

# NOVEL CURING AILMENTS THROUGH MUSIC INSPIRED OPTIMIZATION ALGORITHM

**Lenin Kanagasabai**

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## Abstract

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is applied for solving the true power loss reduction problem. Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is formulated by imitating the actions of pontiff's curing the body and mental ailments of human beings. Music is a dynamism that bonds civilization the biosphere over. Music has for eras been acknowledged to have a fair entreaty to both individuals and faunae. Music is a congruent feature in today's biosphere which is full of struggles and strains. Contravening man-made boundaries, Music guides the communication of congruence, concord and comradeship. Musical Harmonies are utilized to assist in curing patients with sicknesses in a corporal and psychological mode in various conditions. Human beings with ailments should cooperate with the pontiff. Since the therapy intermingled with musical tones, Ayurveda, Psychology, Gemenotherapy and Astrology. If an individual with ailments not cooperating then; cure of sickness not possible in the body and mind. The concentration and aspiration competence of the sick individual is more important in the therapy. If a sick individual unable to concentrate and not aspire to get well soon then, the therapy won't be succeeded. The concentration and aspiration of the sick individual are mathematically formulated to design the exploitation segment of the algorithm. Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is validated in 23 benchmark functions, IEEE 30, 354 systems and 220 KV Egyptian network.

**Keywords:** Curing ailments; Music; Pontiff SGS; Therapy

## Introduction

True power loss Lessening and voltage constancy Expansion in Power Systems is an international problem. In this paper Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is applied to solve the true power loss reduction problem.

## Literature survey

Many researchers around the world are applying numerous algorithms for various applications. Kanagasabai (2020c) used the monkey optimization algorithm, Prastyo *et al.* (2018) applied the Taguchi method, Dirik (2022) applied the fuzzy genetic system, Dulal *et al.* (2024) applied tensor methods, Shahvaroughi *et al.* (2023) applied sparrow search algorithm, Kanagasabai (2020b) applied amplified black hole algorithm, Kanagasabai (2020a) applied Greenland wolf algorithm, Edalatpanah *et al.* (2024) applied forecasting method, Martin and Edalatpanah (2023) applied extended fuzzy method, Kanagasabai (2020d) applied Acridodea stirred artificial bee colony algorithm, Muniz and Muniz (2023) used IOT design, Rasoulzadeh *et al.* (2022) cheused DEA method, Omelchenko *et al.* (2020) designed new algorithm, (Talebitooti *et al.*, 2017; Talebitooti *et al.*, 2021; Ghafouri *et al.*, 2022, Zarastvand *et al.*, 2022), worked in composite shell structures.

## Projected Design

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is formulated by imitating the actions of pontiff's curing the body and mental ailments of human beings. Music is a dynamism that bonds civilization the biosphere over. Music has for eras been acknowledged to have a fair entreaty to both individuals and faunae. Music is a congruent feature in today's biosphere which is full of struggles and strains. Contravening man-made boundaries, Music guides the communication of congruence, concord and comradeship. Musical Harmonies are utilized to assist in curing patients with sicknesses in a corporal and psychological mode in various conditions.

### Pontiff Sri Ganapati Sachchidananda

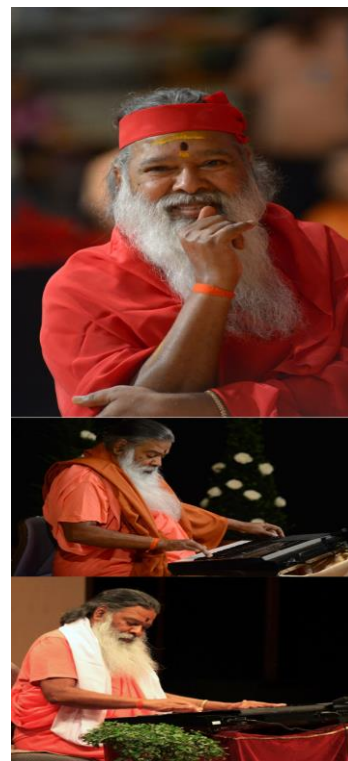
Pontiff Sri Ganapati Sachchidananda (SGS) of Mysore [Sri Ganapathy Sachchidananda Ashrama - Avadhoota Datta Peetham] India (Figure 1), himself a prodigious Musician and a creator. Pontiff has been conducting many Spiritual Music Concerts around the globe for healing the corporal and

psychological of the human beings. Musical melodies from Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings. Pontiff said, in the healing of ailments music therapy is combined with Ayurveda, Psychology, Gemenotherapy and Astrology. Science is emerging very fast. All the mechanisms are united as one synthesizer.

Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings. Pontiff said in the healing of ailments music therapy is combined with Ayurveda, Psychology, Gemenotherapy and Astrology.

In the Exploration these attributes are emulated mathematically to formulate the algorithm. Human beings with ailments should cooperate with the pontiff. Since the therapy intermingled with musical tones, Ayurveda, Psychology, Gemenotherapy and Astrology (Xu, 2021; Ursutiu *et al.*, 2019).

If an individual with ailments not cooperating then; cure of sickness not possible in the body and mind. The concentration and aspiration competence of the sick individual is more important in the therapy.



