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Utilization of Swarm Optimization Technique to Solve Load Dispatch Problem

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ABSTRACT : This work considered economic load dispatch problem with valve point loading effect. Here we considered first case of, six generating units are taken for the load of 1263 MW.Secondcaseisof 13 generating units for the demand of 1800MW and next case is considered for the 15generating units of the load demand of 2530 MW. The results are compared by PSO, TVPSO with results of literature. Results obtained are typically compared with the previous results available in literature and find superior in provisions of objective function and cost of generation as well. ELD is a crucial optimization task in power grid operation for allocating generation among the committed units specified the constraints obligatory are glad and also the energy necessities in terms of British thermal units per hour (Btu/h) or dollar per hour ($/h) are reduced.Theeconomicloaddispatchplaysacrucialrolewithintheoperationofpowergrid.Theeconomic load dispatch problem involves the solution of two different kinds of problems. Theunit commitment or pre-dispatch is the first problem, where verit's needed to pick out best oneamongst the offered generating units to work to satisfy the expected load and supply a specifiedmargin of operational reserve over a specified amount of your time. The second side of economicdispatch is that the on line economic dispatch, where by it's needed to distribute the load amongstoffered generating units paralleled with the system in such a way the re fore on minimize the entire price of provision minute-to-minute power need soft he system.Particles warm optimization and Particle swarm optimization with Time varying acceleration coefficient called TVACPSO is applied in this work used to get optimum solution of the ELD problem. All results are taken for 50 population sizes and 100 numbers of iterations of PSO in this work. The suggested techniques are tested for different test case taken from the literature of data of different

generating unit system. The purpose of the proposed work is to find the global solution of the evolutionary techniques i.e. PSO and TVAC PSO in particular to the economic load dispatchproblem.

1. INTRODUCTION:

1.1 TheEconomicOperationofPowerSystem

Economic load dispatch(ELD) isa very important improvement taskin grid operation forallocating generation among the committed units such the constraints obligatory square measuregladandthereforetheenergyneedsintermsofBritishthermalunitsperhour(Btu/h)ordollarper hour ($/h) square measure decreased . enhancements in programming the unit outputs willresult in vital value savings.In the power trade,the economical optimum economic operationand designing of electrical powergenerating system has forever occupied a very importantposition. With giant interconnection of the electrical networks, energy crisis within the world,continuous rise in fuel and tariff structure necessitate the optimum operation of power generatingunits. At in a low saving within the operation of generating system results a big reduction indisbursementofthefacilityplant.Themostobjectiveoftheeconomicloaddispatchofgeneratingsyste ms is to attain minimum disbursement of thermal power house.

This drawback has taken a delicate twist in trendy generating system, as customers becameinvolved with environmental matters, therefore that economic dispatch currently includes thedispatch of systems to attenuate environmental emission as well as accomplish minimum value.Additionally,there'sadesiretoexpandtherestrictedeconomicimprovementdrawbacktoincludec onstraintsonsystemoperationsoastoconfirmtheprotectionofthesystem,forpreventing collapse of the system attributable to unforeseen conditions. But closely associateddrawback with this economic load dispatch is that the commitment of associate in array of unitout of a complete array of units to serve the expected load demands in an optimum method. Forthe aim of optimum economic operation of this massive scale interconnected system, trendyimprovement techniques square measure being applied with the expectation of goodish valuesavings.

1.2 EconomicLoadDispatch

The Economic Load Dispatch is a very important a part of trendy wattage system suchUnit commitment, Load foretelling, obtainable Transfer Capability (ATC) calculation, SecurityAnalysis(SA),programmingof fuel purchaseetc.A listingsurveyonELD waysrevealsthat numerous numerical improvement techniques are used to get the answer of the ELD drawback.ELDdrawbacksolvedhistoricallyvictimizationmathematicalprogrammingsupportedimprovement techniques like Particle Swarm improvement (PSO) with valve purpose result andits variants i.e. Self-Organizing gradable Particle Swarm improvement [2],[3], Hybrid ParticleSwarm improvement Approach [4], Quantum-Inspired Particle Swarm improvement (PSO) withvalveloading[5]andmicroorganismhuntimprovementbasedmostlyDynamicwithNon-Smoothvalue perform [6].

1.3 Nature of Economic Load Dispatch

ThemainaimofELDdrawbackistoschedulethecommittedthermalgeneratingunits,so the per unit generation value will be reduced whereas satisfying all constraints. Because thegift grid is sophisticated interconnected system, thence the optimization drawback formulation ofeconomic dispatch may be a massive scale non-linear, dynamic, non-convex & random in nature.Nonlinearity is introduced as a result of the generation characteristic of the units. Dynamicbehavior is thanks to multiple fuel possibility in thermal power plants and random is introducedas a result of variation in load or demand. In the grid have many generating power plants. Inevery generating power station have many generating units. The full demand of the system isprovided by totally different generating power station, at any explicit of your time. Economicload dispatch drawbackknown the generated output power of every generating power station,and output power of every generating unit at intervals a generated power station in such the wayto reduce the general generation value to supply the system load demand and not violate theconstraints.

1.4 Objective

Economicdispatchproblemswithquadraticcostfunctionsarewellsolvedbyoptimization methods. The objective of the ELD problem is to control the committed generator'soutput such that the total generation cost is minimized, so that fulfilling the power demand andother physical and operational constraints. Traditionally, fuel cost function of a generator isrepresentedbysingle quadratic function.

