Hybrid Lévy flight and chaotic based monodon monoceros-alexander archipelago wolf optimization algorithm for active power loss reduction and voltage stability enhancement in grid connected renewable energy systems

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ABSTRACT

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is designed based on the hunting or stalking behaviour of Monodon Monoceros and Alexander Archipelago wolf. Monodon Monoceros optimization (MMO) algorithm is designed based on the hunting or stalking behaviour of Monodon Monoceros. Monodon Monoceros refined communication based on clacks sound to trace the prey. Signal emanation, signal dissemination, and location modernizing of the Monodon Monoceros has been considered in the mathematical design. Alexander Archipelago wolf optimization algorithm is designed based on the cluster-based hunting behavior of Alexander Archipelago wolf. In the cluster mode hunting each Alexander Archipelago wolf plays a role and collectively as pack will attack the prey. In order to enhance the exploitation ability of the procedure Alexander Archipelago wolf optimization (AWO) algorithm has been hybridized with MMO procedure. Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) validated in IEEE 30, 57 systems and Egyptian 220 KV grid.

Keywords: Lévy flight, chaotic, monodon monoceros, alexander archipelago wolf, hunting, cluster

1. INTRODUCTION

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is designed based on the hunting or stalking behaviour of Monodon Monoceros and Alexander Archipelago wolf. Monodon Monoceros optimization (MMO) algorithm is designed based on the hunting or stalking behaviour of Monodon Monoceros (Figure 1)[1-3]. Monodon Monoceros refined communication based on clacks sound to trace the prey. Signal emanation, signal dissemination, and location modernizing of the Monodon Monoceros has been considered in the mathematical design. The stalking or hunting procedure, which is grounded on signal emanation and dissemination, has been mathematically formulated in the procedure. Monodon Monoceros form clusters and in the cluster twelve to hundred entities will be there. Cluster included males and females along with young Monodon Monoceros. In summer period, Monodon Monoceros cluster passage nearer to coasts. In winter period, Monodon Monoceros cluster move to deeper of waters and they consume many varieties of fishes. Monodon Monoceros utilizes clacks, whacks and screeches for the communication within the cluster. Through this Monodon Monoceros identify the prey and its distance.

Clacks are diminutive pulse of sound are utilized to recognize the matters in the marine comprising prey. After the prey location identified then Monodon Monoceros passage towards the prey along with clusters to attack the prey. In order to enhance the exploitation ability of the procedure Alexander Archipelago wolf optimization (AWO) algorithm has been hybridized with MMO procedure. Alexander Archipelago wolf optimization algorithm is designed based on the cluster-based hunting behavior of Alexander Archipelago wolf[4] (Figure 1). In the cluster mode hunting each Alexander Archipelago wolf plays a role and collectively as pack will attack the prey.

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is validated in IEEE 30, 57 systems and Egyptian 220 KV grid.

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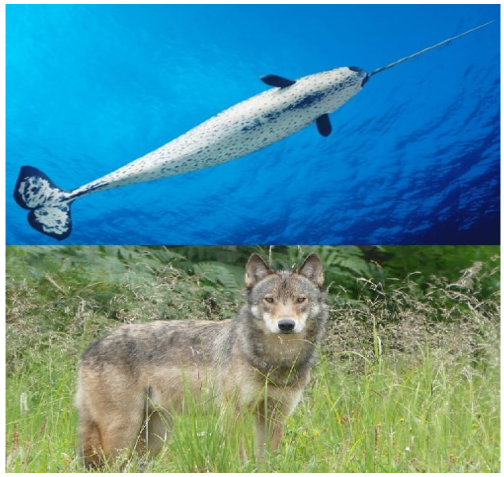

Figure 1. Monodon Monoceros (top) and Alexander Archipelago wolf (down) (image for representation).