**Figure 1. Pontiff SGS playing the music and in the phase of healing the sickness of Human beings**

If a sick individual unable to concentrate and not aspire to get well soon then, the therapy won't be succeeded. The concentration and aspiration of the sick individual are mathematically formulated to design the exploitation segment of the algorithm.

### Novelty of the research

- First time in the globe Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm
- Algorithm is formulated by imitating the actions of pontiff's curing the body and mental ailments of human beings.
- Musical melodies from Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings.

### Validation of the algorithm

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is validated in 23 benchmark functions, IEEE 30, 354 systems and 220 KV Egyptian network.

### Attainment of the proposed algorithm

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is defined and successfully solved the problem. True power loss had been reduced, Voltage deviation has been minimized and Voltage stability of the algorithm has been improved.

### Problem Formulation

Main objective function of the true power loss reduction problem is demarcated as,

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

$$M(\bar{g}, \bar{h}) = 0 \quad (2)$$

$$N(\bar{g}, \bar{h}) = 0 \quad (3)$$

Control ( $\bar{g}$ ) and dependent ( $\bar{h}$ ) vectors are defined as,

$$g = [VL_{G1}, \dots, VL_{GN_g}; QC_1, \dots, QC_{N_c}; T_1, \dots, T_{N_T}] \quad (4)$$

$$h = [PG_{slack}; VL_1, \dots, VL_{N_{Load}}; QG_1, \dots, QG_{N_g}; SL_1, \dots, SL_{N_T}] \quad (5)$$

$Q_c \rightarrow$  reactive power compensator

$T \rightarrow$  Transformer tap

$V_g \rightarrow$  Generator voltage

$PG_{slack} \rightarrow$  Slack generator

$V_L \rightarrow$  Voltage in transmission lines

$Q_G \rightarrow$  Reactive power generator

Fitness functions are defined as follows,

$$F_1 = P_{Min} = \text{Min} \left[ \sum_{m=1}^{NTL} G_m [V_i^2 + V_j^2 - 2 * V_i V_j \cos \theta_{ij}] \right] \quad (6)$$

$$F_2 = \text{Min} \left[ \sum_{i=1}^{NLB} |V_{Lk} - V_{Lk}^{desired}|^2 + \sum_{i=1}^{NG} |Q_{GK} - Q_{KG}^{lim}|^2 \right] \quad (7)$$

$$F_3 = \text{Minimize } L_{Maximum} \quad (8)$$

$S_L \rightarrow$  Apparent power

$$L_{Max} = \text{Max}[L_j]; j = 1; N_{LB} \quad (9)$$

$$\begin{cases} L_j = 1 - \sum_{i=1}^{NPV} F_{ji} \frac{V_i}{V_j} \\ F_{ji} = -[Y_1]^1 [Y_2] \end{cases} \quad (10)$$

$$L_{Max} = \text{Max} \left[ 1 - [Y_1]^{-1} [Y_2] \times \frac{V_i}{V_j} \right] \quad (11)$$

Parity constraints

$$0 = PG_i - PD_i - V_i \sum_{j \in N_B} V_j [G_{ij} \cos[\theta_i - \theta_j] + B_{ij} \sin[\theta_i - \theta_j]] \quad (12)$$

$$0 = QG_i - QD_i - V_i \sum_{j \in N_B} V_j [G_{ij} \sin[\theta_i - \theta_j] + B_{ij} \cos[\theta_i - \theta_j]] \quad (13)$$

Disparity constraints

$$P_{gs1}^{min} \leq P_{gs1} \leq P_{gs1}^{max} \quad (14)$$

Reactive power generation (QGi)

$$Q_{gi}^{min} \leq Q_{gi} \leq Q_{gi}^{max}, i \in N_g \quad (15)$$

Load bus voltage (VLi)

$$VL_i^{min} \leq VL_i \leq VL_i^{max}, i \in NL \quad (16)$$

Transformers tap setting (Ti)

$$T_i^{min} \leq T_i \leq T_i^{max}, i \in N_T \quad (17)$$

Switchable reactive power compensations (QCi)

$$Q_c^{min} \leq Q_c \leq Q_c^{max}, i \in N_c \quad (18)$$

$$|SL_i| \leq S_{Li}^{max}, i \in N_{TL} \quad (19)$$

Generator bus voltage (VGi)

$$VG_i^{min} \leq VG_i \leq VG_i^{max}, i \in N_g \quad (20)$$

$$\text{Multi objective fitness} = F_1 + r_1 F_2 + u F_3 = F_1 + \left[ \sum_{i=1}^{NL} x_v [VL_i - VL_i^{min}]^2 \right] + r_f F_3 \quad (21)$$

$$VL_i^{minimum} = \begin{cases} VL_i^{max}, & VL_i > VL_i^{max} \\ VL_i^{min}, & VL_i < VL_i^{min} \end{cases} \quad (22)$$

$$QG_i^{minimum} = \begin{cases} QG_i^{max}, & QG_i > QG_i^{max} \\ QG_i^{min}, & QG_i < QG_i^{min} \end{cases} \quad (23)$$

$\Delta P$

Incremental change in bus real power.

$\Delta Q$

Incremental change in bus reactive Power injection.

$\Delta \theta$

Incremental change in bus voltage angle.