The aim of the presented work is to calculate the optimal power generation schedule throughcommitted generating units for three, six, thirteen and fifteen thermal power units using timevaryingacceleration coefficients of Particle Swarm Optimization.

1.5 Methodology

Optimalpowerthroughcommittedgenerationunitshasbeen calculatedusingPSOinthiswork.Thebrief methodologyisgiven below:

1) ExhaustiveLiteraturereviewisgivenin theproposedarea.
2) Identifythetestsystemsforwhich optimalgenerationschedulehasbeenobtained.
3) Optimizationproblemisformulatedincludingobjectivefunction&constraints.
4) Finalizedoptimizationalgorithm.
5) MATLABcodingisgiven foralltest systemfor ELDusinglinearlydecreasingTAVCPSO.
6) AsPSOisapopulationbasedalgorithm henceresultsareobtained atvariouspopulationsizes.
7) Resultsforalltestsystemsarecomparedatdifferentpopulationsizes.

2. LITERATURE REVIEW :

1. **Omaranpour et al.:**A technicalapproach to. It's supported native extreme escape. A brand new definition has been referred to asthe worst position. With this definition, convergence and housing in extreme native be preventedandmoreroomaregoingtobesearched.Inseveralcasesofimprovementissues,don'tunderstandthevarythatansweristhat.Withintheresultsofexamineonthebenchmarkfunctions are determined that once data formatting isn't within the vary of the solution, theopposite renowned ways area unit at bay in native extreme. The tactic bestowed is capable ofrunningthrough it andalso theresultsareachieved withhigheraccuracy.

2.A. Jaini et al. : Here for economic load dispatch of standards take a lookat system IEEE 26-BUS.The results unconcealed that the planned technique has advantage inachievingoptimum answer foraddressingofprematureconvergence.Quantum-Inspired Particle Swarm optimization (QPSO) methodology prompt by Hong GangWang et al. [5], that has stronger search ability and faster convergence speed, not solely as aresult of the introduction of quantum computing theory, however additionally as a result of 2special implementations: self-adaptive likelihood choice and chaotic sequences mutation. Theplanned approach is tested with 5 commonplace benchmark functions and 3 installation casesconsisting of three, 13, and forty thermal units. Comparisons with similar approaches as well astheorganic process programming(EP), PSOsquaremeasuregiven.

3. Yangquan Wang et al.: Here Simulated Annealing (SA)algorithm is used to help PSO, to jump out the local optimum. Furthermore, a feasibility-basedruleis introduced to dealwith theconstraints.

4. Xinma et al. [7] proposed the dynamic load economic dispatch model consider the spinningreserveinelectricitymarketandthenanImprovedParticleSwarmalgorithmisputteduptosolvethem.Asystemincluding15generatingunitsisstudiedandtheoptimalresultsofIPSOandPSO arecompared.

5. WU Ya-li et al. : A new cultural PSO algorithm discussed by WU Ya-li et al with feedback control to solveeconomic load dispatchproblems. The results show that the new algorithm not only possessesthebetterglobal convergencebutalso thehigher convergent speed.

6. C.H. Chen et al. : projected methods that explore the locality of particle's best position foundup to now ends up in a stronger result. Additionally, to agitate the equality constraints of theeconomicdispatchissues,astraightforwardmechanismaredevisedthatthedistinctionofdemandedloadandtotalgeneratingpowerisequallysharedamongunits,excepttheonereachingitsgeneratinglimit. Toindicatetheircapability,theprojectedalgorithmssquaremeasure applied to 2cases with 13 andforty generators, severally.Comparisonsamongstorganic process algorithmic program and alternative changed Particle Swarm optimization aregiven.

3. ECONOMIC LOAD DISPATCH

3.1 INTRODUCTION

Economic dispatch is that the methodology of decisive the fore most economical, low-priced andreliable operation of an influence system by dispatching the out there electricity generationresources to provide the load on the system. The first objective of economic dispatch is toattenuate the overall price of generation where as conformation the operational constraints of theout there generation resource Economic load dispatch downside is allocating masses to plants forminimum price whereas meeting the constraints. It's developed as AN optimization down side ofminimizingtheoverall fuelpriceof allcommitted plantwhereas meetingthedemand andlosses.

The variants of the issue are measure various model the target and constraints in sever alwaysthat. The essential economic dispatch down side will delineate mathematically as step-down ofthe overall fuel price of all committed plants subject to the constraints. The Engineers are terriblywinning in increasing the potency of boilers, turbines and generators thus incessantly that everynew other to the generating unit plants of a system operates a lot of expeditiously than any olderunit on the system. In operation the system for any load condition the contribution from everyplant and from every unit among a plant should be determined in order that the value of thedeliveredpower could beaminimum.

3.2 OperatingCostofThermal PowerPlant

The output power of the thermal generating plants is increased sequentially by opening aset of valves to its steam turbine at the inlet. The throttling losses are large when a valve is justopened and it is small when the valve is fully opened. Fig. 3.1 represent the block diagram ofsimple thermal generating power plant used theanalysisof dispatch problem. The generationcostof the thermal powerplant is usuallyrepresented byoneor morequadraticsegment.

