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Real Power Losses Reduced by Network Reconfiguration the Distribution Systems using Modified BAT Algorithm

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ABSTRACT- This research paper is proposed to achieving the minimum power losses in all the branches, minimum number of switching operations, maximizing the power flow through the placing the DG sources, minimizing the voltage deviations with satisfying all the constraints using the modified BAT algorithm. The effect of the offered method is tested on standard systems like IEEE 33, 69 buses and Indian standard 62 bus distribution systems. The mBAT effect is estimated with the recent algorithm including Shuffled Frog, Stud krill, Dingo, Grey Wolf, and Antlion algorithms. MATLAB results are proved that the total power active power losses and branch voltages and number of switches, capacity of DG sources and cost of the DG sources are drastically reduced. The results are compared with many techniques are tabulated. Moreover, the mBAT algorithm is more superior and confirmed with other animal-related algorithms like Antlion, Grey wolf, Gross Hopper, Dingo, sturd Krill, cuckoo crunch algorithm and Shuffled Frog algorithms. In view of more speed of convergence and high accuracy and processed in less number repetition. Also, the results of the proposed techniques are encouraging and helpful to future research.

Keywords: Network reconfigurations, Distribution networks, Algorithm of BAT, Decreasing Losses, Distributed Generations, Voltage Stability Indicator.

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1. INTRODUCTION

The distribution system is a subsystem of the power system that is the duty to deliver electrical power to the tail-end consumers. The advantages of fewer fault currents, fewer control techniques of relays, simplified fault section isolations, and easy power flow in the distribution systems. The huge difference in the power generated from generating stations to power distributed at the consumer's premises is because of power losses in the lines. Abdulkhaleq MT et al (2022) Harmony search: current studies and uses on healthcare systems. In this harmony search algorithm is defiend a path is not clear.[1]. Abualigah L, et.al (2022) in this Black hole algorithm, a comprehensive survey is not well cleared [2]. Abualigah et al (2021) The arithmetic optimization algorithm is not metaheuristic algorithm which is not suitable for optimization problems [3]. Shehab M et al (2020) Moth-fame optimization algorithm constraints are not well defined so which is not taken to problem identification [4]. Bezdan T et al (2022) multi-objective task scheduling in cloud computing environment by hybridized bat algorithm is problem identification is not well derived [5]. Shami TM, et al (2022) Particle swarm optimization: a comprehensive survey constarints are taken into randomly which is not clear formulation [6]. The Grasshopper is great exploitation and great exploration only, but not consider the small level exploitation and exploration, which is unfair the losses calculation. The gray wolf algorithm, the constraints of radial structure, apparent power flow, current flowing through the buses not consider for the above problems. The load factor (λ) analysed only at maximum time only considered. λ changes all the parameters varies, λ should be varies with respect to time factor. In Heap Based Optimizer give only top-level workers only consider not for the base level or lower-level workers are considered for the problem and loads are considered only bulk types of 30% of total loads.

2. NOVEL VOLTAGE STABILITY INDICATOR (NOVEL VSI)

A novel voltage stability indicator (nVSI) is a valuable tool for determining the current carrying capacity of transmission lines. The nVSI equation is designed to assess the stability limits of a conductor. When the values are substituted into the equation, the result will fall within a specific range: If the nVSI value is between 0 and 1, the system is stable. If the nVSI value is

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greater than *1*, less than *0*, or negative, the system is unstable. The nVSI provides a quantitative measure of stability, allowing for proactive management of transmission line capacity and ensuring the reliable operation of the power system. The nVSI is derived from the balanced three phase distribution system of single line diagram is presented for the problems. A huge radial network is converted into a single network using reduction techniques using the branch exchange method has been given below. Using the forward backward sweep algorithm with the help of branch exchange method, have to find the all the parameters like current flow through the branch, voltage drop between the nodes with angle, active power flow and insufficient reactive power flow.