$\Delta V$

Incremental change in bus voltage Magnitude

$J_R$

reduced Jacobian matrix of the system

$\xi$

Right eigenvector matrix of JR

$\eta$

Left eigenvector matrix of JR

$\Lambda$

diagonal eigenvalue matrix of JR

$n$

Number of transmission lines,

$gk$

conductance of branch k,

|                       |                                                                                       |
|-----------------------|---------------------------------------------------------------------------------------|
| $V_i$ and $V_j$       | are the voltage magnitude at bus $i$ and bus $j$ ,                                    |
| $\theta_{ij}$         | voltage angle difference between bus $i$ and bus $j$ .                                |
| $nl$                  | number of load busses                                                                 |
| $V_k$                 | voltage magnitude at bus $k$ .                                                        |
| $nb$                  | number of buses,                                                                      |
| $PG$ and $QG$         | real and reactive power of the generator,                                             |
| $PD$ and $QD$         | real and reactive load of the generator,                                              |
| $G_{ij}$ and $B_{ij}$ | mutual conductance and susceptance between bus $i$ and bus $j$ .                      |
| $Ng, Nt, Nc$          | number of generators, number of tap transformers and the number of shunt compensators |
| $g_k$                 | the conductance of branch between nodes $i$ and $j$ ,                                 |
| $Nbr$                 | total number of transmission lines in power systems.                                  |
| $Pd$                  | total active power demand,                                                            |
| $P_{gi}$              | generator active power of unit $i$ ,                                                  |
| $P_{gsalck}$          | generator active power of slack bus.                                                  |
| $\Omega v$            | weighting factor of voltage deviation.                                                |
| $VD$                  | voltage deviation                                                                     |

## Curing Ailments Through Music Inspired Optimization Algorithm

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is formulated by imitating the actions of pontiff's curing the body and mental ailments of human beings. Music is a dynamism that bonds civilization the biosphere over. Music has for eras been acknowledged to have a fair entreaty to both individuals and faunae. Music is a congruent feature in today's biosphere which is full of struggles and strains. Contravening man-made boundaries, Music guides the communication of congruence, concord and comradeship. Musical Harmonies are utilized assist cure the patients with sicknesses in corporal and psychological mode in various conditions. Pontiff Sri Ganapati Sachchidananda (SGS) Shown in Figure 1, of Mysore [Sri Ganapathy Sachchidananda Ashrama - Avadhoota Datta Peetham] India, himself a prodigious Musician and a creator Pontiff has been conducting many Spiritual Music Concerts around the globe for healing the corporal and psychological of the human beings. Musical melodies from Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings. Pontiff said in the healing of ailments music therapy (Figure 1) is combined with Ayurveda, Psychology, Gemenotherapy and Astrology. Science is emerging very fast. All the mechanisms are united as one synthesizer. Pontiff plays music and also by Ayurveda, Psychology,

Gemenotherapy cure the ailments of human beings. On 31st October 2023, Pujya Sri Swamiji was honored with "Honorary Doctorate" by Dr.Gangubai Hangar Music & performing arts University.

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm, population is produced as:

$$C = \begin{bmatrix} C_1 \\ \vdots \\ C_i \\ \vdots \\ C_N \end{bmatrix}_{N \times m} = \begin{bmatrix} c_{1,1} & \cdots & c_{1,m} \\ \vdots & \ddots & \vdots \\ c_{N,1} & \cdots & c_{N,m} \end{bmatrix} \quad (24)$$

$C \rightarrow \text{Matrix} - \text{population}$   
 $N \rightarrow \text{members} - \text{population}$   
 $m \rightarrow \text{variables}$

$$c_{i,j} = \min_j + \text{Rand}(\max_j - \min_j) \quad (25)$$

$\max_j, \min_j \rightarrow \text{limit ranges}$   
 $R \in [0,1]$

Objective function is calculated as,

$$B = \begin{bmatrix} B_1 \\ \vdots \\ B_i \\ \vdots \\ B_N \end{bmatrix}_{N \times 1} = \begin{bmatrix} B(C_1) \\ \vdots \\ B(C_i) \\ \vdots \\ B(C_N) \end{bmatrix}_{N \times 1} \quad (26)$$

Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings. Pontiff said in the healing of ailments music therapy is combined with Ayurveda, Psychology, Gemenotherapy and Astrology. In the Exploration these attributes are emulated mathematically to formulate the algorithm.

$$C_{i,j}^{L1} = C_{i,j} + \text{Rand} \cdot (A_j - R_2 \cdot C_{i,j}) \quad (27)$$

$$C_{i,j}^{L1} \rightarrow \text{fresh position of } i\text{th member population}$$

$$A_j \rightarrow \text{location in } j\text{th dimension}$$

$$R \in [0,1]$$

$$R_2 \in \{1,2\}$$

$$C_i = \begin{cases} C_i^{L1}, & B_i^{L1} \leq B_i \\ C_i, & \text{Else} \end{cases} \quad (28)$$

