ATLANTIC BLUE MARLIN, BOOPS, CHIRONEX FLECKERI, AND GENERAL PRACTITIONER – SICK PERSON OPTIMIZATION ALGORITHMS

Submitted: 14th February 2024; accepted: 25th March 2024

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DOI: 10.14313/JAMRIS/3-2024/25

Abstract:
In this paper Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner- sick person (PS) optimization algorithm are applied for solving factual power loss reduction problem. Natural actions of Atlantic blue marlin are emulated to design the Atlantic blue marlin (ABM) optimization algorithm and populace in the examination space is capriciously stimulated. Boops optimization (BO) algorithm is designed by imitating the stalking physiognomies of Boops. CSO is based on the drive and search behavior of Chironex fleckeri. A general practitioner will treat a sick person with various procedures which have been imitated to model the Projected PS algorithm. Inoculation, medicine and operation are the procedures considered in the PS algorithm. Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithm validated in IEEE 57, 300 systems and 220 KV network. Factual power loss lessening, power divergence restraining, and power constancy index amplification have been attained.

Keywords: *atlantic blue marlin, Boops, Chironex fleckeri, general practitioner, sick person*

1. Introduction

Factual power loss reduction is aleadingfeature in theelectrical power transmission system. Manymethodologies are applied to solve the problem [5–11]. In this paper four algorithms have been defined and modeled to solve the factual loss reduction problem in an electrical power loss reduction in electrical power transmission system.

Key Objectives

Factual power loss lessening, power divergence restraining and power constancy index amplification are key objectives in this paper.

Design

The Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithm are all designed to be applied for solving the problem.

Atlantic Blue Marlin Optimization Algorithm

- Natural actions of Atlantic blue marlin (Fig. 1) are emulated to design the Atlantic blue marlin (ABM) optimization algorithm.
- Entrant solutions in the proposed ABM algorithm are Atlantic blue marlin, and the populace in the examination space is quixotically stimulated.
- Hegemony involves repetition of the unpretentious appropriate solution to succeeding generations.

Boops optimization algorithm

- Boops optimization (BO) algorithm is designed by imitating stalking physiognomies.
- As a cluster they stalk the quarry by forming the key and subordinate clusters. One Boops (Fig. 2) will set up pursuit behind the quarry and the accompanying Boops will form a wall such that the quarry can't move away.
- Once the victim reaches one of the Boops in the wall formation then inevitably it will be a fresh pursuer.

Chironex fleckeri search optimization algorithm

- The Chironex fleckeri search optimization (CSO) algorithm is based on the drive and search behavior of Chironex fleckeri (Fig. 3).
- Chironex fleckeri will exploit their limbs to paralyze their prey by injecting venom. Countless times in the ocean Chironex fleckeri's are massed overall and it is known as the spread of Chironex fleckeri (in a specific location).

Figure 1. Atlantic blue marlin

Figure 2. Boops

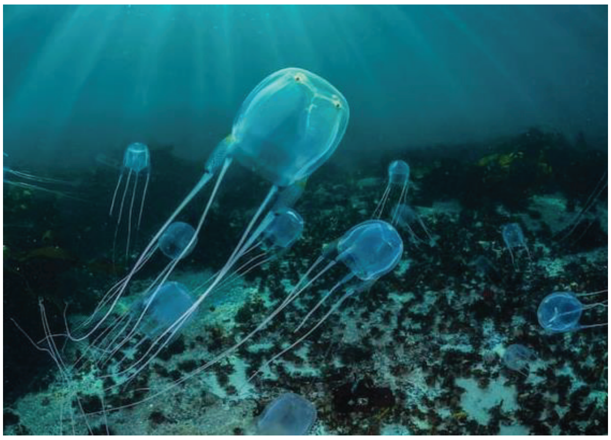

Figure 3. Chironex fleckeri

- When the circumstances are optimistic for them in the ocean Chironex fleckeri will form a swarm in to ocean currents.

General practitioner – sick person optimization algorithm

- General practitioner treats the sick person (Fig. 4) with various procedures; this has been imitated to model the projected PS algorithm.
- In general, people will be inoculated, With respect to disorder and disease – medical treatment will be given by medicines. If needed an operation on the sick person will be done which completely depends on the conditions.
- Inoculation, medicine, and operation are the procedures that have been considered as the phases of the projected PS algorithm.

Validation of the algorithms

The Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm and general practitioner – sick person (PS) optimization algorithm are validated in IEEE 57, 300 systems and 220 KV network.

Figure 4. Image representation of general practitioner treating the sick person

2. Problem Formulation

Power loss minimization is defined by

$$\text{Min } \tilde{F}\,(\overline{m},\overline{n}) \tag{1}$$

$$m = \begin{bmatrix} VG_1, \dots, VG_{Ng}; \\ QC_1, \dots, QC_{Nc}; T_1, \dots, T_{N_T} \end{bmatrix}$$

$$n = \begin{bmatrix} PG_{slack}; VL_1, \dots, VL_{N_{Load}}; \\ QG_1, \dots, QG_{Ng}; SL_1, \dots, SL_{N_T} \end{bmatrix} \tag{2}$$

m, n → control and dependent parameters

$$F_1 = P_{Min} = \text{Min}\left[\sum_{m}^{NTL} G_m \begin{bmatrix} V_i^2 + \\ V_j^2 - 2*V_iV_j\cos\emptyset_{ij} \end{bmatrix}\right]$$

$$F_2 = \text{Min}\left[\sum_{i=1}^{N_{LB}} \begin{matrix} \left|V_{Lk} - V_{Lk}^{desired}\right|^2 \\ + \sum_{i=1}^{Ng}\left|Q_{GK} - Q_{KG}^{Lim}\right|^2 \end{matrix}\right] \tag{3}$$

