TS) [17], pattern search (PS) [18], Genetic algorithm (GA) [19-20], Differential evolution (DE) [21], Optimal power flow[22], Neural network [23] and particle swarm optimization (PSO) [24-32]The heuristic methods do not always guarantee discovering globally optimal solutions in finite time, but they provide a fast and reasonable solution. EP is rather slow converging to a near optimum for some problems. SA is very time consuming, and cannot be utilized easily to tune the control parameters of the annealing schedule. TS is difficult in defining effective memory structures and strategies which are problem dependent. GA sometimes lacks a strong capacity of producing better offspring and causes slow convergence near global optimum, sometimes may be trapped into local optimum. DE greedy updating principle and intrinsic differential property usually lead the computing process to be trapped at local optima. Particle-swarm-optimization method is a population-based evolutionary technique first introduced [26], and it is inspired by the emergent motion of a flock of birds searching for food. In comparison with other EAs such as GAs and evolutionary programming, the PSO has comparable or even superior search performance with faster and more stable convergence rates. Now, the PSO has been extended to power systems, artificial neural network training, fuzzy system control, image processing and so on.

The main objective of this study is to use of PSO with moderate random search technique to solve the economic load dispatch problem with valve point loading effect and generator ramp rate limits to enhance its global search ability. The proposed algorithm has the ability to explore the solution space than in a standard PSO. The proposed method focuses on solving the economic load dispatch with valve point loading effect and generator ramp rate limits constraint. The feasibility of the proposed method demonstrated for the test data of six generator system. The results obtained through the proposed approach and compared with other PSO techniques reported in recent literatures. .

II. PROBLEM FORMULATION

A. Basic Economic Dispatch Formulation

Economic load dispatch is one of the most important problems to be solved in the operation and planning of a power system the primary concern of an ELD problem is the minimization of its objective function. The total cost generated that meets the demand and satisfies all other constraints associated is selected as the objective function. The ED problem objective function is formulated mathematically as:

$$F_t = \left(\sum_{i=1}^{n} F_i(P_i) \right) = \left(\sum_{i=1}^{n} a_i P_i^2 + b_i P_i + c_i \right) \quad (1)$$

Due to presence of valve point loading effect, nonlinearity and discontinuity of the ELD is increases, so the equation (1) can be written as :

$$F_t = \sum_{i=1}^{n} a_i P_i^2 + b_i P_i + c_i + \left| e_i * \sin\left(f_i * (P_i^{\min} - P_i \right) \right| \quad (2)$$

Where, F_t is the objective function, a_i, b_i and c_i are the cost coefficients and e_i & f_i are the valve point loading effect coefficients of the i[th] generator.

B. CONSTRAINTS

This model is subjected to the following constraints,

1) Real Power Balance Equation

For power balance, an equality constraint should be satisfied. The total generated power should be equal to total load demand plus the total losses,

$$\sum_{i=1}^{n} P_i - P_D - P_L = 0 \quad (3)$$

$$P_L = \sum_{i=1}^{n} \sum_{j=1}^{n} P_i B_{ij} P_j + \sum_{i=1}^{n} B_{0i} P_i + B_{00} \quad (4)$$

Where, P_D is the total system demand and P_L is the total line loss. B_{ij} =loss coefficient symmetric matrix B, B_{i0} =i[th] element of the loss coefficient vector and B_{00} =loss coefficient constant.

2). Unit Operating Limits

There is a limit on the amount of power which a unit can deliver. The power output of any unit should not exceed its rating nor should it be below that necessary for stable operation. Generation output of each unit should lie between maximum and minimum limits.

$P_{imin} \leq P_i \leq P_{imax}$ (5)

Where, P_i is the output power of i[th] generator, $P_{i,min}$ and $P_{i,max}$ are the minimum and maximum power outputs of generator i[th] respectively.

3). Ramp Rate Limit According to the operating increases and operating decreases of the generators are ramp rate limit constraints described in eq. (6) & (7).

