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Factual power loss lessening by synthetic supportive exploration algorithm

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ABSTRACT

In this work an innovative synthetic supportive exploration (SSE) algorithm is utilized for solving optimal reactive power problem. Projected algorithm is based on communication between two simulated fabulous creatures as both of them intermingle and voyage to altered zones to find comprehensive minimum. In a definite zone according to the climate altering conditions amount of food can be found will be varied. Due to this reason, fabulous creatures develop seasonal exodus deeds to find out improved food sources. Earlier to exodus fabulous creatures will divide into subgroups in order to find an improved food source. Coordination of sub-groups will determine the performance of the search. Communication and exploration are the two key deeds of the fabulous creatures. Also, the two fabulous creatures make a decision on the marauder and prey by the sub fabulous creature. Proposed synthetic supportive exploration (SSE) algorithm has been tested in IEEE 14 and 300 bus systems. Real power loss power loss reduction achieved.

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1. INTRODUCTION

Reactive power problem plays a key role in secure and economic operations of power system. Optimal reactive power problem has been solved by a various type of methods [1-6]. Never the less numerous scientific difficulties are found while solving problem due to an assortment of constraints. Evolutionary techniques [7-17] are applied to solve the reactive power problem, but the key problem is some algorithms stuck in local optimal solution and failed to balance the exploration and exploitation during the search of global solution. In this paper an innovative synthetic supportive exploration (SSE) algorithm is utilized for solving the problem. Projected algorithm is based on communication between two simulated fabulous creatures as both of them intermingle and voyage to altered zones to find out the comprehensive minimum. In a definite zone according to the climate altering conditions amount of food can be found will be varied. Due to this reason, fabulous creatures develop seasonal exodus deeds to find out improved food sources. Throughout the relocation progression, exploration deeds are continued to discover improved region. Communication deeds are significant actions among the living species and all fabulous creatures living in the similar habitat logically communicate with each other. Scrounger or marauder relationships may appear in alteration, co-extinction, and co-evolution or collaboration communications between fabulous creatures. It makes a decision on the marauder and prey by the sub fabulous creature. Marauder sub- fabulous creature follows the prey as progress in the direction of global minimum of the projected problem. Proposed synthetic supportive exploration (SSE) algorithm has been tested in IEEE 14 and 300 bus systems. Real power diminution achieved.

2. PROBLEM FORMULATION

Objective of the problem is to reduce the true power loss:

$$F = P_L = \sum_{k \in Nbr} g_k \left(V_i^2 + V_j^2 - 2V_iV_j\cos\theta_{ij}\right) \quad (1)$$

Voltage deviation given as follows:

$$F = P_L + \omega_v \times \text{Voltage Deviation} \quad (2)$$

Voltage deviation given by:

$$\text{Voltage Deviation} = \sum_{i=1}^{Npq} |V_i - 1| \quad (3)$$

Constraint (equality),

$$P_G = P_D + P_L \quad (4)$$

Constraints (inequality),

$$P_{gslack}^{min} \le P_{gslack} \le P_{gslack}^{max} \quad (5)$$

$$Q_{gi}^{min} \le Q_{gi} \le Q_{gi}^{max}, i \in N_g \quad (6)$$

$$V_i^{min} \le V_i \le V_i^{max}, i \in N \quad (7)$$

$$T_i^{min} \le T_i \le T_i^{max}, i \in N_T \quad (8)$$

$$Q_c^{min} \le Q_c \le Q_C^{max}, i \in N_C \quad (9)$$

3. SYNTHETIC SUPPORTIVE EXPLORATION ALGORITHM

Synthetic supportive exploration algorithm is based on communication between two simulated fabulous creatures as both of them intermingle and voyage to altered zones to find comprehensive minimum. In a definite zone according to the climate altering conditions amount of food can be found will be varied. Due to this reason, fabulous creatures develop seasonal exodus deeds to find out improved food sources. Earlier to exodus fabulous creatures will divide into subgroups in order to find an improved food source. Coordination of sub-groups will determine the performance of the search. Communication and exploration are the two key deeds of the fabulous creatures. Previous to migrate to a new-fangled region, fabulous creature transmit an explorer or voyager to gather information about the potential qualities of the migration region. After that explorer or voyager distribute the information with the fabulous creatures to collect their opinion for the prospective immigration to the new-fangled exposed region. Throughout the relocation progression, exploration deeds are continued to discover improved region. Creatures make a decision on the marauder and prey by the sub fabulous creature. Marauder sub-fabulous creature follows the prey as progress in the direction of global minimum of the projected problem.