2. PROBLEM FORMULATION

Active Power Loss Reduction and Voltage Stability Enhancement in Grid Connected Renewable Energy Systems[4,5-13] is demarcated as,

$$Min\ \tilde{F}(\bar{g},\bar{h}) \tag{1}$$

$$g = \begin{bmatrix} VLG_1, .., VLG_{Ng}; \\ QC_1, .., QC_{Nc}; T_1, .., T_{N_T} \end{bmatrix}$$

$$h = \begin{bmatrix} PG_{slack}; VL_1, .., VL_{N_{Load}} \\ ; QG_1, .., QG_{Ng}; SL_1, .., SL_{N_T} \end{bmatrix}$$

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

$$F_2 = Min\begin{bmatrix} \sum_{i=1}^{N_{LB}} & \left|V_{Lk} - V_{Lk}^{desired}\right|^2 \\ & + \sum_{i=1}^{Ng}\left|Q_{GK} - Q_{KG}^{Lim}\right|^2 \end{bmatrix}$$

$$F_3 = Minimize\ L_{MaxImum}$$

$$\begin{cases} L_j = 1 - \sum_{i=1}^{NPV} F_{ji}\frac{V_i}{V_j} \\ F_{ji} = -[Y_1]^1[Y_2] \end{cases}$$

$$L_{Max} = Max\left[1 - [Y_1]^{-1}[Y_2] \times \frac{V_i}{V_j}\right]$$

Parity constraints

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

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

Disparity constraints

$$P_{gsl}^{min} \le P_{gsl} \le P_{gsl}^{max} \tag{2}$$

Reactive power generation (QGi)

$$Q_{gi}^{min} \le Q_{gi} \le Q_{gi}^{max}, i \in N_g \tag{3}$$

Load bus voltage (VLi)

$$VL_i^{min} \le VL_i \le VL_i^{max}, i \in NL \tag{4}$$

Transformers tap setting (Ti)

$$T_i^{min} \le T_i \le T_i^{max}, i \in N_T \tag{5}$$

Switchable reactive power compensations (QCi)

$$Q_c^{min} \le Q_c \le Q_C^{max}, i \in N_C \tag{6}$$

$$|SL_i| \leq S_{L_i}^{max}, \mathrm{i} \in \mathrm{N_{TL}} \tag{7}$$

Generator bus voltage (VGi)

$$\mathrm{VG_i^{min}} \leq \mathrm{VG_i} \leq \mathrm{VG_i^{max}}, \mathrm{i} \in \mathrm{N_g} \tag{8}$$

$$F = F_1 + r_i F_2 + uF_3 = F_1 + \left[\sum_{i=1}^{NL} x_v \left[VL_i - VL_i^{min}\right]^2 + \sum_{i=1}^{NG} r_g \left[QG_i - QG_i^{min}\right]^2\right] + r_f F_3$$

$$VL_i^{minimum} = \begin{cases} VL_i^{max}, VL_i > VL_i^{max} \\ VL_i^{min}, VL_i < VL_i^{min} \end{cases} \tag{9}$$

$$QG_i^{minimum} = \begin{cases} QG_i^{max}, QG_i > QG_i^{max} \\ QG_i^{min}, QG_i < QG_i^{min} \end{cases} \tag{10}$$

3. HYBRID LÉVY FLIGHT AND CHAOTIC BASED MONODON MONOCEROS-ALEXANDER ARCHIPELAGO WOLF OPTIMIZATION ALGORITHM

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is designed based on the hunting or stalking behaviour of Monodon Monoceros and Alexander Archipelago wolf. Monodon Monoceros refined communication based on clacks sound to trace the prey. Signal emanation, signal dissemination, and location modernizing of the Monodon Monoceros has been considered in the mathematical design. The stalking or hunting procedure, which is grounded on signal emanation and dissemination, has been mathematically formulated in the procedure. Monodon Monoceros form clusters and in the cluster twelve to hundred entities will be there. Cluster included males and females along with young Monodon Monoceros. Clacks are diminutive pulse of sound are utilized to recognize the matters in the marine comprising prey. After the prey location identified then Monodon Monoceros passage towards the prey along with clusters to attack the prey. Cluster group will be maintained through the continuous information transformation among cluster members. Communications is given to the cluster members to indicate the existence of prey, harmonize the attack, distribution the info about the position of probable threats. The procedure of tracing their prey is grounded on echolocation to discover the prey. Echolocation is a method in which Monodon Monoceros discharge a clack in the marine and pay attention to determinate the location of the prey. Population of Monodon Monoceros optimization (MMO) algorithm is generated as follows,

$$Z = \begin{bmatrix} Z_1 \\ \vdots \\ Z_i \\ \vdots \\ Z_N \end{bmatrix}_{N\times m} = \begin{bmatrix} z_{1,1} & \cdots & z_{1,m} \\ \vdots & \ddots & \vdots \\ z_{N,1} & \cdots & z_{N,m} \end{bmatrix} \tag{11}$$