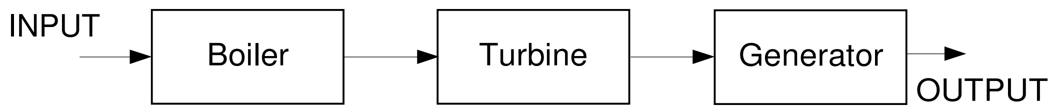

Fig.3.1Thermalpowerplantblockdiagramrepresentation

The objective of the economic load dispatch is to minimize the generation cost of thethermal power plants. Since the economics acts an important part in all fields of industry. So thatpower plants use some well established techniques for choosing the most suitable system. Thegeneration power plants are installed in such a way so that they can operates on most economicalcondition. The major idea of design and operation of the plant is to bring the charge of energyproducedto minimum.

Planning of power system and its operation often use optimal load flow as a powerfulassistanttoolinbothplanningandoperatingstage.Economicdispatchplaysasignificantfuncti on in operation planning and real time control of modem power systems. ELD problem isexpectedtooptimizethetotaloperatingcostofthe powerplants and alsorangeof constraints.

A various investigation has been done in this area to improve solution quality, as bettersolution would result in significant economical benefits. On different world area unit able to} saythat economic dispatch is a crucial optimization task in installation operation for allocatinggeneration among the committed units such the constraints obligatory are glad and also theenergynecessitiesarereduced.

3.3 ProblemFormulation

The main goal of this work is to geta selected set of points of ELD drawback, together with alloutputs of the ability generation units, such all equality and difference constraints areglad.Additionally, the full value operate is reduced. During this work thought-about the equality anddifference constraints indicate the important power balance and limitation of power generation ofevery unit, severally. A number of the opposite constraints together with voltage level andsecurityareassumed to beconstant.

4.PRACTICAL SWARM OPTIMIZATION:

4.1 Introduction

Optimizationmaybeaprocedureoffindingandscrutinypossibleresolutionsunlessbestsolution has been found. varied improvement technique, typical and nonconventional squaremeasure shown in Fig. 5.1 are used for call support of various sorts of universe issues startingfromshorttermgenerationprogrammingtofuturelinecomingupwith.

Conventional algorithms like linear, nonlinear, quadratic, number and geometric programmingsuffers from unidirectional search, single resolution update by purpose by purpose approaches,sensitive to initial condition, use of settled transition rule, not economical for distinct search areaandstuck into suboptimal resolution.

Different from typical search algorithms, non typical technique i.e. biological process or non-gradient probabilistic techniques work on a populationof potential resolution(point) of thesearch area ANN offers an benefits of obtaining multiple appropriate resolution in single run,randomsearch, simpleto implement, robust,parallel computingand plentyofalotof.

Through cooperation and competition among the potential resolution, these techniques kitchenappliance notice optima a lotof quickly onceappliedtoadvancedimprovementdownside.Amongst all biological process techniques PSO may be a relatively new computation techniquethat is galvanized by natural aspects like fish schooling, bird flocking and human relation. Itexploresworldbestresolution throughexploitingthe particle'smemoryand swarmmemory.

PSO has gained unimaginable recognizition throughout last decade as a result of convenience ofrealization,quickconvergenceandpromisingimprovementabilityinvariedissues.Thisimprovement algorithmicrulewasatthestartrecommendedbyKennedy&Eberhartin1995,that was any changed by heap of researchers to enhance the performance of it. Therefore, heap ofvariantsofPSOiscurrentlyobtainableinliterature,thatshownsuperiorresultsoverbasicPSOinterms ofresolution accuracyand speed ofconvergence.

4.2 ImplementationStepsofTVACPSO

InPSOinitializationofparticleposition,initializationofparticlevelocity,evaluationofobjective function, initialization of particles and obtaining pbest & gbest, evaluation of velocity,updateparticlepositionaremajorstepstosearchglobaloptimalsolution.Detailedimplementationsteps are givenbelow:-

Step1:Initialization ofparticleposition

For a population size, the particles area unit indiscriminately generated within the vary 0–1 andsettledbetween themostandalso theminimum inoperationlimits ofthe generators.

If there are Nth generating units, the ith particle is diagrammatical $aP_i=(P_{i1},P_{i2},P_{i3}\ P_{iN})$.

$$P_{initial}=P_{imin}+rand(P_{imax}-P_{imin}) \tag{4.1}$$

Step2:Initializationofparticlevelocity

Initializethe velocityoftheparticles.

$$V_{initial}=V_{imin}+rand(V_{imax}-V_{imin}) \tag{4.2}$$

Step3:Evaluationofobjectivefunction

Foreachparticle,measuresthespecifiedimprovementobjectiveperforminNvariables.Objectiveperform is calculated byequation (5.9).

$$FC_i(\ P_i)=\ a_iP^2_i+b_iP_i+c_i \tag{4.3}$$

Step4:Initializationofpbestand gbest

The fitness values obtained higher than for the initial particles of the swarm area unit set becausethe initial pbest values of the particles. The simplest price among all the pbest values is known asgbest.

Step5:analysisofspeed

The update speed is computed victimization (5.10). To regulate excessive roaming of particles,speedis createdto liebetween Vi,maxandVi minimum, scoopthe utmostspeed limitfortheithgeneratingunit is computed as follows:

$$(P_{max}-P_{min})/rand \quad (4.4)$$

Where,ris thechosennumberof intervals inthe i^{th}dimension.