$$\alpha_{i,j,r} = \text{random} \times \left(\text{high}_j - \text{low}_j\right) + \text{low}_j \quad (10)$$

$$\beta_{i,j,r} = \text{random} \times \left(\text{high}_j - \text{low}_j\right) + \text{low}_j \quad (11)$$

where $= ,2,3,..,Q$, $r = 1,2,3,..,$ maximum iteration

$$z_{r,\alpha} = f(\alpha_i), z_{r,\beta} = f(\beta_i) \quad (12)$$

Rule a. Computation of marauder individuals

If $random < random_{prey}$
$\text{Marauder} = \alpha\ , z_{\text{Marauder}} = z_{\alpha\ ,} key = 1$
Else
$\text{Marauder} = \beta\ , z_{\text{Marauder}} = z_{\beta\ ,} key = 1$
End

Rule b. Computation of Prey individuals
$\boldsymbol{if\ random < random_{prey} = \alpha\ elseprey = \beta end}$
Prey = early (prey)

Rule c. Computation of passive individual
$\boldsymbol{M_{P\times Q} = 1}$
For all elements in M
If $\boldsymbol{ifrandom < (p \times random) thenM_{random\ integers(P), random\ integers\ (Q)} = 0\ end}$
End
If $\boldsymbol{random} < (\boldsymbol{p} \times \boldsymbol{rnd})$ then
For i=1 to P
For j=1 to Q
If $\boldsymbol{ifrandom} < (\boldsymbol{p} \times \boldsymbol{random})$ then $\boldsymbol{M_{i,j} = 1\ or\ elseM_{i,j} = 0}$
End
End
For i=1 to P
$\boldsymbol{if \sum_{j=1}^{Q} M_i = Q\ thenM_{i,random\ integers(Q)} = 0}$
End

$$y = \text{ marauder} + G \times (prey - \text{marauder}) \tag{13}$$

Rule d. Decision rule to acquire the scale factor (G)
If $random < (p \times random)$then
$G = 4.00 \times random \times (random - random, l)$
Else
$G = \Gamma(4 \times random, l)$

Rule e. Location modernizing process use by lively individuals is given by
For i=1 to P
For j=1 to Q
$\boldsymbol{ifM_{i,j} > 0\ theny_{i,j} = \textbf{marauder}_{i,j} end}$
End
End

Rule f. Boundary manage method
For i=1 to P
For j=1 toQ
$\boldsymbol{if\left(z_{i,j} < low_j\right) \vee \left(z_{i,j} < high_j\right) then}$
$\boldsymbol{z_{i,j} = low_j + rand \times \left(high_j - low_j\right)}$
End
End
End

Rule g. Marauder sub-fabulous creature modernization
For i=1 to N
$\boldsymbol{iff(z_i) < y_{ipredator}, then}$
$\boldsymbol{marauder_i = z_i}$
$\boldsymbol{y_{imarauder} = f(z_i)}$
End
End
Rule h. Determination of new-fangled sub fabulous creatures for subsequent generations

If key = 1 then

$$\alpha = marauder\ , y_{\alpha} = y_{marauder}$$

Else

$$\beta = marauder\ , y_{\beta} = y_{marauder}$$

End

Initialize the parameters
Initialization of fabulous creatures
For iteration = 1 to maximum iteration
By applying Rule (a) compute marauder individuals
By applying Rule (b) find out Prey individuals
By using Rule d compute the scale factor (G)
Compute inactive individuals (Rule c)
Pick biological interaction locations with Rule c
Modernize genetical communication positions by lively individuals (Rule e)
Employ the frontier control modus operandi by using Rule f
Modernize marauder fabulous creatures by Rule g
Find out new-fangled fabulous creatures for subsequent generations (Rule h)
Stockpile the most excellent solution and its analogous fitness value
End
Output the most excellent result

4. SIMULATION RESULTS

At first in standard IEEE 14 bus system the validity of the proposed synthetic supportive exploration (SSE) algorithm has been tested and the comparison results are presented in Table 1. Figure 1 gives the details of comparison of real power loss. Then IEEE 300 bus system [18] is used as test system to validate the performance of the synthetic supportive exploration (SSE) algorithm. Table 2 shows the comparison of real power loss obtained after optimization. Figure 2 gives the comparison of real power values. Real power loss has been considerably reduced when compared to the other standard reported algorithms.

