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Economic Dispatch in Steam Power Plant Using Honeybee Mating Optimization

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Abstract— This paper deals with the economic dispatch(ED) of power in steam power plant using modern optimization technique. The importance of economic dispatch is attaining the maximum power using minimum resources. In static economic dispatch dynamic programming can be used. Due its high cost and more convergence time it's considered as drawback. To overcome this problem an optimization technique using honey-bee mating algorithm is introduced. The proposed method used to optimize the economic dispatch problems with satisfying the constraints. And also it reduces on load transformer tap swapping. The HBMO algorithm is tested on four generation units and simulated results are displayed which is better than existing method.
Keywords-economic dispatch, honeybee mating optimization Algorithm,Operation cost, Tap Changing, .

I. INTRODUCTION

The optimization problems are mostly used in the various fields of science and technology. Sometimes such problem can be complex because of the practical nature and model parameters. The main objective of optimization problem minimizes or maximizes an objective function subject to equality or inequality constraints. Economic dispatch is the computational process, where the total required generation is dispersed between the generation units in operation by minimizing the selected cost criterion and satisfying the total demand by reducing the transmission loss and operating constraints. ED is used in real time energy management through most programs to allocate the total generation with the existing units, unit commitment and in some other operation functions. Much different mathematical method such as gradient method, linear programming , lambda iteration, quadratic Programming, nonlinear programming algorithm, Lagrange relaxation algorithm, etc have been used for solving economic dispatch problem. For the effective implementation of this method its must for the formulation to be continuous. The basic ED consider the power balance limitations separated from the producing capacity limits. However in practical ED must take prohibited operating range, valve point loading effects, multi fuel operations into considerations to provide completeness of ED problem formulation. It is more complex for finding local minimum points and global optimum while taking the account of multiple fuel cost and valve point effects.

Evolutionary algorithm are the search methods inspired by natural events like survival of the fittest in the biological world and the behaviour of the social insects such as ants and bees. Because of advancement of software engineering and innovation many evolutionary algorithms such as genetic algorithm, molecule swarm enhancement, reproduced strengthening and tabu pursuit were introduced to solve the economic dispatch problem. One of the recently proposed evolutionary algorithms that have shown great possible and excellent view for the solution of various optimization problems is HBMO. HBMO algorithm is utilized for the single reservoir problem, data mining, distribution network state estimation, multi objective distribution feeder reconfiguration.

II. ECONOMIC DISPATCH FORMULATION

The static economic dispatch minimizes the fuel cost function associated with dispatch units

$$Min\ F(x) = \sum_{j=1}^{Ng} FCj\,(Pj) = \sum_{j=1}^{Ng} a_j\ p_j^2 + b_j P_{j+} c_j \qquad ; \qquad X=[P1,P2.....,PNg]$$

F(X) is the total generation cost
FCj(Pj) is the fuel cost of the generator 'j'
aj, bj, cj are fuel cost coefficients of generator 'j'.
Ng is the number of generators
X is the vector of control variables.

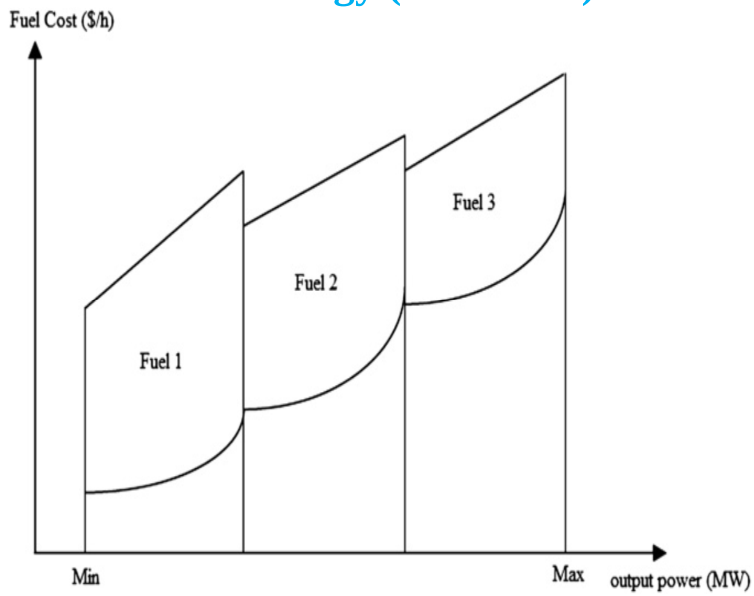

Fig 1- Multiple Fuels Cost

Inclusion of the valve point loading effects makes modeling of fuel cost function of the generator more practical. The arrangement methodology can be effectively caught in local optimum solution. The fuel expense capacity of the producing units with valve-point loadings is represented as follows:

$$FCj(Pj)= ajP_j^2 + b_j + bjPj + cj + ejsin (fj(Pjmin \_ Pj))$$

Usually there are many generating supply with multiple fuels. The cost function of the each unit is represented by piecewise functions which cause effect on fuel cost. The piecewise quadratic function multiple fuel cost is shown in figure 1.In ED problem the below constraints should be satisfied

Power balance constraints

$$\sum_{j=1}^{Ng} Pj = PD + PLoss$$

The above equation is the total load of the consumers

$$P_{Loss} = \sum_{i=1}^{N_g} \sum_{j=1}^{N_g} P_i B_{ij} P_j + \sum_{i=1}^{N_g} B_{0i} P_i + B_{00}$$

Transmission network losses is represented in quadratic function of the generation power output

Power output constraints

The electric output from each unit should be within the minimum and maximum output

$$Pjmin \leq Pj \leq Pjmax$$

III. BASIC CONCEPTS OF HONEYBEE MATING OPTIMIZATION

Honey bees are the social insect which works together in social order and generate hives. There are three different structural forms namely queen, drones, workers. In HBMO algorithm the queen mate with drones probabilistically using annealing function.

$$Pr(D)=exp(-\Delta(F)/Vqueen(t))$$

Pr(D) is the probability of adding drone sperm to the spermatheca of queen, Δ(F) is the difference between the fitness of D and queen. Vqueen(t) is the velocity of the queen at time t. The queen's velocity decreases after every transition represented in equation

$$Vqueen(t+1)= \alpha \times Vqueen(t)$$

Where α is the decreasing factor. It regulates amount of speed for each step transition and changes between 0 and 1.