1) As generation increases

$Pi\ (t) + Pi\ (t-1) \leq URi$ (6)

2) As generation decreases

$Pi\ (\mathrm{t}-1) - (t) \geq DRi$ (7)

When the generator ramp rate limits are considered, the operating limits for each unit, output is limited by time dependent ramp up/down rate at each hour as given below.

$Pimin\ (t) = \max(Pimin\ , Pi\ (t-1) - DRi)$ (8)

$Pimax\ (t) = \min(Pimax\ , Pi(t-1) - URi)$ (9)

$Pimin\ (t) \leq (t) \leq Pimax\ (t)$ (10)

Where, P_{it} is current output power of i^{th} generating unit, $Pi\ (t-1)$ is previous operating point of the ith generator, DRi is the down ramp rate limit (MW/time period) and URi is up ramp rate limit (MW/time period).

III. OVERVIEW OF SOME PSO STRATEGIES

A number of different PSO strategies are being applied by researchers for solving the economic load dispatch problem and other power system problems. Here, a short review of the significant developments is presented which will serve as a performance measure for the MRSPSO technique [36] applied in this paper.

A. Standard particle swarm optimization (PSO)

Particle swarm optimization was first introduced by Kennedy and Eberhart in the year 1995 [26]. It is an exciting new methodology in evolutionary computation and a population-based optimization tool. PSO is motivated from the simulation of the behavior of social systems such as fish schooling and birds flocking. It is a simple and powerful optimization tool which scatters random particles, i.e., solutions into the problem space. These particles, called swarms collect information from each array constructed by their respective positions. The particles update their positions using the velocity of articles. Position and velocity are both updated in a heuristic manner using guidance from particles' own experience and the experience of its neighbors. The position and velocity vectors of the ith particle of a d-dimensional search space can be represented as : $P_i=(p_{i1},p_{i2},\ldots\ldots\ldots p_{id})$ and $V_i=(v_{i1},v_{i2},\ldots\ldots\ldots v_{id},)$ respectively. On the basis of the value of the evaluation function, the best previous position of a particle is recorded and represented as P_{besti}=(pi1,pi2,………pid), If the gth particle is the best among all particles in the group so far, it is represented as $P_{gbest}=g_{best}= (p_{g1},p_{g2},\ldots\ldots\ldots p_{gd})$. The particle updates its velocity and position using (7) and (8).

$V_{i(K+1)=}WV_{iK}+c_1Rand_1\ (\ )\times (P_{besti}-S_{ik}) +c_2Rand_2\ (\ )\times (g_{besti}-S_{iK})$ (11)

$S_{i(K+1)=}S_{iK}+V_{iK+1}$ (12)

Where, V_{ik} is velocity of individual i at iteration k, k is pointer of iteration, W is the weighing factor, c_1, c_2 are the acceleration coefficients, $Rand_1(\ )$, $Rand_2(\ )$ are the random numbers between 0 & 1, S_{ik} is the current position of individual i at iteration k, P_{besti} is the best position of individual i and g_{best} is the best position of the group. The coefficients c_1 and c_2 pull each particle towards p_{best} and g_{best} positions. Low values of acceleration coefficients allow particles to roam far from the target regions, before being tugged back. on the other hand, high values result in abrupt movement towards or past the target regions. Hence, the acceleration coefficients c_l and c_2 are often set to be 2 according to past experiences and W varies linearly from about 0.9 to 0.4.

B. Moderate random search particle swarm optimization (MRSPSO)

MRSPSO was first introduced by Hao Gao and Wenbo in the year 2011[35], In order to enhance the global search ability of the PSO but not slow down its convergence rate, we used a new PSO algorithm with an MRSPSO strategy. In this algorithm used only position update and no need of velocity updating

The position $S_{i(K+1)}$ of the ith particle at the (K + 1) th iteration can be calculated using the following formula:

$S_{i(K+1)\ =}\ P_d + \propto \lambda\ (m_{besti}-S_{iK})$ (13)

$m_{besti} = \sum_{i=1}^{s} \frac{P_{best}}{s}$ (14)

Where, S denotes the population size in the MRSPSO. The parameter α is obtained by changing α from 0.45 to 0.35 with the linear-decreasing method during iteration, P_d is the attractor moving direction of particles, it is given as

$P_d=rand_0P_{best}+(1-rand_0)g_{best}$ (15)

Where, $rand_0$ is random variable between 0 and 1.

