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A GENERALIZED SYSTEM WITH LOSSES LOOK AHEAD ECONOMIC DISPATCH IS INVESTIGATED BY BIO IN-SPIRED ALGORITHMS

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ABSTRACT

Now a days utilization of power for domestic and industrial purposes are increasing day by day. As load increases that is demand increase production should increase, but due to cost oriented point of view at demand side it is very important by including number of units which used for to meet demand. In this paperit considered as economic dispatching the load with optimized way to meet demand with less cost. Here to get optimized output a bio inspired algorithms are used. The bio inspired algorithms such as antlion algorithms (ALA), quantum particle swarm optimization (QPSO) genetic algorithm (GA) is utilized and compared with each other. In this MATLAB programming has been used for getting output. Here the generalized system includes generating units with losses and objective of this work is to meet demand with less cost.

Keywords: Economic load dispatch, bio inspired algorithms, generating units, losses

1. **INTRODUCTION**

India enhancing and meeting the demand play an and in this domain, it is to be eschew unwanted important role. India is the third largest consumer data, since these can provide solutions leading to of electricity and it has to think over about the less a considerable reduction of economic power carbon emission sources that is renewable energy dispatch problem, generator fuel consumption sources such solar, wind etc. In this economic load and provide these solutions at low computational dispatch (ELD) [1] is one of the crucial problems in time. Besides this, recent advances in computapower generation. And also considering the equal tion and the search for global optimum solutions and unequal constraints for optimizing the ELD.For of complex optimization problem have fomented analyzing the ELD we have to assume certain as- the development of a group of techniques known sumption to get solution conventionally. But there as modern heuristic algorithms. For getting the are many bio-inspired algorithms are used to get solution antlion algorithm (ALA) [1][2], quanoptimized solution by including losses. Now a days tumparticle swarm optimization (OPSO) [4] and economic dispatch optimization is one of the major geneticalgorithm (GA) [3] are used. In this work problems in which the researcher has to consider and 5 units and 10 units considered, problem with get the solution. For getting solution that is opti- data is tabulated in table 2 and table 4 mized, the bio inspired algorithms which are useful and crucial. The conventional methods are also used 2. ECONOMIC LOAD DISPATCH to solve economic load dispatch for losses and without losses. But many mathematical approximations 2.1 Generator Fuel Cost Function are required such as convex, quadratic, and differentiable objective and linear or linearized objective and of objective function is required and getting opconstraints were required to simplify the problem. timized solution for reducing the cost and meet-Thence the accurate global optimum [9]

of the problem could not be reached easily.

To continue this, the computation Here in most of the utilization of power in methodologies proceed towards are remarkable

For getting the solution, consideration ing the demand. The objective function is

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 $F_i(P_i) = a_i P_i^2 + b_i P_i + c_i$

where,

 $F_i(P_i)$ = Fuel Cost Function

 P_i = output of generator i

Where ai, bi, ci are cost coefficients for generator i 2.2 Constraints

Equal and inequal constraints are given below

2.2.1 Equal constraints

The power generated from the generator is equal to the sum of the power demand at load side and the transmission losses

$$\sum_{i=1}^{N} P_{i}(t) = power \, demand + transmission \, losses$$

Power demand and transmission losses are in MW Where N= number of generators

2.2.2 Inequality constraints

For ELD, power inequality constraints are given below

$$P_i^{min} \leq P_i \leq P_i^{max}$$

Where,

Pi^{min}- minimum generation limit

P_i^{max}- maximum power limit

Power loss or transmission loss can be defined by considering the loss coefficient of George's Formula and transmission loss constants of generating unit i and Kron's transmission loss constant, respectively is given below from this transmission loss can be analyzed

$$P_{L} = \sum_{i=1}^{N} \sum_{j=1}^{N} P_{gi}B_{ij}P_{gj} + \sum_{i=1}^{N} B_{i0}P_{gi} + B_{00}$$

In the above equation B coefficients are loss coefficients and with Transmission losses are analyzed.

3. METHODOLOGIES FOR SOLVING ELD

In this, economic load dispatch is optimally solved by using bio inspired algorithms such as ant lion algorithm, quantum-based particle swarm intelligence [4], genetic algorithm. These are very useful methods and are used to reduce the total cost and meets the demand. Firstly, antlion algorithm [11] (Fig-1), it is novel nature inspired algorithm and it mimics the hunting mechanism of ant-lion in nature.

This is having total five steps which are used to solve that is random walk of ants, building traps, entrapping the ants in traps, catching preys, and rebuilding traps are accomplished. This method very useful and used for many power system problems. A classical PSO [8] will use particles and the quantum PSO (Fig-2) uses the qubit for analyzing the ELD and it is also one of the efficient methods to get optimal way approach for problem. There are many algorithms are present to solve ELD [6]. Among these methods, this work considers the ant lion algorithm, quantum-based particle swarm optimization and genetic algorithm (Fig-3). For solution convergence is one major part. As these algorithms execution time is important and number of epochs is also crucial.