Human beings with ailments should cooperate with the pontiff. Since the therapy intermingled with musical tones, Ayurveda, Psychology, Gemenotherapy and Astrology. If an individual with ailments not cooperating then; cure of sickness not possible in the body and mind. The cooperation factor is defined as:

$$COP_i = \{C_k, B_k > B_i\} \quad (29)$$

$k = 1, 2, 3, \dots, N$   
 $i = 1, 2, \dots, N$

$COP_i \rightarrow$  cooperation factor of human beings

$$C_{i,j}^{L2} = C_{i,j} + Rand \cdot (C_{i,j} - R_2 \cdot B_{i,j}) \quad (30)$$

$C_{i,j}^{L2} \rightarrow$  fresh position of  $i$ th member population

$R \in [0,1]$

$R_2 \in \{1,2\}$

$B_{i,j} \rightarrow$  Cooperation level of sick person

$$C_i = \begin{cases} C_i^{L2}, B_i^{L2} \leq B_i \\ C_i, Else \end{cases} \quad (31)$$

The concentration and aspiration competence of the sick individual is more important in the therapy. If a sick individual unable to concentrate and not aspire to get well soon then, the therapy won't be succeeded. Concentration and aspiration of the sick individual is mathematically formulated to design the exploitation segment of the algorithm.

$$C_{i,j}^{L3} = C_{i,j} + Rand \cdot (1 - 2 \cdot R) \cdot \frac{max_j - min_j}{t} \quad (32)$$

$C_{i,j}^{L3} \rightarrow$  resh position of  $i$ th member population

$R \in [0,1]$

$t \rightarrow$  iteration present

$$C_i = \begin{cases} C_i^{L3}, B_i^{L3} \leq B_i \\ C_i, Else \end{cases} \quad (33)$$

In the phase of ailment curing, pontiff the music creator which explores multiple modes to find the correct set up of music which will heal the ailment and this replicate the different regions of examination in the exploration space. It is significant to regulate the activities of experimental solutions and about the exploring abilities. In this sequence a weight factor (Abaeifar *et al.*, 2022) is introduced into the procedure,

$$w = w_{max} - \left( \frac{w_{max} - w_{min}}{max\_iter} \right) * i \quad (34)$$

$w_{max}, w_{min} \in [0.9, -0.1]$

With concentrated and supportive approach, the individual who is in the phase of recovery will hear the music; this aspect similar to the learning process (Rathod *et al.*, 2023) and it mathematically formulated as,

$$Zn_{(i)}^g = w * Z_{(i)}^g + R * (Z_P^g - L_F E^g) \quad (35)$$

$Z_P^g \rightarrow$  music creator

Sequentially the individual's ailments impact will be reducing and this aspect is associated with the updated learning process and it scientifically defined as follows,

$$Zn_{(i)}^g = \begin{cases} w * Q_{(i)}^g + R * (Z_{(i)}^g - Z_{(r)}^g) \\ if f(Z_{(i)}^g) < f(Z_{(r)}^g) \\ w * Y_{(i)}^g + R * (Z_{(r)}^g - Z_{(i)}^g) Else \end{cases} \quad (36)$$

Each individual ailment impact will be reduced day by day and it is necessary to determine the phase of the individual. Equally the music creator will identify the recovery rapidness of the individual. These aspects are associated with the velocity and position (Chuanjun *et al.*, 2023) updating of the procedure,

$$Ra_{t+1}^i = \omega_t \cdot v_t^i + c_1 \cdot R_1 \cdot (p_t^i - u_t^i) + c_2 \cdot R_2 \cdot (g_t^b - u_t^i) \quad (37)$$

$$u_{t+1}^i = u_t^i + v_{t+1}^i \quad (38)$$

$R_1, R_2 \in [0,1]$

There will be interactive sessions between the individuals and the Pontiff. In the interactive session Pontiff will identify the stage of the ailment in individuals. If expected improvement is not found, then Pontiff will explore more ways of curing the ailment by composing different version of music. This is almost equivalent to the brain storm session. Many researchers around the globe are continuously working in analyzing the brain storm session activities. These years many version of brain storm optimization algorithm are defined (Zhao *et al.*, 2023) and applied to solve many engineering problems. In this paper the pontiff interact with the individuals for identifying the stage of ailment is defined from the steps a to h as follows,

- Interaction between individual and Pontiff
- Identification of individual's ailments level
- Pontiff explore additional ways to cure the ailments by redefining the music
- Pontiff will examine the emerging the ideas
- Analyzing the Applicability of various levels of music
- Random examination will be executed
- Redefine the curing level of ailments
- Optimized conditions are analyzed

Individual's position during interaction is defined as,

$$Z_{new}^d = Z_s^d + \xi * n(\mu, \sigma) \quad (39)$$

$n(\mu, \sigma)$  is the Gaussian function; mean  $\mu$  and variance  $\sigma$   
 $\xi \rightarrow$  coefficient that weights

$$\xi = l((0.5 * max\_iter - current\_iter)/k) * R \quad (40)$$

Subsequent to the state of brain storm sessions with the individuals, Pontiff will alter the instruments pitch by probing for an impeccable state of Music. Finally pontiff will identify pleasing

musical tones to cure the ailment of the individual. This leads to obtain the better solution. This process of pontiff in search for the pleasing musical tones to cure the ailment after the brain storm session is associated with the Music search procedure (Mansoori and Murali, 2022; Mo *et al.*, 2022; Unehara and Onisawa, 2004; Zhang and Zhang, 2018).