$$Z \rightarrow Matrix\ population$$
$$N \rightarrow members\ of population$$
$$m \rightarrow\ variables$$

$$z_{i,j} = min_j + R\left(max_j - min_j\right) \tag{12}$$

$$max_j, min_j \rightarrow limits$$
$$R \in [0,1]$$

Objective function value is calculated as follows,

$$F = \begin{bmatrix} F_1 \\ \vdots \\ F_i \\ \vdots \\ F_N \end{bmatrix}_{N\times 1} = \begin{bmatrix} F(Z_1) \\ \vdots \\ F(Z_i) \\ \vdots \\ F(Z_N) \end{bmatrix}_{N\times 1} \tag{13}$$

When the Monodon Monoceros navigates, locations are shared with the cluster members. Through the signal dissemination will try to find the prey. Initially the intensity of the signal dissemination is very small level and gradually depends on the condition signal dissemination quantity and intensity will be increased. Function of signal dissemination is defined as,

$$S_D(Z_i) = \frac{0.10}{1+\alpha\cdot\|Z_i - Z_{prey}\|} \tag{14}$$

$$S_D(Z_i) \rightarrow signal\ dissemination$$

$$\|Z_i - Z_{prey}\| \rightarrow Euclidean\ distance\ between$$
$$Monodon\ Monoceros\ \ and\ prey$$
$$\alpha \rightarrow modulate\ the\ signal\ dissemination$$

Disseminated signal will get promulgated in marine and it defined as,

$$S_{PD}(Z_i) = S_D(Z_i) \cdot PD_R(Z_i, Z_{prey}) \tag{15}$$
$$PD \rightarrow\ promulgated\ signal\ in\ the\ marine$$
$$PD_R(Z_i, Z_{prey}) = exp\left(-\frac{\|Z_i - Z_{prey}\|^2}{2\cdot(\sigma^t)^2}\right)$$
$$t \rightarrow iteration$$
$$\|Z_i - Z_{prey}\| \rightarrow Euclidean\ distance\ between$$
$$Monodon\ Monoceros\ \ and\ prey$$
$$\sigma^t \rightarrow\ Gaussian\ function$$
$$\sigma^t \rightarrow determine\ the\ level\ of\ communication$$

Location of the Monodon Monoceros is modernized continuously as follows,

$$Z_i^{t+1} = Z_i^t + \Delta^t \tag{16}$$
$$\Delta^t \rightarrow step$$
$$\Delta^t = \beta * |S_{PD}(Z_i) \cdot Z_{prey} - Z_i|$$
$$\beta = R_1 - \frac{1}{\sigma^t + 1}$$

Sometime prey may identify the passage of the cluster and it may randomly move away from their current location. Lévy flight strategy has been integrated into the procedure.

$$\mathrm{Z(i+1) = Q(i) - |e(t)| \times A \times L(d)} \tag{17}$$
$$\mathrm{L(s) \sim |s| - 1 - \beta}$$
$$0 < ß < 2$$
$$\mathrm{L(s, \gamma, \mu)} = \begin{cases} \sqrt{\frac{\gamma}{2\pi}} \quad \exp\left[-\frac{\gamma}{2(s-\mu)}\right]\frac{1}{(s-\mu)^{3/2}} \\ 0 \quad \text{if } s \leq 0 \end{cases}$$

Chaotic sequences are defined rendering to random passage of prey and Monodon Monoceros. After some time again information shard between the members of the cluster about the location of the prey then again coordination among the cluster members will prevail.

$$\mathrm{p_{t+1} = p_t^2 - q_t^2 + a \cdot p_t + b \cdot q_t} \tag{18}$$

$$\mathrm{q_{t+1} = 2p_t q_t + c \cdot p_t + d \cdot q_t} \tag{19}$$

In order to enhance the exploitation ability of the procedure Alexander Archipelago wolf optimization (AWO) algorithm has been hybridized with MMO procedure. Alexander Archipelago wolf optimization algorithm is designed based on the cluster-based hunting behavior of Alexander Archipelago wolf. In the cluster mode hunting each Alexander Archipelago wolf plays a role and collectively as pack will attack the prey. In first layer of the cluster $\alpha -$ Alexander Archipelago wolf select process of hunting. $\beta -$ Alexander Archipelago wolf assist $\alpha -$ Alexander Archipelago wolf in the process of hunting. $\gamma -$ Alexander Archipelago wolf do the supportive deeds to $\alpha\ and\ \beta -$ Alexander Archipelago wolf . Remaining wolf in the pack will organize the pack effectively time to time during the phase of the hunting. Prey will be encircled and attack by the pack which leads to hunting the prey successfully. These actions are mathematically defined as,