IV. ALGORITHM USING MRSPSO

In this work a new PSO with moderate random search techniques is used to solve the proposed ELD problem with valve point loading effect and generator ramp rate limits as constraints. The following steps were taken when solving the proposed problem by MRSPSO.

Step1:- Initialization of the swarm: For a population size the particles are randomly generated in the range 0–1 and located between the maximum and the minimum operating limits of the generators. Step2:-Initialize velocity and position for all particles by randomly set to within their legal range.

Step3:-Now set generation counter t=1.

Step4:- Evaluate the fitness for each particle according to the objective function.

Step5:-Compare particles fitness evaluation with its p_{best} and g_{best}.

V.CASE STUDY

This test system considers six-generating units in which all units with their valve point and ramp-rate limits constraints. This system supplies a 1263MW load demand. The data for the individual units are given in Table 1. The line loss coefficients are taken from Ref.[36] . The best solutions of the proposed MRSPSO, PSO, and CPSO methods are shown in Table 2.

VI. RESULTS AND ANALYSIS

To assess the efficiency of the proposed MRSPSO approaches in this work, one case study having 6 thermal units or generators of ELD with their valve point loading effect and ramp rate limit constraints are taken into account. All the test data is taken from the literature. The proposed technique is run on a 1.4-GHz, dual core processor with 2GB of RAM.

In each case study, 200 iterations were taken for obtaining optimum results from different PSO variants mentioned in this work. The data used in this study are taken from ref. [35]. The optimal result obtained by MRSPSO for the 6 generating units with line loss and load of 1263 MW shown in table 2, it shows fuel cost of 16317.18 $/h and optimal line loss of 17.79 MW and total computational time taken of 0.3215sec. The optimal result obtained by MRSPSO in this test case is shown that, it give better result means lowest fuel cost value than other PSO variants mentioned in this work and it also taken less computational time. From table 2, it is seen that both the value of computational time as well as fuel cost is less compared to PSO and CPSO methods; hence the effectiveness of the proposed method is verified.

Similarly, the input to forty units is taken from ref [14].The detailed parameter includes each generator range and related coefficients in both system are listed in tables. The total demand for forty generator system is 10500 MW. For forty units system, the global optimum has not been determined. Table 3 shows that optimal power outputs and corresponding costs are 121450.00 while table 4 represents Data for 40 Generators' system

Table1

Unit	P_{imin}	P_{imax}	Output (MW)	Total cost ($/h)
1	36	114	112.2896	949.770867
2	36	114	111.0604	929.504348
3	60	120	97.49442	1191.3841
4	80	190	179.5314	2143.96098
5	47	97	88.88745	724.712068
6	68	140	140	1596.46432
7	110	300	300	3216.42404
8	135	300	284.7229	2782.07788
9	135	300	284.777	2801.46883
10	130	300	130	2502.065
11	94	375	94.00612	1893.44177
12	94	375	94.03925	1909.04089
13	125	500	214.77	3792.32437
14	125	500	394.2823	6414.93466
15	125	500	304.5313	5171.47843
16	125	500	394.2847	6463.72027
17	220	500	489.2826	5296.78245
18	220	500	489.3103	5289.42936
19	242	550	511.2907	5541.17664
20	242	550	511.2942	5541.22861
21	254	550	533.2815	5071.33794
22	254	550	523.401	5073.69249
23	254	550	523.3435	5058.51901
24	254	550	523.3712	5059.07701
25	254	550	523.2819	5275.13219
26	254	550	523.25	5275.10211
27	10	150	10.00003	1140.52503
28	10	150	10.00440	1140.62570
29	10	150	10.01792	1140.93731
30	47	97	92.60279	785.447404
31	60	190	193	1643.99121
32	60	190	193	1643.99121
33	60	190	193	1643.99121
34	90	200	203	2101.01709