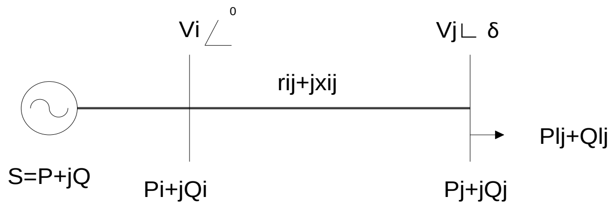

Figure 1. Simple two bus system

Figure 1 shows a two-bus system, with Notation 'i' and "j" buses representing the transmitting and receiving ends. Normally distribution system has number of lines linked with transmission lines to consumer's side. The distribution lines are carrying the apparent power and to maintain the voltages at both ends. The voltage angle of receiving end is assumed as $'\delta'$ and a voltage of sending is zero [7]. The sending end node as reference bus 'i' and the current flow of the branch as I_{ij} is calculated from the below equation as assumed.

$$I_{ij} = \frac{V_i \angle 0 - V_j \angle \delta}{r_{ij} + jx_{ij}} \quad (1)$$

The KVA power flow equations produce the line's current flow as [8]

$$S_j = V_j * I_{ij}^* \quad (2)$$

$$I_{ij}^* = \left[\frac{S_j}{V_j}\right] \quad (3)$$

This equation is used to calculate the current flow from the receiving end equations.

$$\frac{P_j - Q_j}{V_j^* \angle - \delta} = I_{ij}^* \quad (4)$$

The new losses equations have been derived from the above terms, and to calculate the apparent power, real, reactive power flow from above mentioned equations. The losses were derived by applying forward-backward sweep algorithms with reduction techniques.

$$P_l = \left|I_{ij}^2\right| * r_{ij} = \frac{P_i^2 + Q_i^2}{V_i^2} * r_{ij} \quad (5)$$

$$Q_l = \left|I_{ij}^2\right| * x_{ij} = \frac{P_i^2 + Q_i^2}{V_i^2} * x_{ij} \quad (6)$$

The perfect distribution is the receiving end power [9] is almost same as the sending end power. If not matching the powers, the reasons of the deficiency is distribution losses occurred.

The new modified equations have been found from some manipulations.

$$(P_j + jQ_j)(r_{ij} + jx_{ij} = (P_i + jQ_i)(r_{ij} + jx_{ij}) - I_{ij}^2 (r_{ij} + jx_{ij}) \quad (7)$$

The active and reactive terms are and gives the new is

$$\left(P_j r_{ij} - Q_j x_{ij}\right) = \left(P_i r_{ij} - Q_i x_{ij}\right) + I_{ij}^2\left(r_{ij}^2 - x_{ij}^2\right) \quad (8)$$

The second order differential equations have been executed, and the active roots for any system's dependability have been discovered.

$$V_j = \frac{1 \pm \sqrt{\left(1 - 4\left(\left(P_i r_{ij} - Q_i x_{ij}\right) + \left(P_j^2 - Q_j^2\right)\left(r_{ij}^2 - x_{ij}^2\right) r_{ij} P_L + P_i^2 r_{ij}^2 + Q_i^2\right)\right)}}{2} \quad (9)$$

The solution of second order differential equations of right side may be positive [10]

$$1 - 4 * ((P_i r_{ij} - Q_i x_{ij}) + (P_j^2 - Q_j^2)({r_{ij}}^2 - {x_{ij}}^2)) \geq 0 \quad (10)$$

The value of $\Delta = \sqrt{(b^2 - 4ac)}$ is separated to zero, inside the value of square terms is zero. The nVSI equation has been formed as

$$\text{VSI} = 4 * \left(\left(P_i r_{ij} - Q_i x_{ij}\right) + \left(P_j^2 - Q_j^2\right)\left(r_{ij}^2 - x_{ij}^2\right)\right) = 1 \quad (11)$$