- Music Memory Size (MMS) - number of solution vectors in Music memory-
- Music Memory considering Rate (MMCR),  $MMCR \in [0, 1]$ ;
- Pitch modification Rate (PMR),  $PMR \in [0, 1]$ ;
- Stopping Criteria (number of improvisation (NI));

The segments in the process of pontiff in search for the pleasing musical tones are as follows:

- Fix the algorithm factors.
- Fix Music memory (MM).
- Identify the fresh Music from the MM.
- Rationalize the MM.
- Repeat Steps c and d, until end condition is attained.

New Music vector  $z' = \{y'_1, z'_2, \wedge, z'_N\}$  is created from the MM based on memory considerations, pitch adjustments, and randomization. The rate of for the new vector can be selected from any value in the stated MM range ( $z_1^1 - z_1^{HMS}$ ). It is feasible to select the renewed value using the MMCR factor,

$$z'_i \leftarrow \begin{cases} z'_i \in \{z_i^1, z_i^2, \wedge, z_i^{HMS}\}, P(MMCR) \\ z'_i \in Y_i, P(1 - MMCR) \end{cases} \quad (41)$$

$MMCR \in [0, 1]$   
 $P \rightarrow \text{probability}$

The MMCR is selecting one value from the pre-stored values in MM, and (1-MMCR) is the possibility of randomly selecting one reasonable value which not limited to those stored in the MM. Each constituent of the renewed Music vector  $z' = \{z'_1, z'_2, \wedge, z'_N\}$  is examined to describe whether it ought to be pitch-adjusted or not. This method employs the factor that fix the degree of modification for the pitch and it is selected from the MM. Pitch modification assessment specified as,

$$z'_i \leftarrow \begin{cases} 1, PMR \\ 0, 1 - PMR \end{cases} \quad (42)$$

Pitch modification method is completed only after a rate is selected from the MM. Rate (1-PMR) fix the degree of null. When  $PMR = 0.3$ , then the

procedure will choose a neighbouring value with a probability. If the pitch modification decision for  $z'$  is 1, and  $z'$  is recognized to be  $z_i(k)$  i.e., the  $k$ th element in  $Z_i$ , the pitch attuned value of  $z_i(k)$  is:

$$\begin{aligned} z' &= z' + \alpha \\ \alpha &= b \times (1, -1) \\ b &\rightarrow \text{bandwidth} \end{aligned} \quad (43)$$

MMCR and PMR parameters in the Music search will support the procedure to evade from local optima. After new Music found, assessing the renewed music will be done and if the renewed music is superior to the previous one in the MM and then the renewed music will be stored MM. Then MM is classified by the objective function value.

### Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm

- Start
- Fix the parameters
- Generate the population
- $C = \begin{bmatrix} C_1 \\ \vdots \\ C_i \\ \vdots \\ C_N \end{bmatrix}_{N \times m} = \begin{bmatrix} C_{1,1} & \cdots & C_{1,m} \\ \vdots & \ddots & \vdots \\ C_{N,1} & \cdots & C_{N,m} \end{bmatrix}$
- $c_{i,j} = \min_j + \text{Rand}(\max_j - \min_j)$
- compute the objective function
- $B = \begin{bmatrix} B_1 \\ \vdots \\ B_i \\ \vdots \\ B_N \end{bmatrix}_{N \times 1} = \begin{bmatrix} B(C_1) \\ \vdots \\ B(C_i) \\ \vdots \\ B(C_N) \end{bmatrix}_{N \times 1}$
- For  $t = 1:T$
- Streamline the sick individual location
- For  $i = 1:N$
- Apply the Exploration segment
- $C_{i,j}^{L1} = C_{i,j} + \text{Rand} \cdot (A_j - R_2 \cdot C_{i,j})$
- $C_i = \begin{cases} C_i^{L1}, B_i^{L1} \leq B_i \\ C_i, \text{Else} \end{cases}$
- Define the cooperation factor
- $COP_i = \{C_k, B_k > B_i\}$
- $C_{i,j}^{L2} = C_{i,j} + \text{Rand} \cdot (C_{i,j} - R_2 \cdot B_{i,j})$
- Apply the exploitation segment
- $C_{i,j}^{L3} = C_{i,j} + \text{Rand} \cdot (1 - 2 \cdot R) \cdot \frac{\max_j - \min_j}{t}$
- $C_i = \begin{cases} C_i^{L3}, B_i^{L3} \leq B_i \\ C_i, \text{Else} \end{cases}$
- $w = w_{\max} - \left( \frac{w_{\max} - w_{\min}}{\max \text{ iter}} \right) * i$
- $Zn_{(i)}^g = w * Z_{(i)}^g + R * (Z_p^g - L_F E^g)$
- $Zn_{(i)}^g = \begin{cases} w * Q_{(i)}^g + R * (Z_{(i)}^g - Z_{(r)}^g) \\ \text{if } f(Z_{(i)}^g) < f(Z_{(r)}^g) \\ w * Y_{(i)}^g + R * (Z_{(r)}^g - Z_{(i)}^g) \text{Else} \end{cases}$