F — objective function
gk — conductance branch
Vi and Vj are voltages at buses i, j
Nbr — number of transmission lines
θ_{ij} — phase angles
V_{Lk} → Load voltage in k^{th} load bus
$V_{Lk}^{desired}$ → Voltage desired at the k^{th} load bus
Q_{GK} → reactive power generated at k^{th} load bus generators
Q_{KG}^{Lim} → reactive power limits
N_{LB}, Ng → number load and generating units

$$F_3 = \text{Min } L_{Max} : L_{Max} = \text{Max}\left[1 - [Y_1]^{-1}[Y_2] \times \frac{V_i}{V_j}\right] \tag{4}$$

$$0 = PG_i - PD_i - V_i \sum_{j \in N_B} V_j \left[G_{ij}\cos\left[\emptyset_i - \emptyset_j\right] + B_{ij}\sin\left[\emptyset_i - \emptyset_j\right]\right] \tag{5}$$

$$0 = QG_i - QD_i - V_i \sum_{j \in N_B} V_j \left[G_{ij}\sin\left[\emptyset_i - \emptyset_j\right] + B_{ij}\cos\left[\emptyset_i - \emptyset_j\right]\right] \tag{6}$$

NB → number of buses
PG → real power of the generator

QG $\rightarrow$ reactive power of the generator
PD $\rightarrow$ real load of the generator
QD $\rightarrow$ reactive load of the generator
Gij $\rightarrow$ mutual conductance of bus i and bus j
Bij $\rightarrow$ susceptance of of bus i and bus j
Equality and inequality constraints are defined as,

$$P_g^{min} \leq P_g \leq P_g^{max} \; : \quad Q_g^{min} \leq Q_g \leq Q_g^{max}, \; i \in N_g \tag{7}$$

$$VL_i^{min} \leq VL_i \leq VL_i^{max}, \; i \in NL$$

$$T_i^{min} \leq T_i \leq T_i^{max}, i \in N_T \tag{8}$$

$$Q_c^{min} \leq Q_c \leq Q_C^{max}, i \in N_C$$

$$|SL_i| \leq S_{L_i}^{max}, \; i \in N_{TL} \tag{9}$$

$$VG_i^{min} \leq VG_i \leq VG_i^{max}, \; i \in N_g \tag{10}$$

Pg $-$ active power of slack bus
Qg$-$ reactive power of generators
max, min $\rightarrow$ maximum and minimum value
VL_i $\rightarrow$ bus voltage magnitude
T_i $\rightarrow$ transformers tap ratio
Objective function in multi objective mode is defined as,

$$\mathrm{MOF} = F_1 + r_i F_2 + u F_3 = F_1 + \left[\sum_{i=1}^{NL} x_v \left[VL_i - VL_i^{min}\right]^2 + \sum_{i=1}^{NG} r_g \left[QG_i - QG_i^{min}\right]^2 \right] + r_f F_3 \tag{11}$$

$$VL_i^{minimum} = \begin{cases} VL_i^{max}, VL_i > VL_i^{max} \\ VL_i^{min}, VL_i < VL_i^{min} \end{cases} \tag{12}$$

$$QG_i^{minimum} = \begin{cases} QG_i^{max}, QG_i > QG_i^{max} \\ QG_i^{min}, QG_i < QG_i^{min} \end{cases} \tag{13}$$

nc $\rightarrow$ number of switchable reactive power sources
ng $\rightarrow$ number of generators
$nt \rightarrow number\ of\ transformers$

3. Atlantic Blue Marlin Optimization Algorithm

Atlantic blue marlins are rapacious predator ocean fish that school and can stalk sardines in groups, attack form the above herd the sardines dynamically and prey fish cannot escape and the prey fish cannot escape form the school of Atlantic blue marlin [1]. These habits of Atlantic blue marlin are emulated to design the Atlantic blue marlin (ABM) optimization algorithm for the power loss lessening problem.

Entrant solutions in the proposed ABM algorithm are Atlantic blue marlin, and the populace in the examination space is capriciously stimulated. In the penetrating space existing location of the ith adherent is defined as

$$ABM_{i,k} \in R \; (i = 1, 2, \dots, n)$$

Capricious location in the procedure is defined as,

$$ABM_L = \begin{bmatrix} ABM_{1,1} & ABM_{1,2} & \cdots ABM_{1,d} \\ ABM_{2,1} & ABM_{2,2} & \cdots ABM_{2,d} \\ \vdots & \vdots & \dots \vdots \\ ABM_{n,1} & ABM_{n,2} & \cdots ABM_{n,d} \end{bmatrix} \tag{14}$$

ABM_L $\rightarrow$ location of capricious location Atlantic blue marlin
Fitness rate is computed as,

$$ABM_L = \begin{bmatrix} f\left(ABM_{1,1} & ABM_{1,2} \cdots ABM_{1,d}\right) \\ f\left(ABM_{2,1} & ABM_{2,2} \cdots ABM_{2,d}\right) \\ \vdots & \vdots \quad \dots \vdots \\ f\left(ABM_{n,1} & ABM_{n,2} \cdots ABM_{n,d}\right) \end{bmatrix} = \begin{bmatrix} F_{ABM1} \\ F_{ABM2} \\ \vdots \\ F_{ABMn} \end{bmatrix} \tag{15}$$

The Sardine group is amalgamated in the Atlantic blue marlin approach and in the examination area it's whirling. At that time the sardines location and appropriateness are is computed as,

$$Sar_L = \begin{bmatrix} Sar_{1,1} & Sar_{1,2} & \cdots Sar_{1,d} \\ Sar_{2,1} & Sar_{2,2} & \cdots Sar_{2,d} \\ \vdots & \vdots & \dots \vdots \\ Sar_{n,1} & Sar_{n,2} & \cdots Sar_{n,d} \end{bmatrix} \tag{16}$$

where Sar_L specify the location of Sardines

$$Sar_L = \begin{bmatrix} f\left(Sar_{1,1} & Sar_{1,2} \cdots Sar_{1,d}\right) \\ f\left(Sar_{2,1} & Sar_{2,2} \cdots Sar_{2,d}\right) \\ \vdots & \vdots \quad \dots \vdots \\ f\left(Sar_{n,1} & Sar_{n,2} \cdots Sar_{m,d}\right) \end{bmatrix} = \begin{bmatrix} F_{Sar1} \\ F_{Sar2} \\ \vdots \\ F_{Sarn} \end{bmatrix} \tag{17}$$