$$\vec{Q} = |\vec{A}.\overrightarrow{Z_P}(t) - \vec{Z}(t)| \tag{20}$$

$$\vec{Z}(t+1) = \overrightarrow{Z_P}(t) - \vec{B}.\vec{Q} \tag{21}$$
$$t \rightarrow present\ iteration$$
$$\vec{\mathrm{B}} = 2\vec{\mathrm{e}}.\overrightarrow{\mathrm{o_1}} - \vec{\mathrm{e}}$$
$$\vec{\mathrm{A}} = 2.\overrightarrow{\mathrm{o_2}}$$

$$\overrightarrow{Z_P}(t) \rightarrow location\ of\ the\ prey$$
$$\vec{Z} \rightarrow Position\ of\ Alexander\ Archipelago\ wolf$$
$$\vec{e} = 2.0\ to\ 0$$
$$\overrightarrow{o_1}\ and\ \overrightarrow{o_2} \in [0,1]$$

Encircling and attacking the prey by the Alexander Archipelago pack is defined as,

$$\overrightarrow{Q_\alpha} = \left|\overrightarrow{A_1}, \overrightarrow{Z_\alpha} - \vec{Z}\right| \tag{22}$$
$$\overrightarrow{Q_\beta} = \left|\overrightarrow{A_2}, \overrightarrow{Z_\beta} - \vec{Z}\right| \tag{23}$$
$$\overrightarrow{Q_\gamma} = \left|\overrightarrow{A_3}, \overrightarrow{Z_\gamma} - \vec{Z}\right| \tag{24}$$
$$\overrightarrow{Z_1} = \overrightarrow{Z_\alpha} - \overrightarrow{B_1}\ .\overrightarrow{Q_\alpha} \tag{25}$$
$$\overrightarrow{Z_2} = \overrightarrow{Z_\beta} - \overrightarrow{B_2}\ .\overrightarrow{Q_\beta} \tag{26}$$
$$\overrightarrow{Z_3} = \overrightarrow{Z_\gamma} - \overrightarrow{B_3}\ .\overrightarrow{Q_\gamma} \tag{27}$$
$$\vec{Z}(t+1) = \frac{\overrightarrow{Z_1}+\overrightarrow{Z_2}+\overrightarrow{Z_3}}{3} \tag{28}$$

Location of the Alexander Archipelago pack is updated as follows,

$$f_{i,j} = \begin{cases} 1 & Z_{i,j} > 0.5 \\ 0 & Else \end{cases} \tag{29}$$

a. Start

b. Fix the parameters

c. Engender the population

d. $z_{i,j} = min_j + R\left(max_j - min_j\right)$

e. Objective function value is calculated as follows,

f. Define the signal dissemination

g. $S_D(Z_i) = \frac{0.10}{1+\alpha\cdot\|Z_i - Z_{prey}\|}$

h. $S_D(Z_i) \rightarrow signal\ dissemination$

i. Define the promulgation of disseminated signal

j. $S_{PD}(Z_i) = S_D(Z_i)\cdot PD_R\left(Z_i, Z_{prey}\right)$

k. $PD_R\left(Z_i, Z_{prey}\right) = exp\left(-\frac{\|Z_i - Z_{prey}\|^2}{2\cdot(\sigma^t)^2}\right)$

l. Update the location of Monodon Monoceros

m. $Z_i^{t+1} = Z_i^t + \Delta^t$

n. $\Delta^t = \beta * \left|S_{PD}(Z_i)\cdot Z_{prey} - Z_i\right|$

o. $\beta = R_1 - \frac{1}{\sigma^t+1}$

p. Apply Lévy flight strategy

q. $\mathrm{Z(i+1) = Q(i) - |e(t)| \times A \times L(d)}$

r. Engender Chaotic sequences

s. $\mathrm{p_{t+1} = p_t^2 - q_t^2 + a\cdot p_t + b\cdot q_t}$

t. $\mathrm{q_{t+1} = 2p_tq_t + c\cdot p_t + d\cdot q_t}$

u. $\vec{Q} = \left|\vec{A}.\overrightarrow{Z_P}(t) - \vec{Z}(t)\right|$

v. $\vec{Z}(t+1) = \overrightarrow{Z_P}(t) - \vec{B}.\vec{Q}$

w. $\vec{B} = 2\vec{e}.\overrightarrow{o_1} - \vec{e}$

x. Define encircling and attacking strategy

y. $\overrightarrow{Q_\alpha} = \left|\overrightarrow{A_1}, \overrightarrow{Z_\alpha} - \vec{Z}\right|$