35	90	200	203	2042.78709
36	90	200	203	2042.78703
37	25	110	112	1220.16614
38	25	119	112	1220.16614
39	25	110	112	1220.16614
40	242	550	511.3338	5541.89229
Total Generation and cost			10500	121456.81

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39	25	110	112	1220.16614
40	242	550	511.3338	5541.89229
Total Generation and cost			10500	121456.81

Data for 6units Generators' System

unit	1	2	3	4	5	6
a_i	.007	0.0095	0.009	.009	.0080	.0075
b_i	7	10	8.5	11	10.5	12
c_i	240	200	220	200	220	190
e_i	300	150	200	100	150	100
f_i	.031	0.063	0.042	0.08	0.063	0.084
P_{imax}	500	200	300	150	200	120
P_{imin}	100	50	80	50	50	50
P_i	440	170	200	150	190	110
UR_i	80	50	65	50	50	50
DR_i	120	90	100	90	90	90

Table 2 Optimal power dispatch, fuel cost and simulation time of 6-units system

Power output(KW)	PSO	CPSO	MRSPSO
P1	443.034	467.55	437.55
P2	169.03	163.05	165.44
P3	262.02	253.415	258.88
P4	134.78	115.07	134.43

Table 3Optimal power outputs and corresponding costs

Table 4 Data for 40 Generators' System

Unit	P_{imin}	P_{Imax}	a_i	b_i	c_i	e_i	f_i
1	36	114	94.705	6.73	0.0069	100	0.084
2	36	114	94.705	6.73	0.0069	100	0.084
3	60	120	309.54	7.07	0.2028	100	0.084
4	80	190	369,03	8.18	0.00942	150	0.063
5	47	97	148.89	5.35	0.0114	120	0.077
6	68	140	222.33	8.05	0.01142	100	0.084
7	110	300	287,71	8.03	0.00357	200	0.042
8	135	300	391.98	6.99	0.00492	200	0.042
9	135	300	455.76	6.6	0.00573	200	0.042
10	130	300	722.82	12.9	0.00605	200	0.042
11	94	375	635.2	12.9	0.00515	200	0.042
12	94	375	654.69	12.8	0.00569	200	0.042
13	125	500	913.4	12.5	0.00421	300	0,035
14	125	500	1760.4	8.84	0.00752	300	0.035
15	125	500	1728.3	9.15	0.00708	300	0.035
16	125	500	1728.3	9.15	0.00708	300	0.035
17	220	500	647.85	7.97	0.00313	300	0.035
18	220	500	649.6	7.95	0.00313	300	0.035
19	242	550	647.83	7.97	0.00313	300	0.035
20	242	550	647.81	7.97	0.00313	300	0.035
21	254	550	785.96	6.63	0.00298	300	0.035
22	254	550	785.96	6.63	0.00298	300	0.035
23	254	550	794.93	6.66	0.00284	300	0.035
24	254	550	794.53	6.66	0.00284	300	0.035
25	254	550	801.32	7.1	0.00277	300	0.035
26	254	550	801.32	7.1	0.00277	300	0.035
27	10	150	1055.1	3.33	0.52124	120	0.077
28	10	150	1055.1	3.33	0.52124	120	0.077
29	10	150	1055.1	3.33	0.52124	120	0.077
30	47	97	148.89	5.35	0.0114	120	0.077
31	60	190	222.92	6.43	0.0016	150	0.063
32	60	190	222.92	6.43	0.0016	150	0.063
33	60	190	222.92	6.43	0.0016	150	0.063
34	90	200	107.87	8.95	0.0001	200	0.042
35	90	200	116.58	8.62	0.0001	200	0.042
36	90	200	116.58	8.62	0.0001	200	0.042
37	25	110	307.45	5.88	0.0161	80	0.098
38	25	119	307.45	5.88	0.0161	80	0.098
39	25	110	307.45	5.88	0.0161	80	0.098
40	242	550	647.83	7.97	0.00313	300	0.035

VII. CONCLUSIONS

This paper proposes PSO with moderate random search optimization techniques called MRSPSO for the solution of proposed ELD problem. The considered technique has been applied to six generators test system and forty generators to verify its effectiveness and robustness. The optimal results obtained are presented in Table 2 for six units system; similarly Table 3 represents optimal power outputs and corresponding costs. It is evident from table 2, it is seen that MRSPSO outperforms the other methods in terms of a better optimal solution and significant reduction of computing times. However, the much improved speed of computation allows for additional searches to be made to increase the confidence in the solution.