Intermittently grander solutions can be misplaced while streamlining the location of examination representatives and fresh locations may be more meager than the preceding locations so grander selection is linked. Hegemony involves repetition of the unpretentious appropriate solution to succeeding generations. The location of the grander Atlantic blue marlin and the bruised sardines which own the superlative appropriateness rate is indicated as,

$$Z_{H\_ABM}^i ; Z_{B\_Sar}^i$$

where $Z_{H\_ABM}^i$ specify Hegemony Atlantic blue marlin $Z_{B\_Sar}^i$ indicate the bruised Sardines.
In the proposed Atlantic blue marlin approach the fresh location of Atlantic blue marlin designated as,

$$Z_{Fresh_{ABM}}^i = Z_{H\_ABM}^i - \delta_i \times \left(R\,(0,1) \times \left(\frac{Z_{H\_ABM}^i + Z_{B\_Sar}^i}{2} \right) - Z_{pr\ ABM}^i \right) \tag{18}$$

$$\delta_i = 2.0 \times R\,(0,1) \times pc - pc$$

where R is random and pd is prey compactness

$$sar = 1 - \left(\frac{no.of \text{ Atlantic blue marlin}}{no.of \text{ Atlantic blue marlin} + no.of \text{ Sardines}} \right)$$

Throughout the stalking the fresh location of the Sardines is specified as,

$$Z^i_{Fresh\_Sar} = R \times \left(Z^i_{H\_ABM} - Z^i_{pr\ ABM} + BC\_ABM \right) \quad (19)$$

where BC_{ABM} specify Bout control of Atlantic blue marlin
$Z^i_{pr\ ABM}$ indicate preceding Atlantic blue marlin

$$BC = m \times (2 \times iter \times \vartheta)$$

Through Bout control quantity of Sardines will streamline the location (α), parameter no. (β),

$$\alpha = \text{Q\_Sar} \times BC$$

$$\beta = par \times BC$$

Q_Sar specify the quantity of Sardines
Probabilities of Atlantic blue marlin to stalk fresh Sardines is defined as,

$$Z^i_{ABM} = Z^i_P \ if \ f\ (Sar_i) < f\ (ABM_i) \quad (20)$$

1) Start
2) Engender the Atlantic blue marlin population
3) Arbitrarily Create population of Sardines
4) Factor values are selected
5) Compute the fitness rate of Atlantic blue marlin
6) Compute the fitness rate of Sardines
7) Fix Hegemony Atlantic blue marlin
8) $Set\ \ the$ bruised Sardines
9) $While\ stop$ criterion not attained
10) $For\ each$ Atlantic blue marlin$compute\ the\ value\ of\ \delta_i$
11) $\delta_i = 2.0 \times R\ (0,1) \times pc - pc$
12) Rationalised the Atlantic blue marlin location
13) $Z^i_{Fresh_{ABM}} = Z^i_{H\_ABM} - \delta_i \times \left(R\ (0,1) \times \left(\frac{Z^i_{H\_ABM} + Z^i_{B\_Sar}}{2} \right) - Z^i_{pr\ ABM} \right)$
14) End for
15) Calculate the Bout control of Atlantic blue marlin
16) BC = m× (2 × iter×ϑ)
17) while BC < 0.5 ; $compute\ \alpha\ and\ \beta$
18) α= Q_Sar×BC
19) β= par×BC
20) Select the set of Sardines based on α and β
21) Rationalized the location of Sardines
22) $Z^i_{Fresh\_Sar} = R \times \left(Z^i_{H\_ABM} - Z^i_{pr\ ABM} + BC\_ABM \right)$
23) End if
24) Calculate fitness rate of all Sardines
25) Once superior Sardines found then exchange with bruised Sardines
26) $Z^i_{ABM} = Z^i_P \ if \ f\ (Sar_i) < f\ (ABM_i)$
27) At that moment engender the populace and remove the hunted Sardines
28) Streamline the premium Atlantic blue marlin
29) Rationalise the finest Sardines
30) End if
31) End while
32) Return best Atlantic blue marlin
33) End

4. Boops Optimization Algorithm

Boops optimization (BO) algorithm is designed by imitating the actions of Boops. Boops possess the obliging stalking physiognomies [2]. As a cluster they stalk the quarry by forming the key and subordinate bunches. One Boops will start pursuit behind the quarry and the waiting Boops will form a wall such that quarry can't move away. Once the victim reaches one of the Boops which is in the wall formation then inevitably it will be a fresh pursuer. Boops which is a pursuer will be converted to wall maker and Boops which is wall formation may be turned to be a pursuer depending upon location and circumstances. The examination area is created on the foundation of a stalking zone. Contingent on the three-dimensional dissemination of the entity's populace and substitute clusters Boops optimization (BO) algorithm is designed.

Boops population is capriciously created,

$$\{Boops_1, Boops_2, \ldots, Boops_n\}$$

Limitations – maximum and minimum are expressed as,

$$max_j\ ,\ min_j$$

Then the resolution parameters are expressed as

$$Boops_i \in Boops\ ;\ Boops_i = \left\{ Boops^1_i, Boops^2_i, \ldots, Boops^n_i \right\} \quad (21)$$

$$Boops^j_i = R \cdot \left(max_j\ - min_j \right) + min_j; \quad i = 1, 2, 3.., n\ ; j = 1, 2, 3.., m \quad (22)$$

The entire populace of Boops will be alienated into substitute population and clusters are designed for amalgamated stalking. Boops optimization approach has $bunch_b$ – $\sigma_p\ and\ \sigma_w$.