Step6:Updateparticle position

Changethevelocityparticleand position particle accordingto equations

$$V_i^{(K+1)}=WV_i^K+c_1Rand_1\times(Pbest_i-S_i^K)+c_2Rand_2\times(gbest-S_i^K) \quad (4.5)$$

$$W=W_{max}-\frac{W_{max}-W_{min}}{iter_{max}}\times iter \quad (4.6)$$

$$w_{new}=w_{min}+w\times rand_3 \quad (4.7)$$

$$c_1=c_{1max}-\frac{c1max-c1min}{iter_{max}}\times iter \quad (4.8)$$

c_2=c

$$-\frac{c2max-c2min}{iter_{max}}\times iter \qquad (4.9)$$

Where,w_{min},w_{max}:initialandfinal weight, c_{1min},c_{1max}:initialandfinalcognitivefactorsandc_{2min},c_{2max}: initial andfinal social factors.Iteris thecurrent number ofiteration.

Step7:Stoppingcriteria

Go to step three till a criterion is met, typically a enough sensible fitness or a most range ofiterations(generations).

Step8:optimumanswer

If objectiveoperate ismetwehave atendencytoachieved optimumanswer.

4.3 FlowchartofTVACPSO

FlowchartofTVACPSO is

PSO is a population based evolutionary stochastic optimization algorithm and having followingadvantages:

1) Itonly requiresafitnessfunctiontomeasurethe‘quality’ofasolutioninsteadofcomplexmathematicaloperationlikegradientormatrixinversion.Thisreducesthecomputational Complexity and relieves some of the restrictions that are usually imposedonthe objectivefunctionlikedifferentiability,continuity, orconvexity.

2) Itislesssensitive toagoodinitial solutionsinceitis apopulation-basedmethod.

3) Itcanbeeasilyincorporated withotheroptimizationtools toformhybridones.

4) Ithas theabilitytoescapelocalminima sinceitfollows probabilistictransitionrules

5) Itcanbeeasilyprogrammedandmodifiedwithbasicmathematical andlogicaloperations

6) Itisin-expensiveintermsofcomputationtimeand memory.

7) Itrequireslessparameter tuning.

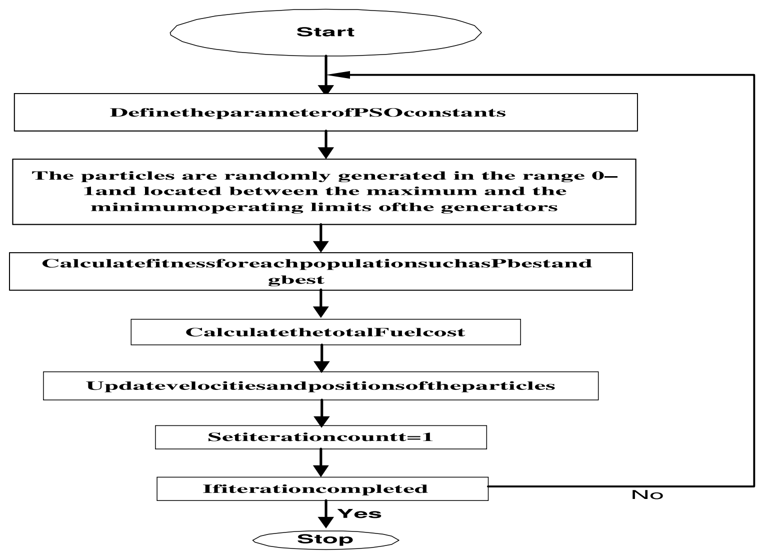

Fig4.1:Flow chartofTVACPSO

Above chapter deals with improvement techniques, original PSO, TVAC-PSO and PSOblessings. Ingiftthesiswe'veusedPSOandTVAC-PSOfortheanswerof theELDdrawback.

5. RESULT & DISCUSSION : The PSO method discussed earlier is applied to three test systems i.e. six, thirteen &fifteen generating units, while satisfying load demand [19], Here for 6, 13 and 15 generating unitcases transmission losses are neglected & program has been coded in MATLAB 7.5 and run onIntel Pentium(R) Dual Core CPU, 2.30 GHZ, RAM-2 GB, 64 bit OS, Window 2007 Dell PC.Standard data's of 6, 13 and 15 generating units test system are taken from reference [14, 19, 21,and25]&results obtained byproposed method aretypicallycompared with [19, 25, and 29, 36].

5.1 ExperimentalSettings

PSO is a population based stochastic optimization algorithm, hence results are taken as differentpopulation sizes i.e. 50, 75 and 100. For each population size, at least 50 trials have been taken &minimum, maximum & average costs of 50 trials are noted. PSO parameters also effects theperformanceof properselection ofPSO,so in presentwork c_1=c_2=2,No.ofiteration=50,ω_{min} =0.4&ω_{max}=0.9are considered.

5.2 Results&Discussion

Fortheaboveexperimentalsettingsresultsofvarioustestsystemsconsideredaregivenbelow:

TESTCASE 1

The test results are obtained for 6 generating unit system in which all units with their fuel costcoefficients. This system supplies a load demand of 1263 MW. The data for the individual unitsand transmission loss coefficients matrices are given in Table 5.1. The best result obtained byPSOforsixunitsystemwithlosscoefficientsand withoutlosscoefficientsisshowninTable5.
2.ResultsobtainedbyproposedPSOalgorithmarecomparedwithPSO[36]andDE[36]anditis seen that our proposed PSO gives better results than other methods mentioned above. Fig 5.3showsthe comparativetotalgenerationcost of differentalgorithm.