So many Indicators are available to find the maximum current carrying capacity of transmission lines. When substituting the per unit values of active and reactive power at both the sending and receiving ends, along with the resistance and inductive reactance of the branches, we derive the value of nVSI. This indicator provides an accurate measure of the transmission line's capacity. By using nVSI, we can select the most suitable conductor for various applications. In India, there are nearly 100 different types of conductors manufactured with similar capacities, making it challenging to determine their transmission capacities. The proposed nVSI equations help identify the appropriate conductor type for specific applications, ensuring the maximum number of current flows through the lines without disturbing the sources and loads. The nVSI correctly determines the conductor's stability value and its maximum current limit, allowing for a thorough analysis of the transmission line conductor strength. This process is a form of optimization, aiding in the efficient management of power transmission systems. When the system is stable condition, the VSI is placed in between 0 to 1. When the system is unstable, the VSI is more than 1 or less than 0. The proposed VSI is simple, more effective than other VSIs. How far the system is away from the stable state, the propose VSI is clearly indicate to power flow of conductor [11].

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Table 1. Technical Data of Different Conductors

S. No.	Name of the conductor	Size (mm)	Size (Inch)	Copper area (Sq.mm)	R (Ω/km)	X_L (Ω/km)	Current capacity
1	RACOON	7/4.09	7.0.161	48	0.395	0.29	200
2	BEAVER,	7/3.99	7/0.157	45	0.42	0.3	189
3	WEASEL	7/2.59	7/0.102	20	0.587	0.333	100
4	RABBIT.	7/3.35	7/0.132	30	0.685	0.347	148

The new VSI has been tested IEEE33 bus, IEEE 69 bus and tested 62 buses with the real time system in Vellore distribution system. In general, the distribution lines are many in the name of animals. In this research to find the power flow capacity of distribution lines, there are four different lines Raccoon, Beaver, Weasel, Rabbit [12] have been used for this research. Technical information is given in tabulated with constant temperature is 40^0C. Gradually adding the electrical loads, using the proposed VSI, the stable point of transmission lines has been calculated easily and clearly in any conductors. The values of loads are increased from 0pu. to the maximum of 1pu. to maximum level have been calculated easily [13].

Table 2. The Final Results of Capacity in Different Conductors

pf	RACCON		BEAVER		WEASEL		RABBIT	
	LMF	VSI	LMF	VSI	LMF	VSI	LMF	VSI
0.85	4.145	0.999	3.78	0.9983	3.90	0.9986	2.11	0.9998
0.9	5.040	0.999	4.56	0.9981	4.55	0.9981	2.37	0.9971
0.95	6.3339	0.9997	5.58	0.9985	5.37	0.9982	2.68	0.9917

3. PROBLEM FORMULATION OF M BAT

The proposed VSI is implemented for minimizing the real power losses and injecting the reactive power sources through DG [14] in the appropriate places using reconfiguration techniques for maximizing the voltage profile in the buses. The objective function of the proposed mBAT algorithm for the minimizing the power losses is given below.

$$MiniF = \sum_{i=1}^{nb} r_i * \left(\frac{P_i^2 + Q_i^2}{|V_i|^2}\right) \quad (12)$$

The main constraints are 1. Active Power flow: $P_{max} \geq P_i \geq P_{min}$ 2. Voltage flows: $V_{max} \geq V_i \geq V_{min}$ 3. apparent power flow: $S_{max} \geq S_i, S_{min} \leq S_i$, 4. Current flow of lines: $I_{max} \geq I_i, I_{min} \leq I_i$ 5. The system should be fulfilling radial structure after reconfiguration 6. Capacity of DGs:

$$Q_{max}^c = LQ_0^c \quad (13)$$

4. IMPLEMENTATION OF MBAT ALGORITM

The modified BAT algorithm (mBAT) is the family of animals. They are living in the roof of the building formed as group. But they are hanging in the roof of the building in reverse position. The mBAT sending the signal by echolocation techniques and radiates the sound to see the fray of food even though the darkness or in the night time [15]. Finding the foods, the wings are having advanced echolocation capabilities. Each and every mBATs are sending the separate signals to find the time taken to reach the food and distance between the foods. The position of flying direction of the mBAT is X_i, The speed of the randomly moving the bats are Vi, wave length of signals are λ, The loudness of sound A_0, rhythm rate is 'r' lies between from 0 to maximum 1. The best solution randomly after generating the population is $G_{best.}$ The difference between the first sound to another consequent sound [16] is timbre t_i. mBATs are finding the food based on their velocity, timbre position, loudness and pulse rate. The sound has been changes depends upon the position and distance. Normally, the sound will reach the food or fray is 5µsec to 2µsec. The distance between the food or fray is normally from 0.7 mm to 17mm. Minimum 10 numbers of BAT and the maximum 40 numbers of mBAT taken to this research. The intensity of sound, the mBAT movement, and the pulse rate are restricted based on the research. The below mentioned equations are used to find the arrangements of bats, noise of sounds, pulse discharge rates. In this algorithm requires some guidelines are required to find the locations of X_i and speeds V_i of the simulated bats. In the traditional BAT algorithm [17]is depend upon the frequency of BAT. In modified BAT algorithm is based on the timbre. So, the mBAT is superior to all other algorithms.

$$t_i = t_{min} + (t_{max} - t_{min})\,\beta \quad (14)$$

$$V_i^t = V_i^{t-1} + (X_i^{t-1} - X^*) \quad (15)$$

$$X_i^t = X_i^{t-1} \quad (16)$$

'β' is the random vector and its position is middle of 0 and 1, The final solution of all the bats is X^*

Research Article | Volume 12, Issue 3 | Pages 881-888 | e-ISSN: 2347-470X

$$X_{new} = X_{old} + \varepsilon A^t \quad (17)$$

'ε' is the scaling factor lies between -1 to +1, α and γ are constant terms [18], the minimum values of intensity of sound are lies between 0 and the maximum values 1. The intensity of sound and pulse rates are constant depend upon the any values.

$$A_i^{i+1} = \alpha A_i^t \quad (18)$$

$$r_i^{t+1} = r_i^0[1-\exp(-\gamma * Iter)] \quad (19)$$

5. RESULTS AND DISCUSSIONS

The proposed mBAT techniques has been validated for evaluating different conductors and DG placement has been installed the appropriate places. These techniques have been implemented in IEEE 33 and IEEE 69 buses (Baron and Wu 1989), and real time 62 bus test system. The limits of DG sources ranges from 100KW to 2 MW. This research, mBAT algorithm have been compared with Antlion, Grey wolf, Gross Hopper, Dingo, stud Krill, cuckoo crunch algorithm and shuffled frog algorithms. This mBAT algorithms is superior, an efficient and optimal solution have been proved. Four instances are used to compare and decide the ideal problems.

Type 1: This system does not require any reconfiguration and DG placement [19].
Type 2: System require reconfiguration and DG placements.
Type 3: system Require reconfiguration after DG installation [20-22].
Type 4: Redesigned the system only optimal placing the DG source.

5.1 IEEE 33 Bus System

After executing these data by the forward backward sweep algorithm, with reduction method using the MATLAB 2016 software, based on the results, the most suitable conductors, and finest locations to fix the DG sources are identified. The basic system configuration consists of 5 tie switches, 32 sectionalized switches. The system is rated at 3.2 MVA, 2.3 MVAr, and 12.7 KV. Before reconfiguration, the system has 228.68KW, 53.3 KVAr and the voltage is 0.9012 pu. After network reconfiguration using the BAT algorithm, the system has 172.62 Kw, 112.13 KVAr, and the voltage is 0.9915 pu. The opening tie switches are 33,34,35,36, and 37. The power factor of the system is 0.98 lagging as station power factor. Very less power factor requires more DG sources needed. [23]. Because the reactive power required in these substations is insufficient, the losses exceed the reconfiguration.