$where\ \partial_p, \partial_w\ are$ pursuer and wall boops

The info will be fixed on the foundation of the populace of Boops, then the info ideas $\{Boops_1, Boops_2, \dots, Boops_n\}$ and shaped error ρ_r in the $bunch_b$ is defined as,

$$e\,(bunch_b) = \sum_{Boops_g \in bunch_b} \left\| Boops_g - \rho_r \right\|^2;$$

$$g = 1, 2, \dots, h\,;\, bunch_b = 1, 2, \dots, k \qquad (23)$$

For $bunch_b$ the quantity of aligned error rate is described as,

$$AE\,(b) = \sum_{b=1}^{k} e\,(bunch_b) \qquad (24)$$

Throughout stalking there will be one Pursuer Boops and its location will be altered, which will be contingent to place and drive of the victim. Selecting the Pursuer Boops among the bunch will be grounded on the victim location; at any instant once the victim touch the Boops which is in wall formation, at that time that specific Boops will be the fresh pursuer. At that juncture the fresh position of the pursuer Boops is defined as,

$$Fresh\,(\sigma_p^{t+1}) = present\ location\,(\sigma_p^t) + \alpha \oplus L\,(\beta)\ \ 0 < \beta \le 2 \qquad (25)$$

In this projected Boops optimization (BO) algorithm β is employed for the regulating of the phase size then the rate will be augmented.

$$\beta = 2.0 + \frac{0.001 \cdot t}{t_{max}/10} \qquad (26)$$

Levy (L) [5] is smeared as,

$$R\ (S) = \alpha \oplus L\,(\beta) \sim \alpha \left(\frac{u}{|v|^{1/\beta}} \right) \cdot (\sigma_p^t - \sigma_{best}^t) \qquad (27)$$

$$\mathrm{u} \sim \mathrm{N}\left(0, \sigma_\mathrm{u}^2\right) \quad \mathrm{v} \sim \mathrm{N}\left(0, \sigma_\mathrm{v}^2\right)$$

$$\sigma_\mathrm{u} = \left\{ \frac{\Gamma\,(1+\beta)\sin\,(\pi\beta/2)}{\Gamma\,[(1+\beta)\,/2]\,\beta 2^{(\beta-1)/2}} \right\}^{1/\beta}, \sigma_\mathrm{v} = 1$$

Grounded on the levy dissemination, the fresh location of the pursuer Boops is defined as

$$Fresh\,(\sigma_p^{t+1}) = \sigma_b^t + R\ (S) \qquad (28)$$

Fresh location of pursuer Boops rendering to comprehensive finest is defined as,

$$\sigma_{best}^{t+1} = \sigma_{best}^t + Q' \qquad (29)$$

$$Q' = \alpha \left(\frac{u}{|v|^{1/\beta}} \right)$$

In the stratagem of the stalking the wall Boops σ_w is,

$$\sigma_w \in Boops$$

Rendering to the location of the victim, the fresh place of σ_w is defined as,

$$\sigma_w^{t+1} = S_w \cdot e^b \cdot \cos 2\pi\rho\ + \sigma_w \qquad (30)$$

Space amongst wall and pursuer Boops is mathematically described as,

$$S_w = \left| R \cdot \sigma_p^t - \sigma_w^t \right| \qquad (31)$$

$$\{\sigma_p^t, \sigma_w^t\} \in bunch_b$$

At any instant the pursuer Boops will turn out to be a wall Boops and vice versa. It is contingent on the appropriateness rate of the role. If a unique zone has been entirely exploited, at that moment instantly alteration of the zone will happen, and it will be defined as,

$$Boops_n^{t+1} = \frac{\sigma_{best} + Boops_n^t}{2} \qquad (32)$$

1) Start
2) Initialize the Boops population
3) $\{Boops_1, Boops_2, \dots, Boops_n\}$
4) Compute the fitness value
5) $Identify\ the\ \sigma_{best}$
6) $Divide\ the$ Boops populationinto bunches
7) $\{bunch_1, bunch_2, ..bunch_b\}$
8) $For\ every\ bunch\ identify\ \sigma_p\ and\ \sigma_w$
9) $While\ (t\ <\ tmax)$
10) For each $bunch_b$
11) Apply stalking agenda for pursuer Boops
12) Apply wall plan for another set of Boops
13) Calculate the fitness rate for Boops
14) $if\ \sigma_w\ fitness\ rate\ > \sigma_p\ then$
15) Exchange the role by streamlining σ_p
16) End If
17) $if\ \sigma_p\ fitness\ rate\ > \sigma_{best}\ then$
18) Streamline σ_{best}
19) End If
20) $if\ \sigma_p\ fitness\ rate\ is\ not\ improved,\ then$
21) $u\ \leftarrow\ u\ +\ 1$
22) End If
23) $if\ u > \delta$
24) Apply an agenda for changing the zone
25) $u\ \leftarrow\ 0$
26) End If
27) End For
28) $t \leftarrow\ t + 1$
29) End While
30) Return the σ_{best}
31) End

5. Chironex Fleckeri Search Optimization Algorithm

The Chironex fleckeri search optimization (CSO) algorithm is designed to solve the problem. CSO is based on the drive and search behavior of Chironex fleckeri. Obviously Chironex fleckeri will exploit their limbs to paralyze their prey by injecting the venom [3]. Chironex fleckeri will exploit their limbs to paralyze their prey by injecting venom. Countless times in the ocean Chironex fleckeri's are massed overall and it is known as the spread of Chironex fleckeri (in a specific location). When the circumstances are optimum in the ocean Chironex fleckeri will form a swarm, and using currents. But Chironex fleckeri won't be marooned at any location. With attention paid to the nutrition location and amount of nutrition Chironex fleckeri movement will be spurred and also once the nutrition availability is extraordinary in that location every Chironex fleckeri will move in the swarm. Because of ocean currents offer a banquet at that time the Chironex fleckeri will converge.