z. $\overrightarrow{Q_\beta} = \left|\overrightarrow{A_2}, \overrightarrow{Z_\beta} - \vec{Z}\right|$

aa. $\overrightarrow{Q_\gamma} = \left|\overrightarrow{A_3}, \overrightarrow{Z_\gamma} - \vec{Z}\right|$

bb. $\overrightarrow{Z_1} = \overrightarrow{Z_\alpha} - \overrightarrow{B_1}\ .\overrightarrow{Q_\alpha}$

cc. $\overrightarrow{Z_2} = \overrightarrow{Z_\beta} - \overrightarrow{B_2}\ .\overrightarrow{Q_\beta}$

dd. $\overrightarrow{Z_3} = \overrightarrow{Z_\gamma} - \overrightarrow{B_3}\ .\overrightarrow{Q_\gamma}$

ee. $\vec{Z}(t+1) = \frac{\overrightarrow{Z_1}+\overrightarrow{Z_2}+\overrightarrow{Z_3}}{3}$

ff. Update the location of Alexander Archipelago pack

gg. $f_{i,j} = \begin{cases} 1 & Z_{i,j} > 0.5 \\ 0 & Else \end{cases}$

hh. $t = t + 1$

ii. Output the best solution

jj. End

4. RESULTS

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is validated in IEEE 30 bus system. Table 1 and Figures 2 and 3 shows the assessment of outcomes. APW (MW)-Active power loss, VEN (PU)-Voltage deviation, VSB (PU)-Voltage stability.

Table 1. Valuation of results-IEEE 30 bus.

Method	APW(MW)	VEN(PU)	VSB(PU)
EIDE[4]	4.6482	0.0802	0.1004
MIWO[5]	4.9448	0.1212	0.1232
EUIA[6]	4.5677	0.1250	0.1135
AVOP[7]	4.5464	1.9889	0.1294
GWOU[8]	4.1781	0.4697	0.1323
AUIA[9]	5.6614	0.1536	0.2683
PTS 1[10]	4.6304	0.1678	0.2524
PTS 2[10]	4.6095	0.1649	0.2578
PUO[11]	5.0763	0.6828	0.3297
MMO	4.0962	0.0120	0.4322
AWO	4.0989	0.0116	0.4329
HMA	4.0901	0.0109	0.4334

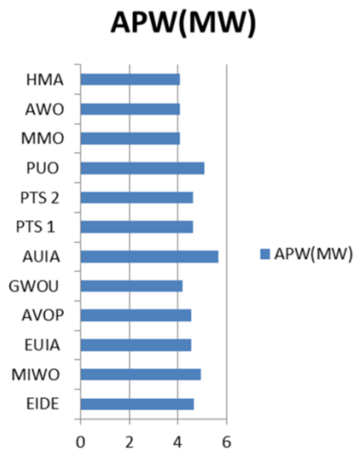

Figure 2. APW (MW) valuation (IEEE 30 BUS).

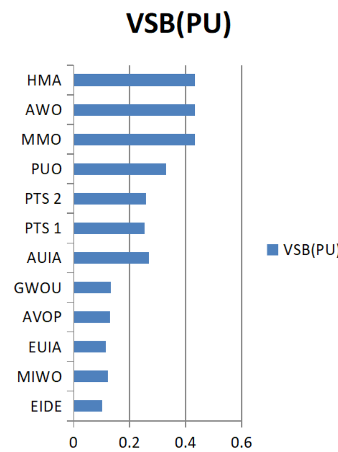

Figure 3. VSB (PU) valuation (IEEE 30 BUS).

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is validated in IEEE 57 bus system. Table 2 and Figures 4 and 5 shows the evaluation of results

Table 2. Valuation of results-IEEE 57 bus.