- w.  $Ra_{t+1}^i = \omega_t \cdot v_t^i + c_1 \cdot R_1 \cdot (p_t^i - u_t^i) + c_2 \cdot R_2 \cdot (g_t^p - u_t^i)$
- x.  $u_{t+1}^i = u_t^i + v_{t+1}^i$
- y.  $Z_{new}^d = Z_s^d + \xi * n(\mu, \sigma)$
- z.  $\xi = l((0.5 * max\_iter - current\_iter)/k) * R()$
- aa. Define the Music Memory Size (MMS) // number of solution vectors in Music memory//
- bb. Fix the Music Memory considering Rate (MMCR), (MMCR  $\in [0, 1]$ )
- cc.  $z'_i \leftarrow \begin{cases} z'_i \in \{z_i^1, z_i^2, \dots, z_i^{HMS}\}, P(MMCR) \\ z'_i \in Y_i, P(1 - MMCR) \end{cases}$
- dd.  $z'_i \leftarrow \begin{cases} 1, PMR \\ 0, 1 - PMR \end{cases}$
- ee. Determine the Pitch modification Rate (PMR), (PMR  $\in [0, 1]$ )
- ff.  $z' = z' + \alpha$
- gg.  $\alpha = b \times (1, -1)$
- hh. The segments in the process of pontiff in search for the pleasing musical tones are defined
- ii. Fix the algorithm factors

- jj. Fix the Music memory (MM)
- kk. Identify fresh Music from the MM
- ll. Rationalize the MM
- mm. End if
- nn.  $t = t + 1$
- oo. Output the best solution
- pp. End

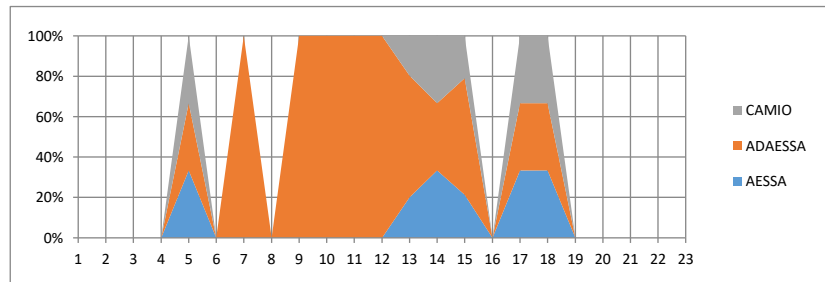
The above Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm defines the complete - procedure. Steps “b” to “oo” is defined rendering to the sequential process of the procedure.

## Simulation Study

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is corroborated in 23 benchmark functions (Unimodal-7, Multimodal-6, fixed- dimension multimodal- 10) (Tudose *et al.*, 2021), Table 1 and Figure 2 demonstrate the results of CAMIO in 23 benchmark functions.

**Table 1. Result of camio in benchmark functions**

| Function | AESSA (Tudose <i>et al.</i> , 2021) | ADAESSA (Tudose <i>et al.</i> , 2021) | CAMIO                  |
|----------|-------------------------------------|---------------------------------------|------------------------|
| 1        | $6.38 \times 10^{-12}$              | $6.96 \times 10^{-9}$                 | $6.30 \times 10^{-12}$ |
| 2        | $3.08 \times 10^{-7}$               | $5.48 \times 10^{-6}$                 | $3.00 \times 10^{-7}$  |
| 3        | $2.53 \times 10^{-1}$               | $4.35 \times 10^{-10}$                | $2.50 \times 10^{-1}$  |
| 4        | $6.71 \times 10^{-7}$               | $1.19 \times 10^{-5}$                 | $6.71 \times 10^{-7}$  |
| 5        | 4.110208                            | 4.11726                               | 4.11206                |
| 6        | $3.19 \times 10^{-10}$              | $4.50 \times 10^{-10}$                | $3.18 \times 10^{-10}$ |
| 7        | $2.23 \times 10^{-5}$               | 0.002002                              | $2.20 \times 10^{-5}$  |
| 8        | -2877.61                            | -3052.87                              | -2870.72               |
| 9        | $1.01 \times 10^{-12}$              | 22.85084                              | $1.00 \times 10^{-12}$ |
| 10       | $4.79 \times 10^{-7}$               | 0.810233                              | $4.70 \times 10^{-7}$  |
| 11       | $5.91 \times 10^{-12}$              | 0.33718                               | $5.90 \times 10^{-12}$ |
| 12       | $2.56 \times 10^{-12}$              | 0.051897                              | $2.50 \times 10^{-12}$ |
| 13       | 0.000366                            | 0.001099                              | 0.000361               |
| 14       | 0.998004                            | 0.998004                              | 0.998001               |
| 15       | 0.000307                            | 0.000829                              | 0.000301               |
| 16       | -1.03163                            | -1.03163                              | -1.03160               |
| 17       | 0.397887                            | 0.397887                              | 0.397883               |
| 18       | 3                                   | 3                                     | 3                      |
| 19       | -3.86278                            | -3.86278                              | -3.86272               |
| 20       | -3.23084                            | -3.21497                              | -3.23081               |
| 21       | -10.1532                            | -8.80506                              | -10.1530               |
| 22       | -10.0486                            | -8.46635                              | -10.0482               |
| 23       | -10.5364                            | -9.28557                              | -10.5361               |



**Figure 2. Results of CAMIO in 23 benchmark functions**

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is corroborated in IEEE 30 bus system Table 2 shows the True power loss (TRS (MW)), Voltage deviation (VDN (PU)) and reliability (VRI (PU)). Figures 3-5 gives valuation.