Unsurprisingly, the ocean currents direct more quantity of nutrition will be there and Chironex fleckeri fascinated (sg) towards that. Scientifically it can be demarcated as,

$$\overrightarrow{Sg} = \frac{1}{n_{pop}} \sum \overrightarrow{Sg_i} \quad (33)$$

$$\sum \overrightarrow{Sg_i} = \sum \left(Z^* - E_f Z_i\right) = Z^* - E_f \frac{\sum Z_i}{n_{population}} = Z^* - E_f \mu \quad (34)$$

$E_f \mu \rightarrow$ difference between present and average position of all Chironex fleckeri

The crusade of the Chironex fleckeri may be due to ocean currents and it will find passage inside the swarm. In this paper a point – in-time dealing system has been premeditated to rule the switching between the movements. Logically Chironex fleckeri passage in the direction of the accessibility of nutrition is extraordinary. Perceptibly the magnetism towards compactness of the nutrition place is high and the crusade of all Chironex fleckeri will flow towards that position. Place and analogous objective function will describe the amount of the nutrition.

Then $\overrightarrow{Sg}$ is determined by,

$\overrightarrow{Sg} = Z^* - difference\ between\ present$ $and\ average\ position\ of\ all$ Chironex fleckeri

Z^* *is* present best position of Chironex fleckeri,

n_{pop} indicates the number of Chironex fleckeri

μ *is* average location of Chironex fleckeri (35)

In all magnitudes of Chironex fleckeri maintain a distance of $\pm\beta\sigma$ (postulate) in a standard three-dimensional ruckus mode ($\sigma - standard\ deviation$).

$Difference\ between\ presentand\ average$ $position\ of\ all$ Chironex fleckeri $= \beta \times \sigma \times R^f\ (0,1)$ (36)

$$\sigma = R^{\alpha}\ (0,1) \times \mu$$

$Difference\ between\ present\ and$ $average\ position\ of\ all$ Chironex fleckeri

$$= \beta \times \sigma \times R^f\ (0,1) \times R^{\alpha}\ (0,1) \times \mu \quad (37)$$

$Difference\ between\ present\ and$ $average\ position\ of\ all$ Chironex fleckeri

$$= \beta \times R(0,1) \times \mu \quad (38)$$

$$E_f = \beta \times R\ (0,1) \quad (39)$$

$$\overrightarrow{Sg} = Z^* - \beta \times R(0,1) \times \mu \quad (40)$$

Every Chironex fleckeri fresh position is computed by,

$$Z_i\ (t+1) = Z_i\ (t) + R\ (0,1) \times \overrightarrow{Sg} \quad (41)$$

$$Z_i\ (t+1) = Z_i\ (t) + R\ (0,1) \times Z^* - \beta \times R\ (0,1) \times \mu; \quad \beta - dcf \quad (42)$$

Primarily most of the Chironex fleckeri move actively but in concluding stages it moves to passive method. Once the Chironex fleckeri passes in active manner then the position is demarcated as,

$$Z_i\ (t+1) = Z_i\ (t) + \gamma \times R\ (0,1) \times (max - min)\ ; \gamma - mc \quad (43)$$

Mathematical design for the passive crusade of Chironex fleckeri is premeditated. It is grounded on the crusade of the Chironex fleckeri in the direction of the nutrition obtainability. Once a Chironex fleckeri passes from a position in the direction of another position in a certain habitation at that moment there will be reposition of the Chironex fleckeri and this aspect imitates the local exploration. In this segment exploitation has been accomplished. The drive (p) defined as,

$$\vec{P} = z_i\ (t+1) - z_i\ (t) \quad (44)$$

$$\vec{P} = R\ (0,1) \times \overrightarrow{dir} \quad (45)$$

$$\overrightarrow{dir} = \begin{cases} Z_j\ (t) - Z_i\ (t)\ \ if\ f\ (Z_i) \geq f\left(Z_j\right) \\ Z_j\ (t) - Z_i\ (t)\ \ if\ f\ (Z_i) < f\left(Z_j\right) \end{cases} \quad (46)$$

$$Z_i\ (t+1) = Z_i\ (t) + \overrightarrow{dir} \quad (47)$$

The drive of the Chironex fleckeri in active, passive and throughout ocean streams is organized by an idea in time handling organization (THO).

$$THO = \left| \left(1 - \frac{1}{Max_{iter}}\right) \times (2 \times R\ (0,1) - 1) \right| \quad (48)$$

Logistic chaotic [5] equation for the populace initialization is demarcated as,

$$Z_{i+1} = \eta Z_i\,(1 - Y_i)\,, 0 \leq Z_0 \leq 1; Z_0 \in (0,1)\,;$$
$$Z_0 \notin \{0.00,\ 0.25, 0.75, 0.5, 1.0\}\,; \eta = 4.00 \quad (49)$$

Limit settings are demarcated for the Chironex fleckeri, ever since as soon as they passage yonder the limit then it has to bind back to the margin.

$$\begin{cases} Z'_{i,d} = \left(Z_{i,d} - max_d\right) + min\ (dim)\, if Z_{i,d} > max_d \\ Z'_{i,d} = \left(Z_{i,d} - min_d\right) + max\ (dim)\, if Z_{i,d} > min_d \end{cases} \quad (50)$$

1) Start
2) Initialization of parameters
3) Exploration space, extreme number of iterations and population size are prefixed
4) Population of Chironex fleckeri initialized by applying logistic chaotic map
5) $Z_i\left(i = 1, 2, 3, \ldots, n_{pop}\right)$
6) Nutrition volume is computed – Z_i; i.e. $f(Z_i)$
7) Position of the Chironex fleckeri recognised with nutrition obtainability (z^*)
8) $Time\ : t = 1$
9) Repeat
10) $for\ i = 1; n_{pop} do$
11) Calculation of time handling organization (THO).
12) $\{\ start$