REFERENCES

[1]. M.E. EI- hawary & G.S. Christensen, Optimal economic operatiom of Electrical power system, New York,Academic,1979.

[2]. Mezger Alfredo J & Katia de Almeida C, Short term hydro thermal scheduling with bilateral traction via bundle method, International Journal of Electrical power & Energy system, 29(5), pp-387-396, 2007.

[3]. Martinez Luis Jose, Lora Trancoso Alicia & Santos Riquelme Jesus, Short term hydrothermal coordination based on interior point nonlinear programming and genetic Algorithm, IEEE porto power Tech Confrence,2001.

[4]. M. Gar CW, Aganagic JG,Tony Meding Jose B & Reeves S, Experience with mixed integer linear programming based approach on short term hydrothermal scheduling, IEEE transaction on power system ;16(4),pp.743-749,2001.

[5]. G.Torres and V. Quintana, On a non linear multiple-centrality corrections interior-point method for optimal power flow, IEEE. transaction on power system, vol.16,no2,,pp.222-228.2001.

[6]. K.Ng and G.Shelbe, ― Direct load control –a profit-based load management using linear programming,‖ IEEE transaction on power system, vol.13,no.2, pp.688-694,1998.

[7]. Shi CC, Chun HC, Fomg IK & Lah PB., Hydroelectric generation scheduling with an effective differential dynamic programming algorithm, IEEE transaction on power system 15(3),pp.737-743,1990.

[8]. Erion Finardi C, silva Edson LD, & Laudia sagastizabal CV., Solving the unit commitment problem of hydropower plants via Lagrangian relaxation and sequential quadratic programming, Computaional & Applied Mathematics,24(3), 2005.

[9]. Tkayuki S & Kamu W., Lagrangian relaxation method for price based unit commitment problem, Engineering optimization taylor Francis,pp. 36-41, 2004.

[10]. D.I. sun, B.Ashley, B.Brewer, A.Hughes and W.F. Tinney, Optimal power flow by Newton Aproach, IEEE transaction on power system, vol.103,pp.2864-2880, 1984.

[11]. A.Santos and G.R. da Costa, Optimal power flow by Newtons method applied to an augmented Lagrangian function, IEE proceedings generation, Transmission & distribution, vol.142,no.1,,pp.33-36, 1989.

[12]. X.Yan & V.H. Quintana, Improving an interior point based OPF by dynamic adjustments of step sizes and tolerances, IEEE transaction on power system , vol.14,no.2,,pp.709-717, 1999.

[13]. J.A. Momoh and J.Z. Zhu, Improved interior point method for OPF problem, IEEE transaction on power system, vol.14, no.2, pp.1114-1120, 1999.

[14]. Nidhul Sinha, R.Chakrabarti & P.K. Chattopadhyay, Evolutionary programming techniques for Economic load Dispatch, IEEE transactions on Evolutionary Computation, Vol.7 No1, , pp.83-94, 2003.

[15]. K.P. wong & J. yuryevich, Evolutionary based algorithm for environmentally constraints economic dispatch, IEEE transaction on power system , vol.13,no.2,pp.301-306, 1998.

[16]. K.P. Wong & C.C. Fung, Simulated annealing based economic dispatch algorithm, proc. Inst. Elect. Eng. C., Gen., transm.,Distrib.,vol.140,no.6,,pp.505-519, nov.1993.

[17]. W.M. Lin,F.S. Cheng & M.T. Tsay, An improved Tabu search for economic dispatch with multiple minima, IEEE transaction on power system , vol.17,no.2,pp.108-112, 2002.

[18]. J.S. Al-Sumait, A.K. Al-Othman & J.K. Sykulski, Application of pattern search method to power system valve point economic load dispatch, Elect. Power energy system,vol.29,no.10,,pp.720-730, 2007.