Table 3. 33 Bus Using all Animals Algorithms

Parameters	Antlion	Grey wolf	Gross Hopper	Dingo	stud Krill	cuckoo crunch	shuffled frog	Proposed mBAT
Year	2017	2021	2023	2023	2022	2019	2019	
Tie switches	6,30,16	18,30,06	24,12	7,11,17,27,34	20,24,13	8,5,37,30,12	35,14,26,24,33	7,9,14,32,37
Qc (KVAr)	1542.67	176.0343	139.59	512	50.6814	300	0.27MW	0.99 MVAR
Cost ($)	-	-	18.54	-	-	50103	-	
Location	6,30,16	18,30,06	12,24	7,11,17,27,34	20,24,13	8,30,23	35,14,26,24,33	7,9,14,32,37,
Ploss (KW)	185.80	106.3945	219.9908	20.488	72.7853	195.6628	139.98	172.62
V min	0.9527	0.9981	0.9006	0.9131	0.9657	0.9704	0.9621	0.9652
V max	0.9652	0.9562	0.9562	0.9530	0.9988	1.0	0.961	0.9915
% saving	-	26.08		48	56	-	-	67
Iteration	-	-	-	-	150	50	-	150

The results suggest that the proposed algorithm is superior to other results. The period required to test a one-year variance in loads in distribution systems. It was determined that the suggested method achieved maximum power losses and a superior voltage profile, as well as the lowest DG cost and best DG location. The proposed algorithm has been shown to outperform all other techniques. The proposed nVSI has been implemented through the forward backward sweep algorithm by reduction methods. The proposed nVSI has been proved for the best algorithm for optimal placement of DG [24], and the lowest cost of DG source in the system. The table confirmations the upgraded concert of finest placement of DG source, Exact rating of DG source, and the number of DG sources necessary to maintain the stability of distribution systems.

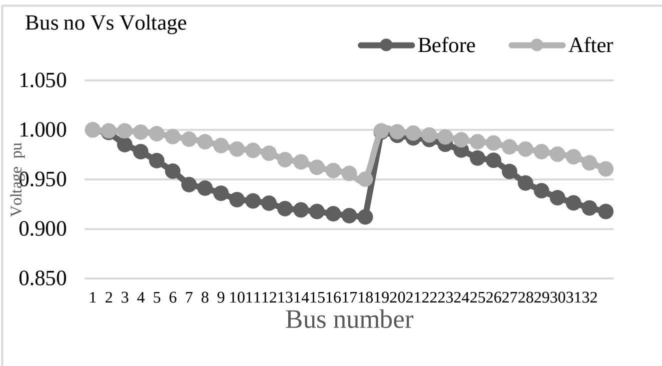

Figure 2. Bus voltages with bus numbers

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Previous results violated several limits on capacitor sizes and placed of DG sources in the distribution systems. The modified algorithms cleared the number of DG source sizes and suitable distribution system placements. The presented algorithms demonstrate the dominance and cost-effectiveness of these algorithms for effectively selecting capacity, placement, conductor selection, and to reduce the cost of DG source. The performance of the results is compared with Antlion [25], Grey wolf, Gross Hopper, Dingo, sturd Krill, cuckoo crunch algorithm and shuffled frog algorithms. The proposed mBAT algorithm has been derived to preserve a best voltage profile while minimizing power losses in the networks. Figure 2.0 denotes the convergence structures of the mBAT algorithm for the real power loss reduced and increased the bus voltages of the 33-bus system after the iterations, the suggested mBAT algorithm has been converged to the ideal results [26].

5.2 IEEE 69 bus system

The results of IEEE 69 bus system (Baran, Wu 1989) have been tested and associated with six techniques, as indicated in table 4.0, for reducing active power losses and improving the voltage contour of the systems. This system has 7 main feeders, 3 laterals, and 5 tie lines, as well as 68 load buses with capacities of 3.80 MW, 2.69 MVAr, and 12.66 KV. Before reconfiguration the real and reactive power losses for the 69-bus system are 224.476 KW, 178.56KVAr and the minimum voltage of the buses are 0.9101 pu. After the reconfiguration and DGs are inserted, the system has 146.64 KW, 89.28 KVAr, and the bus voltage is improved to 0.9624pu. The comparison results shows that the proposed mBAT algorithm has been developed to keep a best voltage profile. The seven techniques have been compared to this algorithm to optimally inject the DG source and position. In this research, the system has 68 sectionalized switches, 5 tie switches for the DG placements. Based on the comparison, the proposed mBAT algorithm is greater than the others in terms of voltage flow, power losses, DG locations [27], sizes, placements, and cost savings. Table 4.0 shows the outcomes of reconfiguration and suitable place of DG sources injected in radial distribution systems.