Table5.1
Capacitylimits andfuelcostcoefficients for6generatingunits forthe demandload of1263MW

Units	a_i($)	b_i($/Mw)	c_i($/Mw^2)	Pmin	Pmax
1	240	7	0.0070	100	500
2	200	10	0.0095	50	150
3	220	8.5	0.0090	80	300
4	200	11	0.0090	50	150
5	220	10.5	0.0080	50	200
6	190	12	0.0075	50	120

Table5.2

Resultsof6GeneratingUnitsafter50trials

Generatingunits	PSO Populationsize50		PSO[36]	DE[36]
	WithoutLoss	WithLoss	-	-
P1(MW)	429.354	461.4751	-	-
P2(MW)	133.4669	120.8947	-	-
P3(MW)	300	247.2173	-	-
P4(MW)	144.8439	150	-	-
P5(MW)	162.0876	191.3338	-	-
P6(MW)	93.2476	94.8865	-	-
Loss(MW)		2.807	-	-
Total PowerGeneration (MW)	1263	1265.807	1263	1263
Minimumcost	15308.17	15350.77	15456.67	15455
Cpu. Time(sec)	0.89	0.73	1.59	25.7689

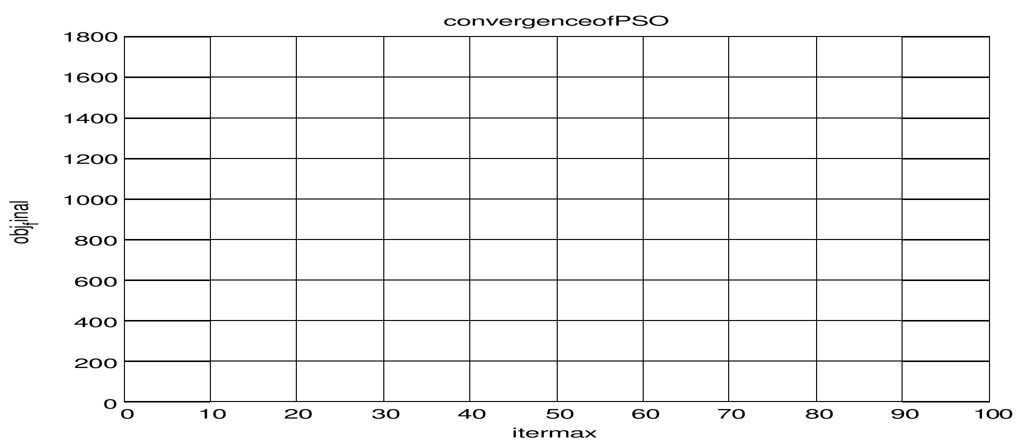

Fig.5.1 (a)Convergence characteristicofPSOfor6generatingunits(withloss).

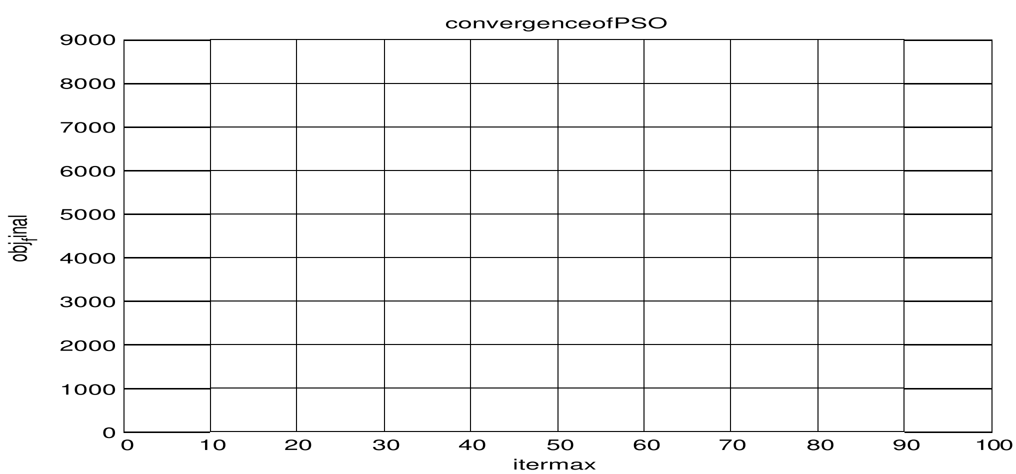

Fig.5.2 (b)ConvergencecharacteristicofPSOfor 6generatingunits(withoutloss).