[19]. C.Walter & G.B.Sheble, genetic algorithm solution of economic dispatch with valve point loading, IEEE transaction on power system , vol.8,no.3,pp.1325-1332, 1993.

[20]. Tarek Bouktir, Linda Slimani & M.BelkacemiA genetic algorithm for solving for the optimal power flow problem, Leonardo journal of sciences, Issue-4,pp.44-58, 2004.

[21]. K. Vaisakh & L.R. Srinivas, Differential Approach for optimal power flow solutions, Journals of theoretical and applied information Technology, pp. 261-268, 2005-08.

[22]. Boumediene Allaoua & Abedellah Laoufi, Optimal power flow solution Unsing ant manners for electrical network, Advance in Electrical & Computer engg. Vol.9,pp.34-40, , 2009.

[23]. L.L. Lai & Mata Prasad, Application of ANN to economic load dispatch, proceeding of 4th international conference on Advance in power system control, Operation and management, APSCOM-97, Hong-Kong, pp.707-711, nov-1997.

[24]. J.Kennedy & R.C. Eberhart, Particle Swarm Optimization, proceeding of IEEE international conference on Neural networks , Vol.4,pp. 1942-1948, , 1995.

[25]. C.H. Chen & S.N. Yeh, PSO for Economic power dispatch with valve point effects, IEEE PES transmission & Distribution conference and Exposition Latin America, Venezuela,2006.

[26]. K.S. Swarup, Swarm intelligence Approach to the solution of optimal power flow, Indian Institute of science, pp. 439-455, oct-2006.

[27]. K.T. Chaturvedi, Manjaree pandit & Laxmi Srivastava, Self Organizing Hierachical PSO for nonconvex economic load dispatch, IEEE transaction on power system, vol.23, no.3,pp.1079-1087, 2008.
[28]. G.Krost, G.K. Venayagamoorthy & L. Grant, Swarm intelligence and Evolutionary approaches for reactive power and voltage control, IEEE Swarm Intelligence Symposium, pp.21-23, 2008.
[29]. N. Mo., Z.Y. Zou, K.W. Chan & T.Y. G. Pong, Transient Stability Constrained optimal power flow using particle swarm optimization, IEEE Generation, Transmission & Distribution, Vol.1,Issue 3, pp. 476-483, 2007.
[30]. Adel Ali Abou EL-Ela & Ragab Abdel-Aziz EI-Sehiemy, Optimized Generation costs using modified particle Swarm optimization version, Wseas transactions on power systems, pp.225-232, oct-2007.
[31]. J.B. Park,K.S. Lee, J.R. Shin & K.Y. Lee, A PSO for economic dispatch with non smooth cost functions, IEEE Trans. Power syst., vol.20, no.1, pp. 34-42, feb 2005.
[32]. J.G. Vlachogiannis & K.Y. Lee, Determining generator contribution to transmission system using parallel vector evaluated PSO, IEEE transaction on power system , vol.20, no4, pp.1765-1774, 2005.
[33]. A.Pereira-Neto, C. Unsihuay & O.R. Saavedra, Efficient evolutionary strategy optimization procedure to solve the nonconvex economic dispatch problem with generator constraints, IEE proc. Gener. Transm. Distributed, vol.152,no.5, pp.653-660, sep. 2005.
[34]. R.C. Eberhart & Y. Shi, Comparing inertia weights and constriction factor in PSO, in proc. Congr. Evolutionary computation, vol.1,pp.84-88, 2000.
[35]. Hao Gao & Wenbo Xu, A new particle swarm algorithm and its globally convergent modifications, N.Sinha, R. chakrabarti ,16(4),pp.743-749, 2001.
[36]. Phan Tu Vu, Dinhlungle & Joef, A Novel weight-Improved Particle swarm optimization algorithm for optimal power flow and economic load dispatch problem, IEEE Transaction , pp.1-7, 2010.
[37]. H. Shayeghi & A. Ghasemi, Application of MOPSO for economic load dispatch solution with transmission losses, International journal on technical and physical problems of Engineering, Issue 10, vol. 4, pp. 27-34, 2012.

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