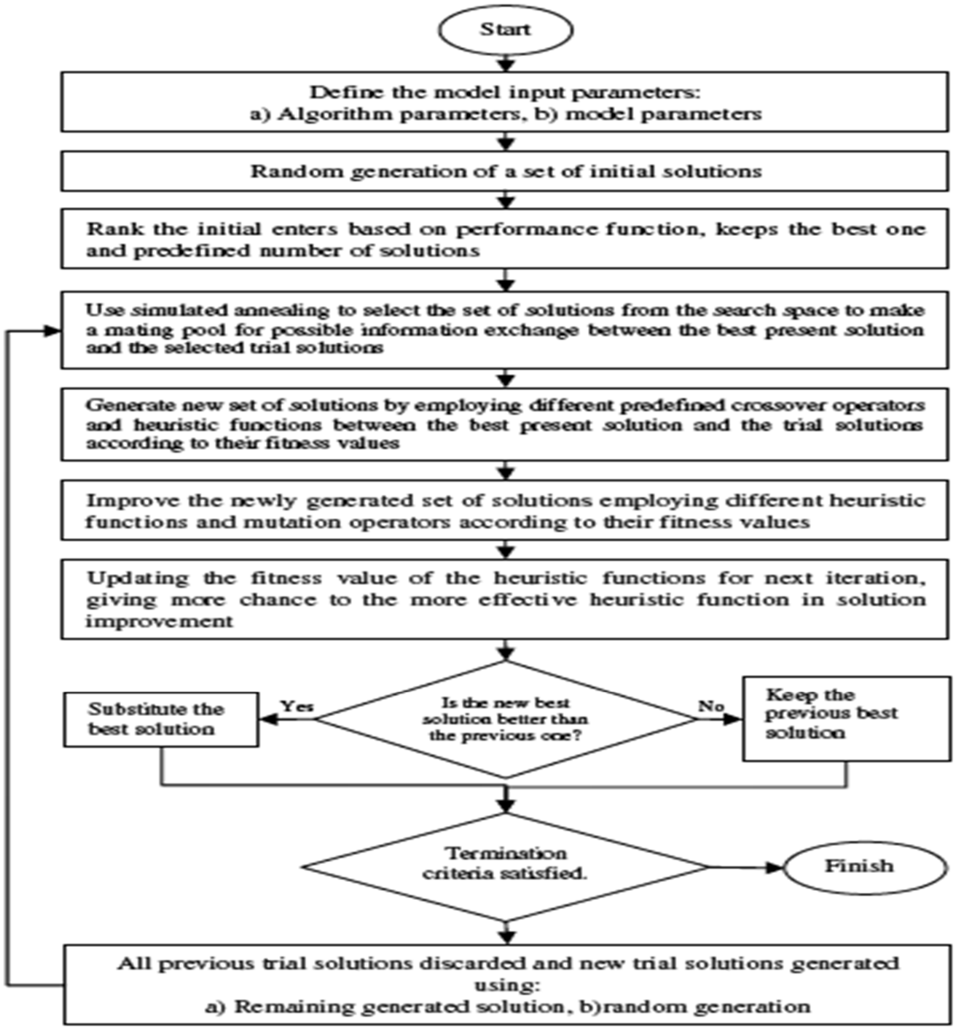

Fig no 2-Flow chart of proposed HBMO algorithm

TABLE I: The parameters used in the proposed algorithm

parameter	explanation	value
	Number of queen	1
NDreone	Number of drones	100
NBrood	Number of broods	100
NSperm	Size of the queens spermathec	50
Vmax	Velocity of queen at the start of a mating flight	Randomly between(0.5,1)
Vmin	Velocity of the queen at the end of a mating flight	Randomly between(0,1)
α	Decreasing factor	0.98

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IV. APPLYING THE HBMO TO THE ED PROBLEM

The following steps have to be taken for applying HBMO algorithm

Step 1: Initialize the population of bee and select the queen bee. State of Committed generators are designated with "1" and non-commited generators are designated with "0".Determines the initial status (ON/OFF = 1/0) for each generator.

Step 2: Start the bee for first flight

For each hour, program finds the potentially feasible states. (Potentially feasible states are the states where demand can be supplied by the commited generators). stop the iteration if spermatica is full or flight energy is 0(If there are no potentially feasible states, program displays the error message and terminates.)

Step 3: For new population of the bee bread the bee and select the new queen bee.

For each potentially feasible state take all feasible states from the previous hour and checks if the transition to the current state (in current hour) is possible. If it is not possible, the corresponding transition (start-up) cost is set to Inf. if the transition is possible, calculated are the transition costs.

Step 4: Energy of the new bee is given as from energy of the previous bee and start from the step 2.

Production for the current hour is calculated based on demand taking into account production at previous hour (ramp-up and down constraints).

Step 5: Finally, total cost is the sum of the transition cost, production cost, and the total cost at the state in previous hour this procedure is repeated for all the states in previous hour.

Step 6: Total costs are then sorted and MN of them are saved. If the transition to a state in current hour is not possible from any of the states in previous hour, then current state is regarded as infeasible and is not considered anymore. If all the states in an hour are infeasible, program displays the error message and terminates.

TABLE II: TEST SYSTEM SPECIFICATIONS

S.NO	PARAMETERS	VALUES
1	Generator 1	25MW≤X≤80MW
2	Generator 2	60MW≤X≤250MW
3	Generator 3	75MW≤X≤300MW
4	Generator 4	20MW≤X≤60MW
5	Ultc	3Φ,70/10KV,40MVA,32step

TABLE III: GENERATOR DATA

STATE NO	MW MIN	MW MAX	UNITS			
			1	2	3	4
1	0	0	0	0	0	0
2	20	60	0	0	0	1
3	25	80	1	0	0	0
4	45	140	1	0	0	1
5	60	250	0	1	0	0
6	75	300	0	0	1	0
7	80	310	0	1	0	1
8	85	330	1	1	0	0
9	95	360	0	0	1	1
10	100	380	1	0	1	0
11	105	390	1	0	1	1
12	120	440	1	0	1	1
13	135	550	0	1	1	0
14	155	610	0	1	1	1
15	160	630	1	1	1	0
16	180	690	1	1	1	1

TABLE IV: HOURLY RESULTS

Hour	Demand	Tot.Gen	Min MW	Max MW	Tap swap cost	Prod. Cost	F-Cost	State	Units ON/OFF
0	-	-	135	550	0	0	0	13	0110
1	450	450	135	550	113	9208	9208	13	0110
2	530	530	135	550	0	10648	19857	13	0110
3	600	600	155	610	75	12450	32307	14	0111
4	540	540	135	550	68	10828	43135	13	0110
5	400	400	135	550	0	8302	51444	13	0110
6	280	280	135	550	0	6198	57635	13	0110
7	290	290	135	550	0	6366	64002	13	0110
8	500	500	135	550	0	10108	74110	13	0110