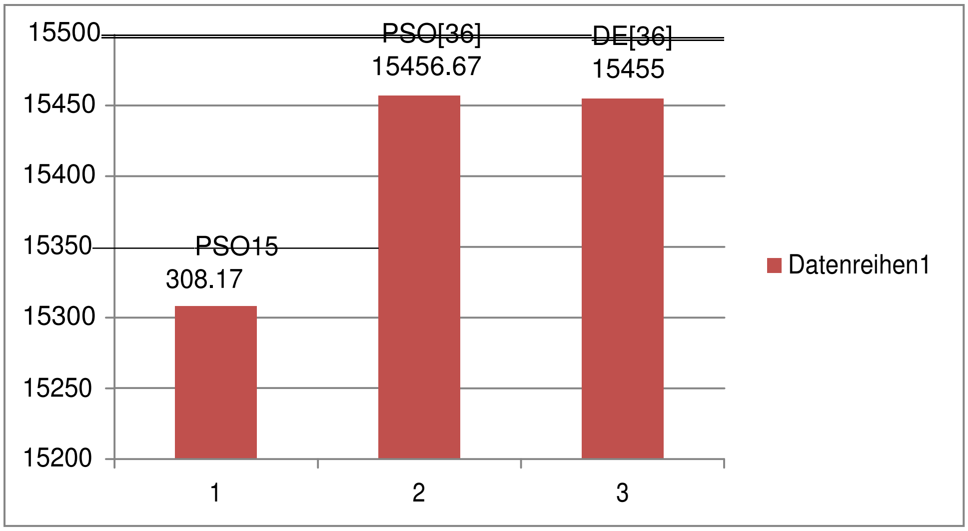

Fig.5.3Convergenceresultsof6generatingunits(withoutloss).

TESTCASE 2

The test results are obtained for 15 generating unit system in which all units with their fuelcost coefficients. This system supplies a load demand of 2630 MW. The data for the individualunits are given in Table 5.4. The best result obtained by PSO for different population size isshown in Table 5.5. Results obtained by proposed PSO algorithm are compared with PSOand DE and it is seen that our proposedPSO gives better results than other methodsmentionedabove.

Table5.3
Capacitylimits andfuelcostcoefficientsfor15generatingunitsforthedemand loadof2630MW

Units	a_i($)	b_i($/Mw)	c_i($/Mw^2)	Pmin	Pmax
1	671.03	10.07	0.000299	150	455
2	574.54	10.22	0.000183	150	455
3	374.59	8.80	0.001126	20	130
4	374.59	8.80	0.001126	20	130
5	461.37	10.40	0.000205	150	470
6	630.14	10.10	0.000301	135	460
7	548.20	9.87	0.000364	135	465

8	227.09	11.50	0.000338	60	300
9	173.72	11.21	0.000807	25	162
10	175.95	10.72	0.001203	20	160
11	186.86	11.21	0.003586	20	80
12	230.27	9.90	0.005513	20	80
13	225.28	13.12	0.000371	25	85
14	309.03	12.12	0.001929	15	55
15	323.79	12.41	0.004447	15	55

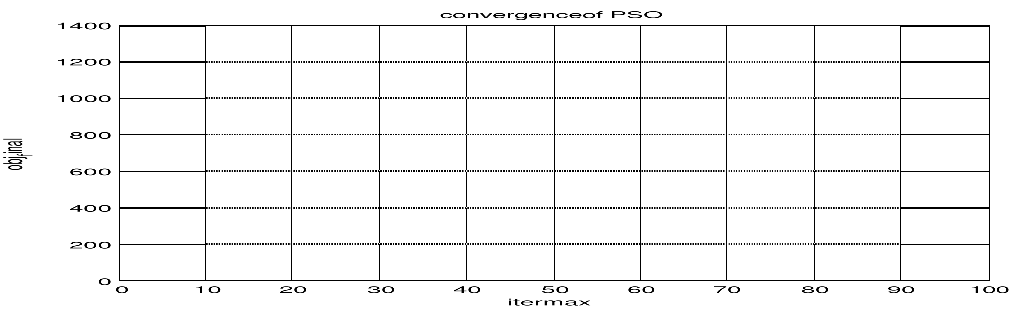

Fig.5.4Convergencecharacteristicof PSOfor50populationsizeof 15generatingunits.

Table5.4 Resultsfor15generating unitsafter50trials

Generatingunits	PSO			PSO[36]	DE[36]
	Populationsize				
	50	75	100		-
P1	350.6954	405.345	312.735	-	-
P2	309.5086	415.3405	455	-	-
P3	53.5735	102.4841	120.3598	-	-
P4	96.2559	127.4206	108.4275	-	-
P5	283.7532	354.7904	438.1031	-	-
P6	349.5598	460	225.4266	-	-
P7	465	376.5076	375.3483	-	-
P8	273.5866	64.3009	182.0772	-	-
P9	49.5369	25.4005	124.3079	-	-
P10	158.2293	136.7247	94.6955	-	-
P11	77.6709	40.7512	42.8043	-	-
P12	60.6102	36.6468	24.7375	-	-
P13	25	31.148	55.0594	-	-
P14	45.8074	22.4836	36.2255	-	-
P15	31.213	30.656	34.6924	-	-
Total powergeneration (MW)	2630	2630	2630	2630	2630
Minimum fuelcost($/hr)	33017.67	32554.56	32912.12	33665	35122
Minimumtime(sec)	0.51	0.54	0.63	00.75	23.01