Method	APW(MW)	VEN(PU)	VSB(PU)
SIDE[4]	21.9452	0.6012	0.0948
BIWO[5]	23.3235	0.58553	0.2561
PISHO[11]	25.4715	0.6828	0.3231
EISO[12]	25.4963	0.799021	0.3129
MOPA[12]	26.8927	0.80991	0.3345
PSRO[12]	29.535	0.8725	0.3791
MMO	20.0987	0.4876	0.47892
AWO	20.0998	0.4881	0.47899
HMA	20.0971	0.4869	0.47951

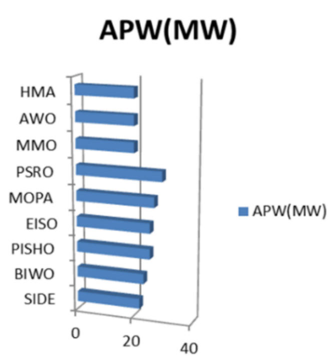

Figure 4. APW (MW) valuation (IEEE 57 BUS).

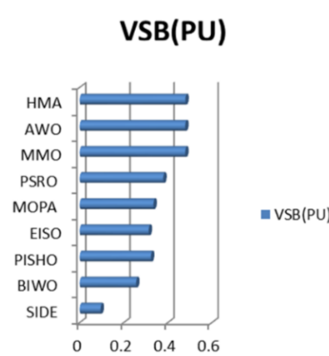

Figure 5. VSB (PU) valuation (IEEE 57 BUS).

Table 3. Valuation of outcomes-Egyptian 220KV grid.

Method	APW (MW)	VEN (PU)
BUSO[15]	32.314	0.5800
MIA[14]	30.786	0.6751
QIP[13]	29.009	0.5819
PRO[13]	29.001	0.5810
MMO	27.087	0.5762
AWO	27.091	0.5768
HMA	27.069	0.5754

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is validated in Egyptian 220 KV grid[14]. Table 3 and Figure 6 shows the assessment of results.

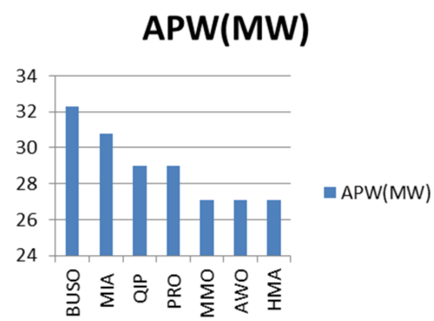

Figure 6. APW (MW) assessment-Egyptian 220 KV GRID.

Time taken by the HMA approach is shown in Table 4 and Figure 7.

Table 4. Time taken by MMO, AWO, HMA.

Method	30 Bus T(S)	57 Bus T(S)	220 KV T(S)
MMO	13.78	18.98	16.02
AWO	13.69	18.76	16.06
HMA	12.67	18.12	15.92

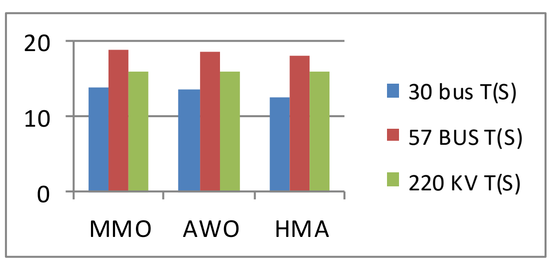

Figure 7. Time taken by MMO, AWO, HMA.

5. CONCLUSION

Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) solved the active power loss reduction problem proficiently. In Monodon Monoceros optimization (MMO) algorithm Clacks, whacks and screeches will be used by the Monodon Monoceros to signal the existence of the prey and information shared among the cluster members about the position of the prey, and then coordinated actions initiated to attack the prey. The procedure of tracing their prey is grounded on echolocation to discover the prey. Echolocation is a method in which Monodon Monoceros discharge a clack in the marine and pay attention to determinate the location of the prey. When the Monodon Monoceros navigates, locations are shared with the cluster members. In order to enhance the exploitation ability of the procedure Alexander Archipelago wolf optimization (AWO) algorithm has been hybridized with MMO procedure. Alexander Archipelago wolf optimization algorithm is designed based on the cluster-based hunting behavior of Alexander Archipelago wolf. In the cluster mode hunting each Alexander Archipelago wolf plays a role and collectively as pack will attack the prey. Hybrid Lévy flight and Chaotic based Monodon Monoceros-Alexander Archipelago wolf Optimization Algorithm (HMA) is validated in IEEE 30, 57 systems and Egyptian 220 KV grid.