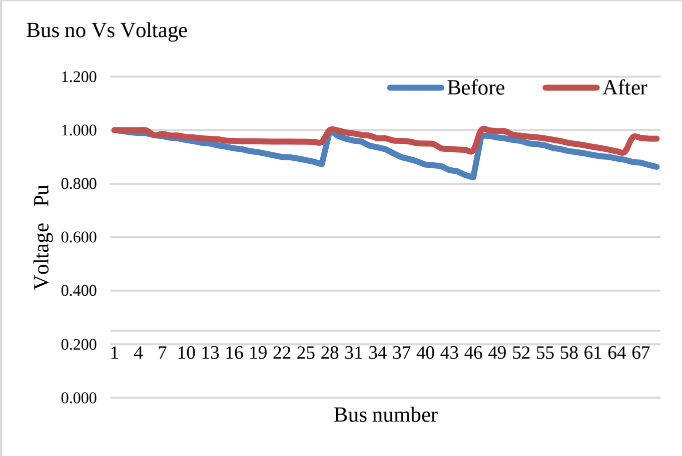

Figure 3. Bus voltages with bus numbers

Table 4. IEEE 69 BUS results and Comparison with and without DG Source

Parameters	Antlion	Grey wolf	Gross Hopper	stud Krill	cuckoo crunch	shuffled frog	Proposed mBAT
Year	2019	2021	2023	2022	2019	2019	-
Tie switches	30,55,61	30,06,18	12	61,17,11	15,50,61	57,73,13 ,69,12	69, s70 71, 72, 73.
Qc (KVAr)	946.347	2.62	151.6664	34.3566	1950	0.89 MVAr	89.28 KVAr
Cost ($)	-	-			64397	-	75000
Location	30,55,61	57,73,13,69 ,12	12	61,17,11	15,50,61	57,73,13,69 ,12	45,46,71
Ploss (KW)	224.049	164.42 8 M W	225.1789	68.1523	190.8139	149.51	146.64
V min	0.9109	0.939	0.9221	0.9492	0.951	0.942	0.9624
Vmax	-	0.9987	0.9578	1.0	1.0	-	1.05
% saving	62%	69.14	55	59.8	54.4	71.57	76.12
Iter	--	-	-	-	100	-	100

To compute the optimization process for the IEEE 33 bus system using the RACCOON conductor and a bat algorithm, you need the following data for the number of bats 40, Loudness of sound (A0A_0A0) 0.566, Rhythm rate (rrr): 0.289 (assumed fro all bats), Frequency range of bats: 0 to 1.972, Sound rate timbre: Assumed as per the calculation [27].

Table 5. Summary of main parameters

S. No.	N	A_0	r_0	f_{min}	f_{max}
1	40	0.566	0.289	0	1.972

5.3 Test 62 Bus System

The south Indian test system has been used to implement for the research. The total installed capacity of the three transformers

International Journal of
Electrical and Electronics Research (IJEER)
Research Article | Volume 12, Issue 3 | Pages 881-888 | e-ISSN: 2347-470X

is 3.6 MVA, 4.0MVA, and 5.35 MVA. The 10 MVA, 33kV. The consumers side of lines are 11KV at 0.95 lagging power factor, conductor size of 91.97mm^2. The switch positions are denoted by 0, 1 for this network as integer variables and the binary coding techniques has been used. The proposed mBAT techniques for reducing the losses have been tested and estimated on a real-time Indian distribution system of 62 buses. The real and imaginary power losses have been reduced from 90.0851 KW to 63.447 KW, and from 72.812 KVAr to 42.56 KVAr accurately in the lines.