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm reduced the power loss, minimized the voltage deviation and enhanced the voltage stability. The values obtained by the CAMIO algorithm are CAMIO; TRS (MW) - 4.4912, VDN (PU) - 0.0836, VRI (PU) - 0.1512. Figures 3 - 5 shows the comparison of obtained results had been done with standard reported algorithms. It is evident that proposed CAMIO algorithm has reduced the power loss as well as improved the voltage stability.

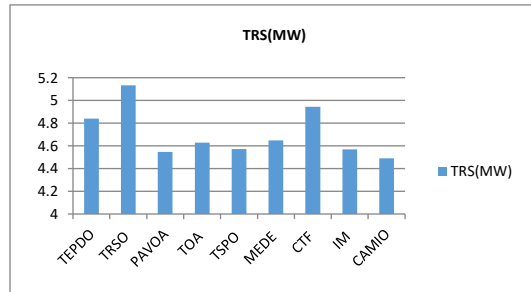
Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm is corroborated in IEEE 354 bus system (Nagarajan, 2020). Table 3 and Figures 6 and 7 shows the valuation of true power loss and voltage deviation. It is evident that proposed CAMIO algorithm has reduced the power loss as well as reduced the voltage deviation.

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm verified in west Delta Egyptian 220 KV network (El-Ela et al., 2019). Table 4, Figures 8 and 9 shows the valuation of true power loss and voltage deviation. It is evident that proposed CAMIO algorithm has reduced the power loss as well as reduced the voltage deviation.

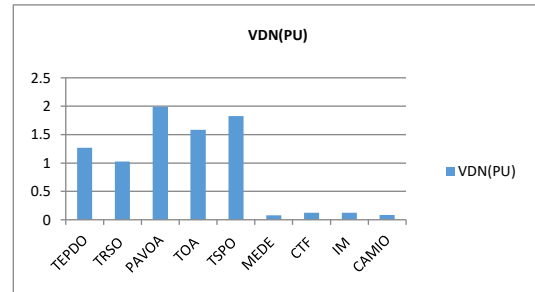
Table 5 and Figure 10 show the time taken by Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm.

**Table 2. Assessment of results (IEEE 30 BUS)**

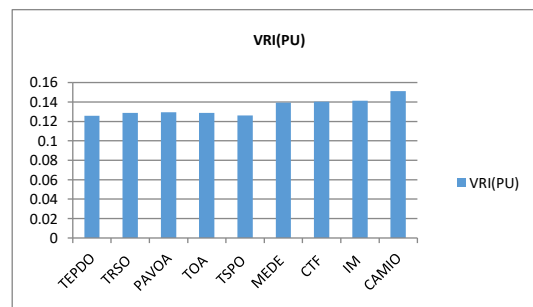
| Technique                               | TRS(MW) | VDN(PU) | VRI(PU) |
|-----------------------------------------|---------|---------|---------|
| TEPDO (Ali <i>et al.</i> , 2023)        | 4.8395  | 1.2663  | 0.1259  |
| TRSO (Ali <i>et al.</i> , 2023)         | 5.1328  | 1.0240  | 0.1287  |
| PAVOA (Ali <i>et al.</i> , 2023)        | 4.5464  | 1.9889  | 0.1294  |
| TOA (Ali <i>et al.</i> , 2023)          | 4.6271  | 1.5865  | 0.1289  |
| TSPO (Ali <i>et al.</i> , 2023)         | 4.5730  | 1.8257  | 0.1262  |
| MEDE (Ali <i>et al.</i> , 2023)         | 4.6482  | 0.0802  | 0.1394  |
| CTF (Abd-El Wahab <i>et al.</i> , 2022) | 4.9448  | 0.1212  | 0.1402  |
| IM (Habib Khan <i>et al.</i> , 2022)    | 4.5677  | 0.1250  | 0.1414  |
| CAMIO                                   | 4.4912  | 0.0836  | 0.1512  |



**Figure 3. Appraisal of TRS (IEEE 30 bus)**



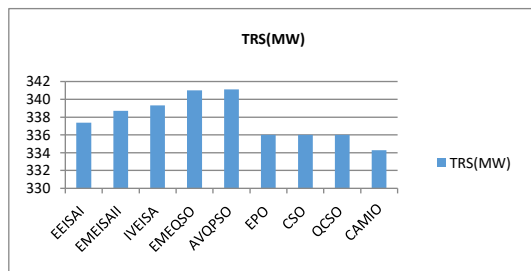
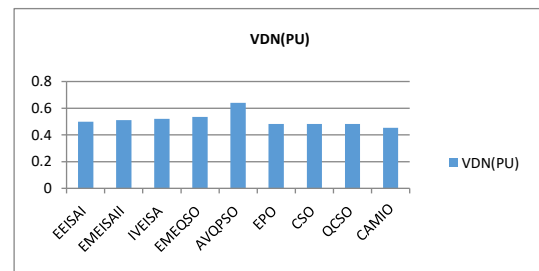
**Figure 4. Appraisal of VDN (IEEE 30 bus)**