REFERENCES

[1] Alam, M. S., Liu, Q., Schneider, P., Mozumder, M. M. H., Uddin, M. M., Monwar, M. M. and Barua, S., "Stock assessment and rebuilding of two major shrimp fisheries (Penaeus monodon and Metapenaeus monoceros) from the industrial fishing zone of Bangladesh", Journal of Marine Science and Engineering 10(2), 1-15 (2022).

[2] Laidre, K. L. and Heide-Jørgensen, M. P., "Life in the lead: extreme densities of narwhals Monodon monoceros in the offshore pack ice," Marine Ecology Progress Series 423, 269-278 (2011).

[3] Laidre, K. L., Heide-Jørgensen, M. P., Dietz, R., Hobbs, R. C. and Jørgensen, O. A., "Deep-diving by narwhals Monodon monoceros: differences in foraging behavior between wintering areas", Marine Ecology Progress Series 261, 269-281 (2003)

[4] Brooks, J. J., Markegard, S. I., Langdon, S. J., Anderstrom, D. S. E., Douville, M. G., George, T. A. and Smythe, C., "Indigenous knowledge and species assessment for the Alexander Archipelago wolf: successes, challenges, and lessons learned," The Journal of Wildlife Management 1(1), 1-15 (2024).

[4] Pg, A. K., Jeyanthy, A. and Devaraj., "Hybrid CAC-DE in optimal reactive power dispatch (ORPD) for renewable energy cost reduction," Sustainable Computing Informatics and Systems 35(1), 1-15 (2022).

[5] Abd-El Wahab, A. M., Kamel, S., Hassan, M. H., Mosaad, M. I. and Abdul Fattah, T. A., "Optimal reactive power dispatch using a chaotic turbulent flow of water-based optimization algorithm," Mathematics 10(3), 346-352 (2022).

[6] Habib Khan, N., Jamal, R., Ebeed, M., Kamel, S., Zeinoddini-Meymand, H. and Zawbaa, H. M., "Adopting Scenario-Based approach to solve optimal reactive power Dispatch problem with integration of wind and solar energy using improved Marine predator algorithm," Ain Shams Engineering Journal 13(5), 101726, 1-15 (2022).

[7] Ali, M. H., Soliman, A., Abdeen, M., Kandil, T., Abdelaziz, A. Y. and El-Shahat, A., "A novel stochastic optimizer solving optimal reactive power dispatch problem considering renewable energy resources," Energies 16(4),1562-152 (2023).

[8] Varan, M., Erduman, A. and Menevşeoğlu, F., "A grey wolf optimization algorithm-based optimal reactive power dispatch with wind-integrated power systems," Energies 16(13), 1-10 (2023).

[9] Lian, L., "Reactive power optimization based on adaptive multi-objective optimization artificial immune algorithm," Ain Shams Eng. Ain Shams Eng. J. 13(5), 101677 (2022).

[10] Sahli, Z., Hamouda, A., Sayah, S., Trentesaux, D. and Bekrar, A. "Efficient hybrid algorithm solution for Optimal Reactive Power Flow using the sensitive bus approach," Eng. Eng. Technol. Appl. Sci. Res. 12(1), 8210-8216 (2022).

[11] Hasanien, H. M., Alsaleh, I., Tostado-Véliz, M., Zhang, M., Alateeq, A., Jurado, F. and Alassaf, A., "Hybrid particle swarm and sea horse optimization algorithm-based optimal reactive power dispatch of power systems comprising electric vehicles," Energy 286(1), 1-15 (2024).

[12] Shaheen, M. A. M., Ullah, Z., Hasanien, H. M., Tostado-Véliz, M., Ji, H., Qais, M. H. and Jurado, F., "Enhanced transient search optimization algorithm-based optimal reactive power dispatch including electric vehicles," Energy 277(1), 1-15 (2023).

[13] Lenin, K., "Quasi opposition-based quantum Pieris rapae and parametric curve search optimization for real power loss reduction and stability enhancement, "IEEE Trans. Ind. Appl. 59(3), 3077-3085 (2023).

[14] Mouwafi, M. T., El-Ela, A. A. A., El-Sehiemy, R. A. and Al-Zahar, W. K., "Techno-economic based static and dynamic transmission network expansion planning using improved binary bat algorithm," Alexandria Engineering Journal 61(2), 1383-1401 (2022).