Table 6. Indian Standard Test 62 BUS System Results and Comparison

Parameters	Antlion	Grey wolf	Gross Hopper	Dingo	stud Krill	cuckoo crunch	shuffled frog	Proposed mBAT
Tie switches	15,48,56	15,49,55	15,48,56	15,48, 56	15,48,56	12,34,6 2	12,36,62	15,46,51
Qc (KVAr)	1.34	1.26	1.34	1.34	1.34	1.125	1.5	0.4256 MVAr
Cost ($)	1.75	1.15	1.15	1.16	1.21	2.0	1.75	1.05
Location	15,48,56	15,49,55,29	13,44,57,51	15,47,55, 44	15,46,56, 36	13,34,5 9,28	12,36,62, 41	11,35,58
Ploss (KW)	86.28	43.09	37.8	52.28	86.21	34.12	62.78	63.447
V min	0.9312	0.9287	0.9142	0.9101	0.9413	0.9372	0.9256	0.9106
Vmax	0.945	0.94718	0.9521	0.9443	0.9461	0.9532	0.928	0.996
% saving	29	46	32	41	51	55	34	62.82
Iteration	175	150	1250	125	175	500	125	85

The RACCON [28] and their family of conductors have been used to find the capacity of lines using the VSI and find the breaking capacity of conductors from gradually increased to maximum level of 6.34 times of electrical loads. The system power factor is always 0.96 lagging with full loads carrying the lines. The proposed methods are taken 100 numbers of convergence takes place to this research. The data for the proposed systems have been tabulated in 6. The 60 nos of population, 85 nos of generations, 0.566 is the loudness, and the 0.289 is the pulse rate utilized in this research. The selected parameters are used in this research as experimental method. When compared with other techniques only 3 switches utilized for this research out of 15 switches. The cost of switches also saved in this research.

Table 7. Summary of Main Parameters

S. No.	N	A_0	r_0	f_{min}	f_{max}
1	60	0.566	0.289	0	1.972

The above parameters are used for getting the optimal solution. In the *table 7* gives the power losses of the south Indian test system results [29]. In this paper used for the mBAT algorithm 60 bats, 0.566 emission rate,0.289 loudness, and frequency 1.972 have been working to find the best optimal solution [30]. Fewer computing iterations are required. In this research, the recently designed mBAT algorithm coding is articulated and achieved.

Table 8. Power Loss Results of Indian 62 Bus Systems

Type	Tie switches placed	P_{LOSS} (KW)	Q_{LOSS} (KVAr)	Min Node Voltage	Power loss reduction
Proposed BAT	12-32, 36-48, 38-57. (3 switches)	63.447 KW	42.56 KVAr	0.9617, Node 11. 0.9549, Node 35. 0.9761, Node 58.	62.82%

6. CONCLUSION

In this research, the most important work is to reduce the real power losses, maximizing the real power flow, uphold the bus voltages in the distribution systems. The nVSI has been designed to determines the conductor's stability point of any distribution lines. The weak nodes have been identified by using a different sectionalized and tie switch. In the shortage of reactive powers on the weak nodes have been injected DG sources to maintain the system stability. Using the mBAT algorithm, identifying the weak nodes, injecting the required amount of DG sources in the weak nodes easily. Determining the sizes of DG sources, finding the DG location, calculating the number of insufficient DGs are easily found by the mBAT algorithm. Reduction techniques using the branch exchange method have been used to find the novel VSI. The forward backward sweep algorithm has been utilized to find the parameters of distribution lines. The proposed mBAT algorithm is implemented to IEEE 33 bus,69 bus and Indian test system for multiple DGs to prove the value of algorithms. The results prove including DGs are minimizing the real power losses and improves the power flow and maintain the voltage of nodes. The mBAT algorithm gives, the IEEE 33 bus power losses reduced from 228.68 to 172.62 KW, 69 bus system has been reduced from 224.996 KW to 178.56 KW, and the test 62 bus reduced from 90.0851 KW to 63.447 KW. The results of mBAT algorithm are maintain the bus voltage and lies between 0.96 to 1.02 pu. For better goal functions, a nonlinear optimization problem has been developed. The new VSI is the most valuable to transmission lines manufacturers. In future research, so many load flow equations and so many soft computing techniques may be generated and without any interruptions for analyzing the distribution side problems.

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