    $for\ i = 1; n_{population} do$

    $Compute$ time handling organization (THO)

    $THO = \left|\left(1 - \frac{1}{Max_{iter}}\right) \times (2 \times R\,(0,1) - 1)\right|$

    $if\ THO \geq 0.50\,; then$ Chironex fleckeri follow ocean stream

    $Otherwise$ Chironex fleckeri move into the swarm

    $if\ R\,(0,1) > (1 - THO)\,; then$

    Chironex fleckeri is in active movemnet

    $Otherwise$ Chironex fleckeri is in passive movemnet
13) $if\ THO \geq 0.50\,; then$ Chironex fleckeri follow ocean stream
14) Determine Ocean stream
15) $\overrightarrow{Sg} = Z^* - \beta \times R(0,1) \times \mu$
16) Fresh position of Chironex fleckeri is determined
17) $Z_i\,(t+1) = Z_i\,(t) + R\,(0,1) \times Z^* - \beta \times R\,(0,1) \times \mu;\ \beta - dcf$
18) Otherwise Chironex fleckeri passage into swarm
19) $if\ R\,(0,1) > (1 - THO)\,; then$ Chironex fleckeri is in active movement
20) Fresh position is determined
21) $Z_i\,(t+1) = Z_i\,(t) + \gamma \times R\,(0,1) \times (max - min)\,; \gamma - mc$
22) Otherwise Chironex fleckeri in passive movement
23) Identify the Chironex fleckeri direction
24) $\overrightarrow{dir} = \begin{cases} Z_j\,(t) - Z_i\,(t)\ \ if\ f\,(Z_i) \geq f\left(Z_j\right) \\ Z_j\,(t) - Z_i\,(t)\ \ if\ f\,(Z_i) < f\left(Z_j\right) \end{cases}$
25) Find the Fresh position of Chironex fleckeri
26) $Z_i\,(t+1) = Z_i\,(t) + \overrightarrow{dir}$
27) End if
28) End if
29) Limit conditions are tested
30) In fresh position amount of nutrition checked
31) Position of the Chironex fleckeri (Z_i)rationalized
32) Position of the Chironex fleckeri which own plentiful nutrition(z^*)
33) End for i
34) $t = t + 1$
35) $t > Max_{iter}$
36) $output\ the\ best\ results$
37) End

6. General Practitioner-Sick Person Optimization Algorithm

In the real time world a general practitioner will treat as sick person with various procedures. This process has been imitated to model the projected general practitioner – sick person (PS) optimization algorithm algorithm. In general people will be inoculated and then with respect to disorder and disease, – medical treatment will be given by medicines [4]. At utmost an operation on the sick person will be done which completely depends on the conditions. Inoculation, medicine, and operation are the procedures that have been considered as the phases of the projected PS algorithm.

Population is created on the basis of numbers of the sick person treated by the general practitioner and mathematically defined as follows,

$$V = \begin{bmatrix} \begin{bmatrix} V_1 \\ \cdot \\ \cdot \\ V_i \\ \cdot \\ \cdot \\ V_N \end{bmatrix} \begin{bmatrix} v_1^1 & \cdots & v_1^o \\ \vdots & \ddots & \vdots \\ v_N^1 & \cdots & v_N^o \end{bmatrix} \end{bmatrix} \quad (51)$$

Where "V" is the sick person's population, "O and "N" are the number of variables and sick person. Inoculation, medicine, and operation are the processes that have been considered as the phases of the projected PS algorithm.

$$Quantity\ of\ Inoculation_i = 2.00 - Fitness_i^n / Fitness_{best}^n \quad (52)$$

$$Fitness_i^n = Fitness_i - Fitness_{worst} / \sum_{j=1}^{n} \begin{pmatrix} Fitness_i \\ -Fitness_{worst} \end{pmatrix} \quad (53)$$

$$Fitness_{worst} = Maximum(Fitness) \quad (54)$$

$$V_{worst} = V\ (location\ (Fitness_{worst})) \quad (55)$$

$$Fitness_{Best} = Minimum\ (Fitness) \quad (56)$$

$$V_{Best} = V\ (location\ (Fitness_{Best})) \quad (57)$$

V_{worst} and V_{Best} are the position of the Sick person

In the first phase people are get Inoculation and it mathematically formulated as follows,

$$I_i^d = Random\ (R) \times \left(Quantity\ of\ Inoculation_i \times v_i^d - v_{worst}^d\right); \quad R \in [0-1] \quad (58)$$

$$I_i^d = Random\ (R) \times \left(Quantity\ of\ Inoculation_i \times v_i^d - v_{best}^d\right); \quad R \in [0-1] \quad (59)$$

With respect to disorder and disease – treatment will be given by medicines and it formulated as follows,

$$M_i^d = R(R) \times \begin{pmatrix} v_{Best}^d - \\ Quantity\ of\ Inoculation_i \times v_i^d \end{pmatrix} \quad (60)$$

$$V_i = \begin{cases} V_i + M_i\ ,\ Fitness(V_i - M_i) \leq Fitness_i \\ V_i\ ,\ otherwise \end{cases} \quad (61)$$

When the condition of the Sick person is very stern, then the General practitioner will move towards the performance of the operation and it has been mathematically defined as follows,

$$V_i = \begin{cases} 0.59 \times V_i + 0.39 \times V_{Best},\ Fitness_{Best}^n - \\ Fitness_i^n \geq 0.89 Fitness_{Best}^n \\ V_i\ ,\ otherwise \end{cases} \quad (62)$$

1) Begin
2) Determine the values for the parameters
3) Preliminary population of sick person engendered
4) $For\ iteration = 1; iteration\ maximum$
5) Compute the fitness value
6) Modernize the value of $Fitness_{worst}$ and V_{worst}

   $Fitness_{worst} = Maximum(Fitness)$

   $V_{worst} = V\ (location\ (Fitness_{worst}))$
7) Modernize the value of $Fitness_{Best}$ and V_{Best}