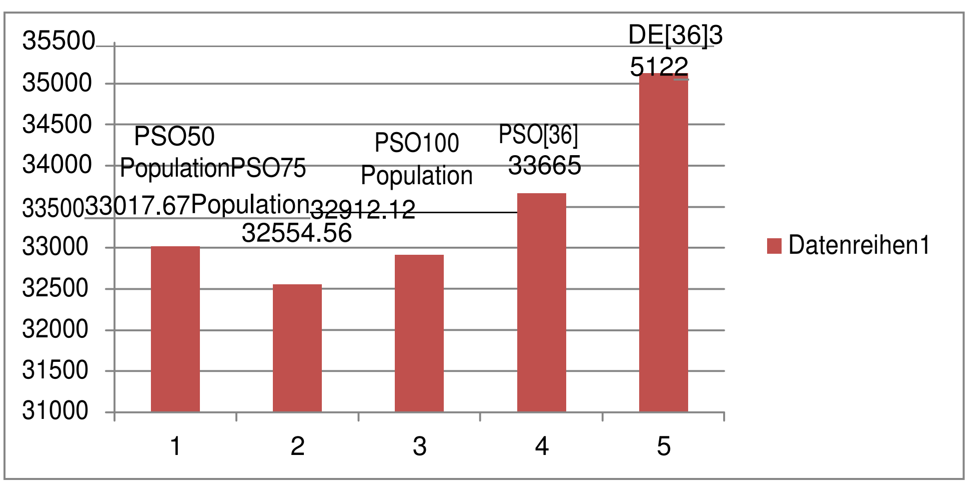

Fig.5.5Resultsofdifferentalgorithmfor15 generatingunits

TestCaseIII

In this case considered 13 generating unit systems for the load demand of 1800 MW. Thecapacity and cost coefficient of 13 generating unit system is shown in table 5.5. These given dataare tested on PSO and TVACPSO algorithm. The result obtained by PSO and TVAC PSO for 50runs is shown in table5.6. Conversance characteristic of PSO and TVACPSO are shown infigure5.4 and 5.5respectively.

Table5.5

Costcoefficientandcapacityfor 13 generatingunitsystemsforthedemandof1800MW

Gen.Units	a_i	b_i	c_i	P_i^{min}	P_i^{max}
1	0.00028	8.10	550	0	680
2	0.00056	8.10	309	0	360
3	0.00056	8.10	307	0	360
4	0.00324	7.74	240	60	180
5	0.00324	7.74	240	60	180
6	0.00324	7.74	240	60	180
7	0.00324	7.74	240	60	180
8	0.00324	7.74	240	60	180
9	0.00324	7.74	240	60	180
10	0.00284	8.60	126	40	120
11	0.00284	8.60	126	40	120
12	0.00284	8.60	126	55	120
13	0.00284	8.60	126	55	120

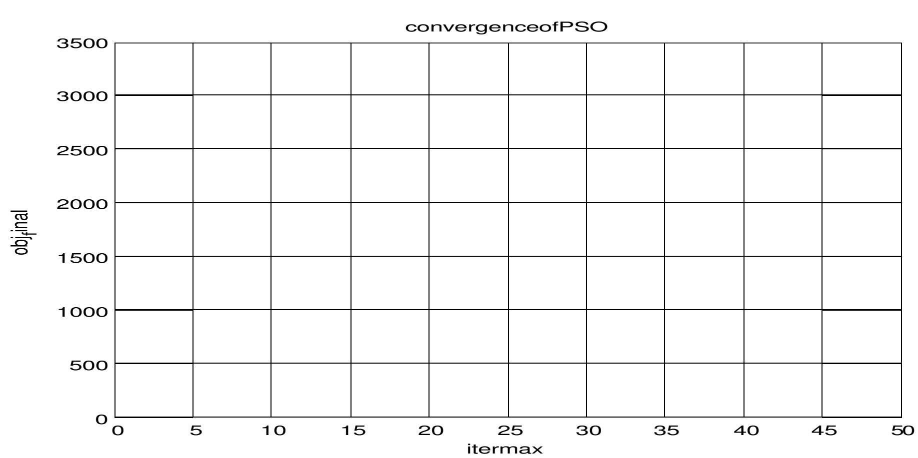

Fig.5.6.ConvergencecharacteristicofPSOfor13 generatingunits

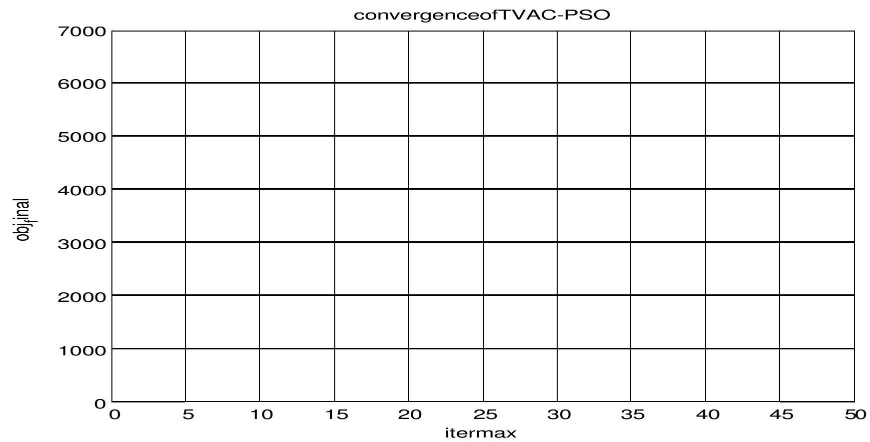

Fig.5.7.ConvergencecharacteristicofTVACPSOfor13 generatingunits

Table5.6

Resultsof13generatingunitsystemsforthedemandof1800MW

Generatingunits	PSO	TVAC-PSO
P1	530.813	445.06
P2	228.249	142.1269
P3	112.172	223.0765
P4	94.9472	94.5694
P5	121.948	92.7582
P6	115.117	154.034
P7	63.7752	160.67
P8	144.935	87.1845
P9	85.7846	151.522
P10	59.199	81.8955
P11	92.4675	59.9208
P12	71.1374	56.087
P13	79.454	51.13
PowerOutput(MW)	1800	1800
TotalCost($/h)	18022.64	18004.76
Computationtime (sec)	1.2032	1.1702

Results obtained by TVAC PSO shown in table 5.6,gives betterresults than simple PSO.Minimum total generation cost obtained by TVAC PSO is 18004.76 $/h and time taken forcomputationof1.1702sec,whereastotalgenerationobtainedby PSOof18022.64$/handcomputationtime taken of 1.2032 sec.