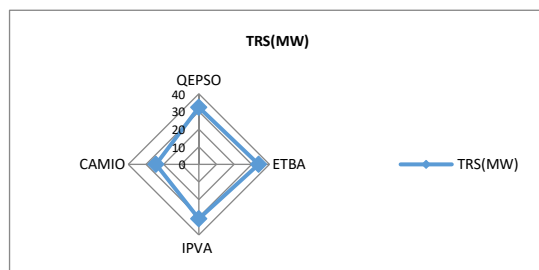
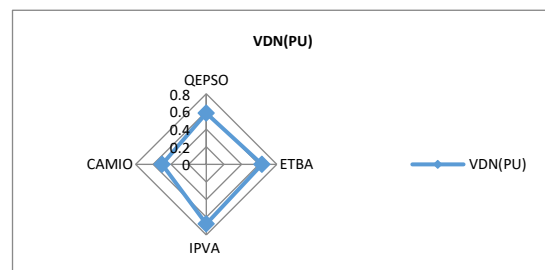
**Figure 5. Appraisal of VRI (IEEE 30 bus)**

**Table 3. Loss comparison (IEEE 354)**

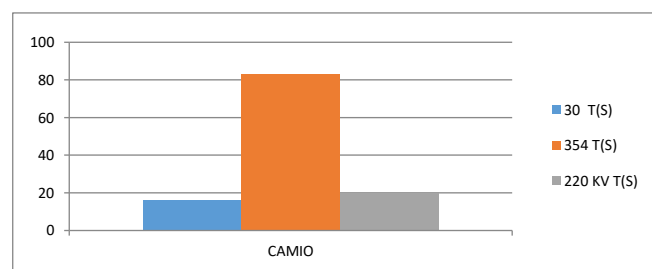
| Technique                               | TRS(MW) | VDN(PU) |
|-----------------------------------------|---------|---------|
| EEISAI (Mouassa and Bouktir, 2019)      | 337.374 | 0.4978  |
| EMEISAI (Mouassa and Bouktir, 2019)     | 338.715 | 0.5117  |
| IVEISA (Mouassa and Bouktir, 2019)      | 339.325 | 0.5216  |
| EMEQSO (Nagarajan <i>et al.</i> , 2020) | 341.001 | 0.5354  |
| AVQPSO (Nagarajan <i>et al.</i> , 2020) | 341.123 | 0.6395  |
| EPO (Kanagasabai, 2022)                 | 336.025 | 0.4821  |
| CSO (Kanagasabai, 2022)                 | 336.017 | 0.4819  |
| QCSO (Kanagasabai, 2022)                | 336.011 | 0.4813  |
| CAMIO                                   | 334.269 | 0.4539  |

**Figure 6. Valuation of TRS (IEEE 354 bus)****Figure 7. Appraisal of VDN (IEEE 354 bus)****Table 4. Valuation of result (220 KV)**

| Technique             | TRS(MW)  | VDN(PU)  |
|-----------------------|----------|----------|
| QEPSO (Mohamed, 2022) | 32.31400 | 0.580000 |
| ETBA (Mohamed, 2022)  | 33.87500 | 0.632700 |
| IPVA (Mohamed, 2022)  | 30.78600 | 0.675100 |
| CAMIO                 | 24.28601 | 0.500125 |

**Figure 8. Appraisal of TRS (220KV)****Figure 9. Appraisal of VDN (220KV)****Table 5. Time taken by CAMIO**

| TECHNIQUE | 30 T(S) | 354 T(S) | 220 KV T(S) |
|-----------|---------|----------|-------------|
| CAMIO     | 16.29   | 83.21    | 20.02       |

**Figure 10. Time taken by CAMIO in ieee 30, 354, and 220kv systems**

## Conclusion

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm solved the problem proficiently. Pontiff SGS heal the ailments of physical bodies and mental depression of the human beings. Pontiff said in the healing of ailments music therapy is combined with Ayurveda, Psychology, Gemenotherapy and Astrology. In the Exploration these attributes are emulated mathematically to formulate the algorithm. Human beings with ailments should cooperate with the pontiff. Since the therapy intermingled with musical tones, Ayurveda, Psychology, Gemenotherapy and Astrology. If an individual with ailments not cooperating then; cure of sickness not possible in the body and mind. The concentration and aspiration competence of the sick individual is more important in the therapy. If a sick individual unable to concentrate and not aspire to get well soon then, the therapy won't be succeeded. Concentration and aspiration of the sick individual is mathematically formulated to design the exploitation segment of the algorithm.

Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm authenticated in 23 benchmark functions, IEEE 30, 354 systems and 220 KV Egyptian network. Curing Ailments through Music Inspired Optimization (CAMIO) Algorithm reduced the power loss, minimized the voltage deviation and enhanced the voltage stability. The values obtained by the CAMIO algorithm in IEEE 30 bus system are CAMIO; TRS (MW) - 4.4912, VDN (PU) - 0.0836, VRI (PU) - 0.1512. Comparison of obtained results had been done with standard reported algorithms. It is evident that proposed algorithm has reduced the power loss as well as improved the voltage stability.

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