Table 1. Comparison of real power loss

Control variables	ABCO [19]	IABCO [19]	SSE
V1	1.06	1.05	1.00
V2	1.03	1.05	1.00
V3	0.98	1.03	1.03
V6	1.05	1.05	1.01
V8	1.00	1.04	0.90
Q9	0.139	0.132	0.101
T56	0.979	0.960	0.900
T47	0.950	0.950	0.900
T49	1.014	1.007	1.000
Ploss (MW)	5.92892	5.50031	4.20914

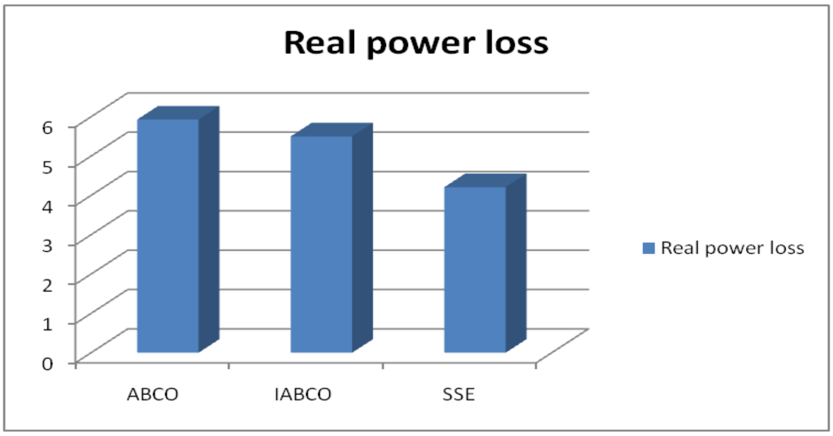

Figure 1. Comparison of real power loss

Table 2 Comparison of real power value

Parameter	Method CSA [20]	Method EGA [21]	Method EEA [21]	SSE
PLOSS (MW)	635.8942	646.2998	650.6027	615.9896

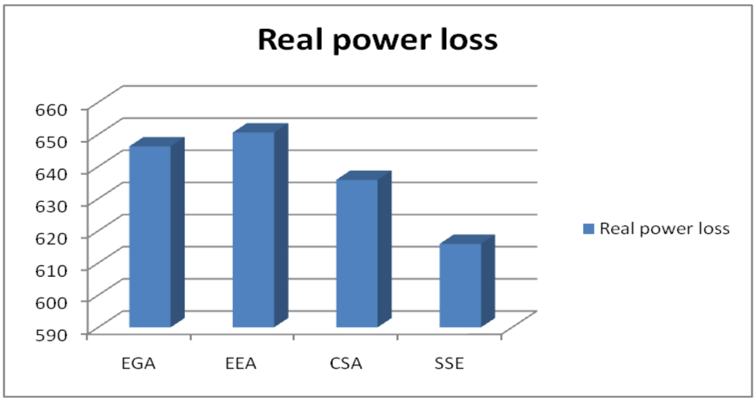

Figure 2. Comparison of active power losses

5. CONCLUSION

In this paper synthetic supportive exploration (SSE) algorithm reduced the power loss. Projected SSE algorithm is based on communication between two simulated fabulous creatures as both of them intermingle and voyage to altered zones to find comprehensive minimum. Every fabulous creature possesses P members and every sub extraordinary creature posses-Q associates, which correspond to facet of the problem. Furthermore, the two extraordinary creatures make a decision on the marauder and prey by the sub fabulous creature. Marauder sub- fabulous creature follows the prey as progress in the direction of global minimum of the projected problem. Proposed synthetic supportive exploration (SSE) algorithm validated in IEEE 14 and 300 buses test systems. Reduction of active power loss attained.

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