   $Fitness_{Best} = Minimum\ (Fitness)$

   $V_{Best} = V\ (location\ (Fitness_{Best}))$
8) Modernize the value of $Fitness_i^n$

   $$Fitness_i^n = \begin{matrix} Fitness_i - \\ Fitness_{worst} \end{matrix} / \sum_{j=1}^{n} \begin{pmatrix} Fitness_i \\ -Fitness_{worst} \end{pmatrix}$$
9) $For\ i = 1; N$
10) Modernize the value of $Quantity\ of\ Inoculation_i$

   $$Quantity\ of\ Inoculation_i = 2.00 - Fitness_i^n / Fitness_{best}^n$$
11) Modernize V_i

   $$I_i^d = Random\ (R) \times (Quantity\ of\ Inoculation_i \times v_i^d - v_{worst}^d); \quad R \in [0-1]$$

   $$I_i^d = Random\ (R) \times (Quantity\ of\ Inoculation_i \times v_i^d - v_{best}^d); \quad R \in [0-1]$$
12) Modernize V_i

   $$M_i^d = Random(R) \times (v_{Best}^d - Quantity\ of\ Inoculation_i \times v_i^d)$$

   $$V_i = \begin{cases} V_i + M_i\ ,\ Fitness(V_i - M_i) \leq Fitness_i \\ V_i\ ,\ otherwise \end{cases}$$
13) Modernize V_i

   $$V_i = \begin{cases} 0.59 \times V_i + 0.39 \times V_{Best}, \\ Fitness_{Best}^n - Fitness_i^n \\ \geq 0.89 Fitness_{Best}^n \\ V_i\ ,\ otherwise \end{cases}$$
14) $Fitness_{Best}\ and\ V_{Best} are\ saved$
15) $Return\ the\ most\ excellent\ solution$
16) End

7. Simulation Study

Atlantic blue marlin (ABM) optimization algorithm,Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithmare validated in IEEE 57 bus system [13]. Table 1 shows the factual power loss (FLO (MW)), Voltage deviation (VDT (PU)) and Voltage stability (VSL (PU)). Figures 5–7 show the assessment of FLO, VDT and VSL.

Table 1. Assessment of Parameters (IEEE 57 Bus)

Method	FLO (MW)	VDT(PU)	VSL(PU)
IMCOA [6]	24.5358	0.6711	0.2757
MEAI [7]	26.8800	1.0642	0.2529
ERPSO [8]	27.8300	1.1000	0.3000
ADFO [9]	24.2500	1.0179	0.2824
EEGA [10]	25.6400	1.0910	0.3120
SIDE [11]	21.9452	0.6012	0.0948
SDWO [12]	23.3235	0.5855	0.2561
ABM	20.3812	0.5253	0.3213
BO	19.9918	0.5249	0.3215
CSO	20.4001	0.5258	0.3209
PS	19.9939	0.5251	0.3210

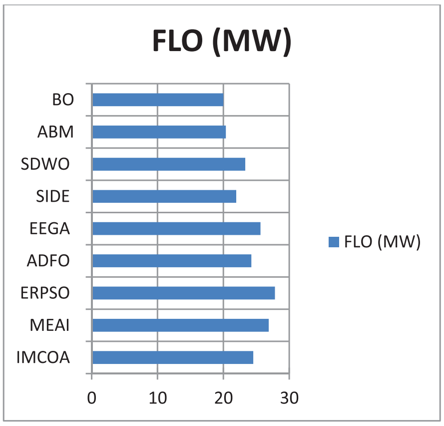

Figure 5. Assessment of FLO (MW)(IEEE 57 bus)

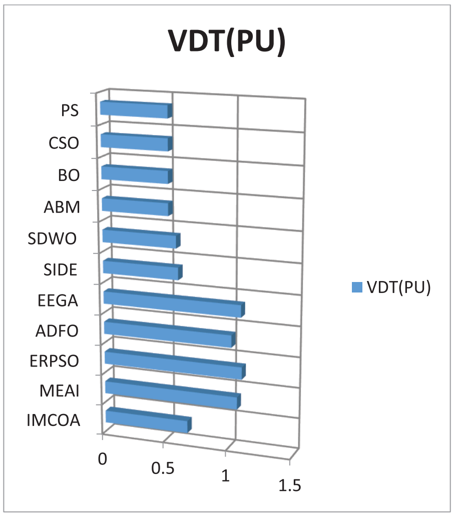

Figure 6. Assessment of VDT (PU)(IEEE 57 bus)

Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner -sick person (PS) optimization algorithm are validated in IEEE 300 bus system. Table 2 shows the factual power loss and voltage deviance assessment for IEEE 300 bus system. Figures 8 and 9 show the evaluation of assessment.

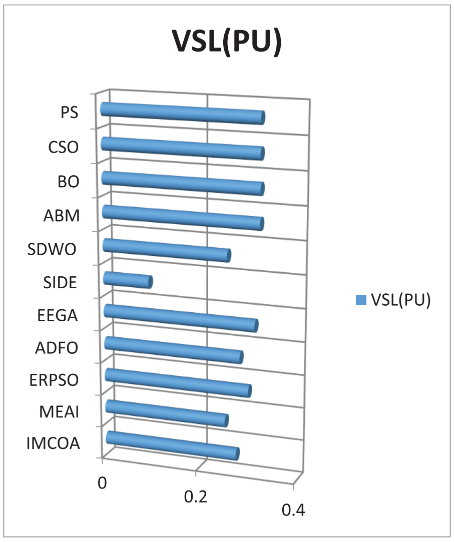

Figure 7. Assessment of VSL (PU) (IEEE 57 bus)

Table 2. Outcome Assessment (IEEE 300 BUS)