V. SIMULATION RESULTS

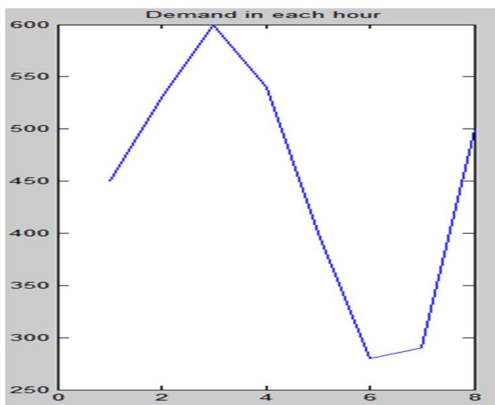

Fig 3

The above graph is plotted between time and demand for each hourly load.

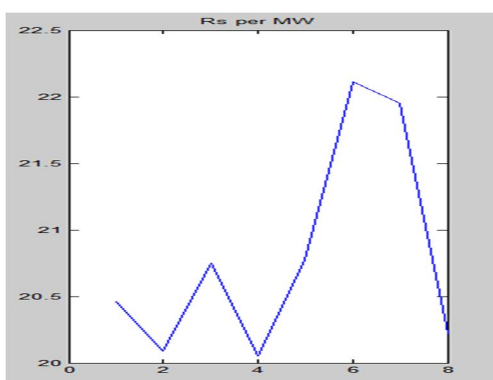

Fig 4

The above graph represents the Rs per MW which respect to time. It is drawn in the hourly basis.

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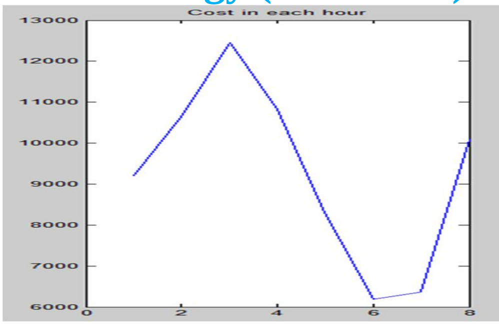

Fig 5

The above graph is plotted between cost per each MW in hourly basis. And when compare to existing methods the cost per MW reduces in proposed method.

VI. CONCLUSION

In this paper we proposed the modern optimization technique for the economic dispatch problem. The main objective is to find the optimal combination of power outputs for generating units that reduces the fuel cost in combine with less convergence time. And when connected to load through on load tap changer the tap swapping gets reduced when compare to existing methods. Some of the characteristics of generator valve point loadings and multiple fuel were considered during practical examination. To validate the proposed HBMO system it is tested in four generating units and wave forms are plotted. The outcome explains the effectiveness in terms of quality, economic, convergence.

REFERENCES

[1] Panigrahi BK, Pandi VR, Das S. Adaptive particle swarm optimization approach for static and dynamic economic load dispatch. Energy Conversion and Management 2008;49(6):1407e15.
[2] He DK, Wang FL, Mao ZZ. Hybrid genetic algorithm for economic dispatch with valve-point effect. Electric Power Systems Research 2008;78(4):626e33.
[3] Pothiya S, Ngamroo I, Kongprawechnon W. Ant colony optimisation for economic dispatch problem with non-smooth cost functions. Electrical Power and Energy Systems 2010;32(5):478e87.
[4] Amjady N, Sharifzadeh H. Solution of non-convex economic dispatch problem considering valve loading effect by a new Modified Differential Evolution algorithm. Electrical Power and Energy Systems 2010;32(8):893e903.
[5] Sivasubramani S, Swarup KS. Hybrid SOAeSQP algorithm for dynamic economic dispatch with valve-point effects. Energy; 2010. 08.018. doi:10.1016.
[6] Chiang CL. Improved genetic algorithm for power economic dispatch of units with valve-point effects and multiple fuels. IEEE Transactions on Power Systems 2005;20(4):1690e9.
[7] Niknam T, Olamaie J, Khorshidi R. A hybrid algorithm based on HBMO and fuzzy set for multi-objective distribution feeder reconfiguration. World Applied Sciences Journal 2008;4(2):308e15.
[8] Haddad OB, Afshar A, Marino MA. Honey bees mating optimization (HBMO) algorithm: a new heuristic approach for water resources optimization. Water Resources Management 2006;20:661e80.