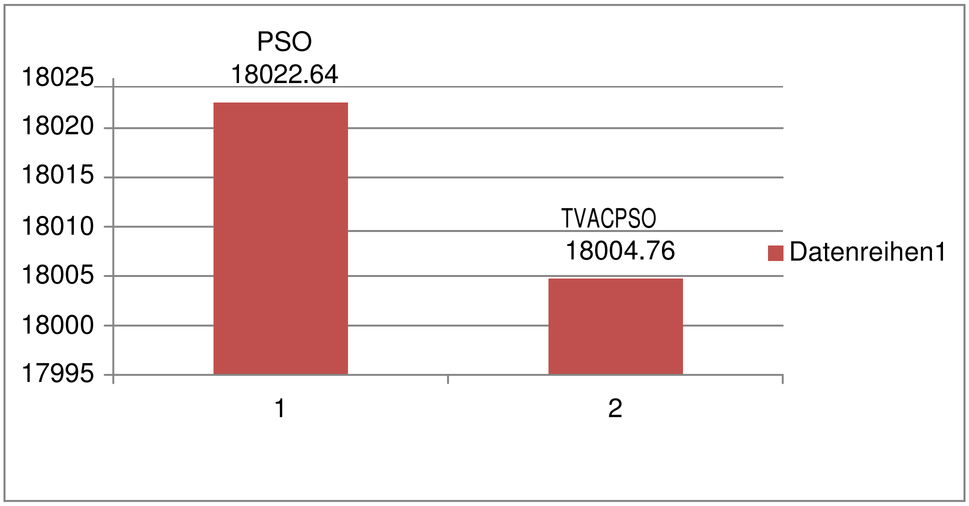

Fig.5.8Resultsof 13garnetingunits ofPSOandTVACPSO

6. CONCLUSION : Economic load dispatch in electric power sector is an important task, as it is required to supplythe power at the minimum cost which aids in profit-making. As the efficiency of newly addedgenerating units is more than previous units, hence economic load dispatch has to be efficientlysolved for minimizing the cost of generated power. Load dispatch problems are solved for fourdifferent test systems i.e. three, six, thirteen & sixteen units generating station. For each testsystem mentioned above economic load dispatch schedule has been determined by PSO andTVAC- PSO. The program has been coded in MATLAB version 7.5 and results are obtained,which are typically compared with the results available in Literature. The conclusions are arrivedonthe basis of performanceandcapabilityofPSO.

6.1 Conclusions

Detailed results of the economic load dispatch for all above test systems for 50 population sizesusing TVAC PSO are given in previous chapter. Here it shows that TVAC PSO is better thanPSOand othertechniques listed in literature.

REFERENCES

[1] M.E. EI- hawary & G.S. Christensen, "Optimal economic operatiom of Electrical powersystem,"NewYork,Academic,1979.

[2] MezgerAlfredoJ&KatiadeAlmeidaC,"Shorttermhydrothermalschedulingwithbilateral traction via bundle method," International Journal of Electrical power & Energysystem2007, 29(5), pp-387-396.

[3] MartinezLuisJose,LoraTrancosoAlicia&SantosRiquelmeJesus,"ShorttermhydrothermalcoordinationbasedoninteriorpointnonlinearprogrammingandgeneticAlgorithm,"IEEEporto power TechConfrence,2001.

[4] M. Gar CW, Aganagic JG,Tony Meding Jose B & Reeves S, "Experience with mixed integerlinearprogrammingbasedapproachonshorttermhydrothermalscheduling,"IEEEtransactionon power system2001;16(4),pp.743-749.

[5] G.Torres and V. Quintana, "On a non linear multiple-centrality corrections interior-pointmethodforoptimalpowerflow,"IEEE.transactiononpowersystem,vol.16,no2,2001,pp.222-228.

[6] K.Ng and G.Shelbe, " Direct load control –a profit-based load management using linearprogramming," IEEEtransactionon powersystem,vol.13,no.2,1998,pp.688-694.

[7] Shi CC, Chun HC, Fomg IK & Lah PB., " Hydroelectric generation scheduling with aneffective differential dynamic programming algorithm," IEEE transaction on power system1990,5(3),pp.737-743

[8] Erion Finardi C, silva Edson LD, & Laudia sagastizabal CV., "Solving the unit commitmentproblemofhydropowerplantsviaLagrangianrelaxationandsequentialquadraticprogramming,"Computaional &AppliedMathematics2005,24(3).

[9] Tkayuki S & Kamu W., " Lagrangian relaxation method for price based unit commitmentproblem,"Engineeringoptimizationtaylor Francis2004,pp.36-41.