Method	FLO (MW)	VDT(PU)
TEHAI [12]	396.98	5.93
TEHAII [12]	397.23	5.94
IMTSA [11]	397.90	5.96
ANLO [11]	398.85	6.01
ABM	393.35	5.09
BO	392.91	5.07
CSO	393.54	5.08
PS	392.89	5.06

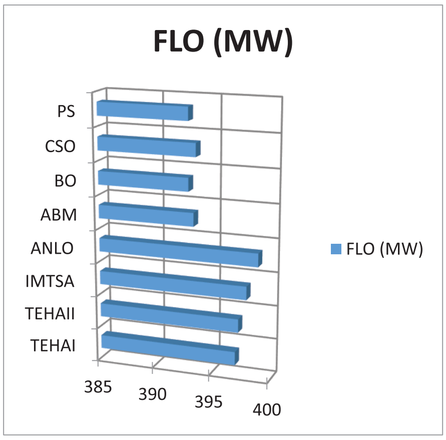

Figure 8. Assessment of FLO (MW) (IEEE 300 bus)

Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithm arevalidated in Egyptian Grid system (WDSTN) 220 KV [15]. Table 3 and Figures 10, 11 show the valuation.

Table 4 and Figure 12 show the time taken byAtlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search Optimization (CSO) algorithm and general practitioner – sick person (PS) optimization algorithm.

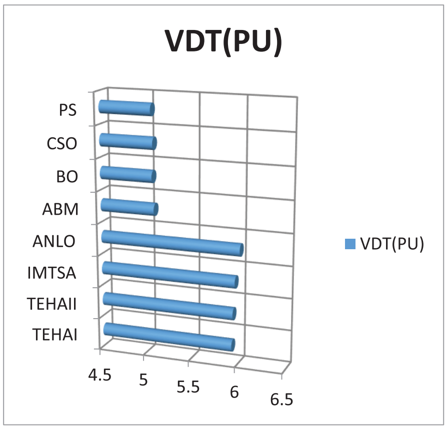

Figure 9. Assessment of VDT (PU) (IEEE 300 bus)

Table 3. Valuation of Parameters (WDSTN) 220 KV

Method	FLO (MW)	VDT(PU)
PEPSO [14]	32.31	0.58
TIHBA [14]	33.87	0.63
IMTBA [14]	30.78	0.67
ABM	28.09	0.53
BO	27.12	0.51
CSO	28.09	0.53
PS	27.12	0.51

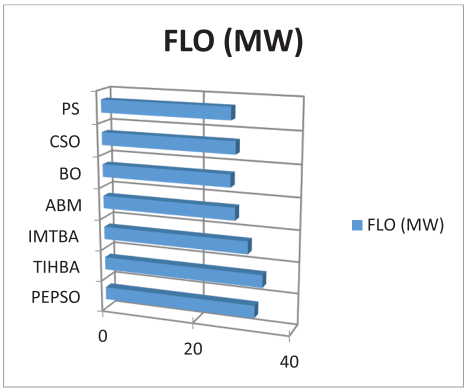

Figure 10. Assessment of FLO (MW)(220KV)

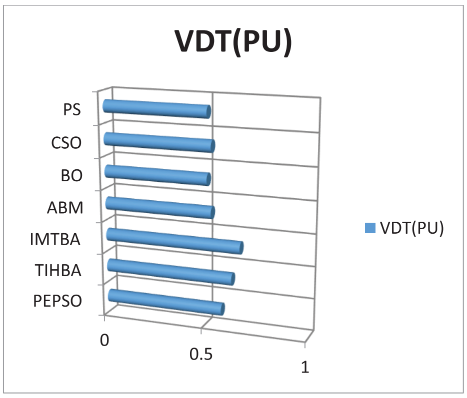

Figure 11. Assessment of VDT (PU) (220 KV)

Table 4. Time Taken By ABM, BO, CSO, PS

Method	57 bus T(S)	300 bus T (S)	220KV T(S)
ABM	22.29	63.72	16.85
BO	21.31	61.75	15.83
CSO	22.33	63.78	16.91
PS	21.29	61.70	15.80

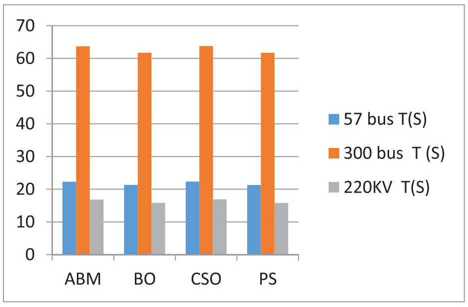

Figure 12. Time taken by ABM, BO, CSO, PS

8. Conclusion

Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithm solved the problem competently. True power loss lessening, power divergence curtailing, and power constancy index augmentation has been attained. Natural actions of Atlantic blue marlin are emulated to design the Atlantic blue marlin optimization algorithm.Intermittently grander solutions can be misplaced while streamlining the location of examination representatives and fresh locations may be more meager than the preceding locations, so grander selection is linked. Boops possess the obliging stalking physiognomies. As a cluster they stalk the quarry by forming the key and subordinate bunches. CSO is based on the drive and search behaviour of Chironex fleckeri. The crusade of the Chironex fleckeri may be due to ocean currents and it will pass inside the swarm. General practitioner will treat the sick person with various procedures; this process it has been imitated to model the projected PS algorithm. The operation on the sick person will be done, completely depending on the conditions. Inoculation, medicine and operation are the procedures that have been considered as the phases of the projected PS algorithm.

Validation and attained objectives

Atlantic blue marlin (ABM) optimization algorithm, Boops optimization (BO) algorithm, Chironex fleckeri search optimization (CSO) algorithm, general practitioner – sick person (PS) optimization algorithm are validated in IEEE 57, 300 systems and 220 KV network.

Factual power loss lessening, power divergence restraining, and power constancy index amplification has been attained.

Future Scope of Work

In future, projected algorithms can be applied to solve t other engineering problems. In cancer diagnosis the presented algorithms can be applied to detect cancer in an early stage.

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