3.1 Schema Chart For ALA





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- 3.2 Schema Chart For Quantum PSO
- 3.3 Schema Chart For GA





Fig-2 Flow Chart For QPSO



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These three techniques used for solving the economic load dispatch. In this paper these bioinspired algorithms are considered. Here the objective function and loss function mentioned above are considered.

4. **RESULTS AND ANALYSIS**

In this paper three bio inspired algorithms are used i.e., ant lion algorithm, quantum-based particle swarm optimization, genetic algorithm. Based on this algorithm economic load dispatch problem with 5 units including losses are obtained. In this work the results are obtained by using MATLAB programming. The system used for running the programs are having 12GB RAM with i5 processor.

Here while analyzing the problem with losses the system is excluded with valve point effect and also for 5 units and 10 units data is considered, and according to above steps given in Fig-1, Fig-2, Fig-3 a program is executed in MATLAB.

The unit's data is given in below tables, this data is used for all the algorithms. These algorithms are chosen to get optimized solution for economic load dispatch problem with losses. In this work recognizing the constraints and used for solution is very important. Economic load dispatch for 5 units is evaluated and finally got the solution. These bio-inspired algorithms [5][7][8] will help to get the solution in optimized way.

Results are given below, as these are bio inspired algorithms and these required population size, number iterations etc.,

Parameters	Values
Population	2200
Iterations	300

Table 1 Parameter Settings

Table 2 shows the fuel cost coefficients values, power minimum values and maximum values for 5 units

Table 2	Cost Coefficients,	Power Loss	Coefficients And
	Pmax.	And Pmin	

Unit	Unit1	Unit2	Unit3	Unit4	Unit5
a_{i}	0.204	0.059	0.048	0.046	0.032
b_{i}	40.65	50.26	25.41	58.41	39.38
ci	800.8	500.3	1151	1344	1760
Pmin	12	40	30	35	140
Pmax	150	300	250	300	400

Loss	Coefficients	Or B	Coefficients
L033	coefficients	OI D	coefficients

1(10-6)	15	1.7	3.6	2.5	5.5
2(10-6)	1.8	7.5	3.5	1.2	3.2
3(10-6)	4.6	3.5	8.1	6.2	2.5
B ₀ (10 ⁻⁴)	-80.1	-5.4	20.1	8.5	25
B_{00}			5.0237		

Table 3 shows simulation result of the 5 units of the quantum based PSO, ant lion algorithm and genetic algorithm with losses

Unit	GA	QPSO	ALA
1	331.755	320	280
2	291.92	300	320
3	284.5399	275	280
4	290.776	320	300
5	380.5078	362.62	400
P(MW)	1580	1580	1580
FUEL COST (\$)	16990.33	16980.32	16971.9

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Table 4 gives information regarding 10 units with loss coefficients and also maximum and minimum power limits.

Unit	ai	bi	ci	Pmax	Pmin
1					
	0.00068	18.19	1000	150	600
2					
	0.00071	19.26	970	50	200
3					
	0.0065	19.8	600	50	200
4					
	0.005	19.1	700	50	200
5					
	0.00738	18.1	420	50	160
6					
	0.00612	19.26	360	20	100
7					
	0.0079	17.14	490	25	125
8					
	0.00813	18.92	660	50	150
9					
	0.00522	18.27	765	50	200
10					
	0.00573	18.92	770	30	150

With this values consideration power and the fuel cost is obtained from quantum based PSO, ant lion algorithm and genetic algorithm. Table5 shows the simulation results of 10 units

Tahle 5	simulation	results	for	10	units	
i ubie s	simulation	resuits	jur	10	unns	

,			
UNITS	GA	QPSO	ALA
1	598.234	601.2	600
2	202.561	203.1	200
3	199.5	204.5	200
4	200.56	200	200
5	161.2	160	160
6	116	116	115
7	123	125.2	125
8	149	150	150
9	202	202	200
10	150	150.325	150
P(MW)	2100	2100	2100
FUEL COST (\$)	462214.916	462212.916	462202.92



Power generated from each generator through MATLAB using ALA, QPSO, GA



Power generated from each generator through MATLABusing ALA, QPSO, GA for 10 units

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5. CONCLUSION

In this work it is made evident by the fact that economic load dispatch is one of the major parts in the power system and by using the bio inspired algorithms, this may get solved and get optimized output. Here three bio inspired algorithms are considered i.e., antlion algorithm (ALA), quantumbased particle swarm optimization (QPSO), genetic algorithm (GA) and applied to 5-unit system and 10-unit system. This persistent usage of algorithms for economic load dispatch may result optimized solution. In this paper economic load dispatch solution is solved by ALA, QPSO, GA. And from this it may show as ant lion algorithm solution is good and efficient.

The MATLAB(R2019A) used for programing, from this ALA gives efficient result

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