Turkish Journal of Computer and Mathematics Education Vol.12 No.9 (2021), 2341– 2355

Research Article

A Comparative analysis of DPFC with UPQC performance using various control techniques to Improve Power Quality in Smart Grid

P. Malleswara Reddy[a], Dr.A.Srinivasula Reddy[b], Dr.P.Sujatha[c], and Dr.P.Bharath Kumar[d]

[a] Research Scholar, Electrical Engineering, JNTUA University, Anantapuramu, India.
[b]Electrical and Electronics Engineering,,CMR College of Engineering, Hyderabad, India.
[c]Professor of EEE Department, JNTUCEA, Anantapuramu, India.
[d]Assistant Professor(Adhoc),Department of EEE,JNTUA CE,Anantapuramu.

Article History: Received: 10 January 2021; Revised: 12 February 2021; Accepted: 27 March 2021; Published online: 20 April 2021

Abstract: Electricity generation from the Wind and sun based photovoltaic (PV) frameworks are profoundly relies on climate conditions. Their irregular nature prompts vacillations in their yield. In this manner, the requirement for quick pay of vitality transmission and circulation frameworks is progressively significant. This paper explores examination of intensity quality issues of utility associated with Smart Grid utilizing Unified Power Quality Conditioner (UPQC) and Distributed Power Flow Controller (DPFC) device. Improvement of PQ in SG from disrupting impacts happened power structure controller utilized DPFC. From start, proposed structure power stream is surveyed and Multi Wavelet Transform (MWT) is used to incorporate extraction system of power parameters for PQ agitating impacts. In event that the yield signal has any aggravations, at that point yield signal is constrained by proposed controller based DPFC. Proposed calculation is utilized to hold supported DC-link voltage of DPFC by controlling yield voltage to enhance PQ. Modeling of solar PV-Wind Hybrid Micro-grid system increases power quality of system. In this paper, a new method was proposed with an Elephant Herding Optimization(EHO) based on DPFC control scheme, which is compared such as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC . The main objective of proposed method is to detect and control PQ problems in SG. In order to achieve the objective, simulation is carried out in MATLAB SIMULINK model.

Keywords: Smart Grid, Power Quality, Multi Wavelet Transform, Unified Power Quality Conditioner, Distributed Power Flow Controller, Cuttlefish Algorithm, Particle Swarm Optimization Algorithm, EHO Algorithm

1. Introduction

The proficiency improvement of electric machines and the advancement of sustainable power source are viewed as the most basic issues for the reasonable condition . In the mean time, it is pressing to improve the utilization of clean vitality and diminish the extent of coal and other fossil vitality age in the force matrix. By and large, the greater part of the DGs have littler establishment limit and must be associated with the appropriation organize for giving electric capacity to the utility just as neighborhood loads [1]. The developing utilization of inexhaustible and Distributed Generation (DG) has quickened and extended the job of intensity electronic gadgets for productive electrical use and improved security and unwavering quality of the electric utility lattice. Inferable from the reciprocal nature, a Wind- PV mixture power age framework offers higher dependability to get improved force yield than a sole inexhaustible force age framework. Among the PQ issues, unsymmetrical voltage sag and swell brutally influence WECS.

Distortions and harmonics in in voltage and current are treated as major issues in PQ investigation [2]. Among different force sorts of conditioners, unified power quality conditioner (UPQC) has earned tremendous enthusiasm because of elite capacity for relief of voltage and current in the distribution systems[3]. The power from a fundamental generator is transmitted to a large quantity of users or customers by the conventional power grids. Two-approach flows of electricity and information are used by the SG to produce a computerized and disseminated energy deliverance network [4]. A high level of PQ activated by the SG overcomes the snags like augmentation of system failures, electric utensils overheating, metering failures, insulation fail, or power disruption [5].

The developed standards are organized on the basis of the PQ problems such as failure of construction, augmenting labor-based failures, augmenting the quantity of imperfect products and delayed shipments . Accordingly, PQ examination and control has become a significant issue for taking choices to improve, work, oversee, and grow power frameworks . Along these lines, the improvement of sign preparing strategies has become a significant issue for PQ. Nonetheless, the achieved outcomes with different discovery and control strategies might be influenced by the framework clamor [6]. There are different types of FACTS devices are used to enhance capacity of power stream in transmission systems [7]. UPFC is good controller for the parameters, for instance, transport voltage, line impedance and transmission line in structure. Along these lines, to adjust to future

SG application, it will be a propensity of framework interfacing converters to coordinate PQ upgrade and force framework together [8].

The recent literature reviews based on the proposed technique with power quality issues, which is described below,

Pouria et al. [9] described about PQ enhancement, power flow control, immediate power reparation, and removal of power swings have been examined by Pouria Goharshenasan .In both grid associated and inaccessible methods the process performs the entire aforesaid target. Suitable control format for back to back interface converters among AC and DC MG comprising significant personality is supplied by the competence of the DC MG and the establishment of a UPQC like UPQC-DC.

Wajahat Ullah Tareen et al. [10] have talked about an exceptionally flimsy gadgets combined with the developing interest for nonlinear burdens and sustainable power source assets impact the force systems and frameworks execution regarding power quality. The answers for these issues were uninvolved channels (PFs), static var generators, and dynamic force channels (APFs). In any case, the utilization of PFs in a powerful framework builds its cost, size, and weight.

Veerasekhar1 et al. [11] examined about savvy electric matrix adjustment and to improve the force quality for effective usage of electric force utilizing balanced force channel compensator (MPFC). A tri – circle blunder driven entomb coupled PID controller was utilized to alter the PWM exchanging for MPFC and a Digital approval for various instances of burdens and shortcoming conditions without and with MPFC conspire for power quality improvement, power factor amendment, voltage adjustment and transmission line lose decrease.

Nirmala et al. [12] have displayed an advanced force utilities to react various difficulties, for example, development of power request particularly in non-direct loads in power frameworks; therefore, that all the more impressive quality should be thought of. DPFC resembles bound together UPFC in structure, which is used to direct the voltage rundown and swell as a power quality issue. What's more, moreover to recognize voltage records and find three single-stage reference voltages of DPFC, coordinated reference diagram strategy is displayed[13].

2. Model of Proposed Technology Using Dpfc

Right now DPFC is used rather than UPQC. Microgrid is the blend of different elective vitality sources associated with a typical transport bar. The DPFC is gotten from UPFC, which removes regular DC-Link between shunt and series converters. The DPFC can control all parameters of transmission line. In this structure we utilized both wind and PV system. Here we are carry out a comparison analysis of the various technologies exercised previously. First inverter is utilized to convert direct current to alternate current. Transformer is utilized to transmit mutual induction between two or more windings allows for electrical energy to be transferred between circuits.AC electrical signal in one circuit to electrical sign of a similar recurrence in another circuit is transmitted with a little loss of intensity.

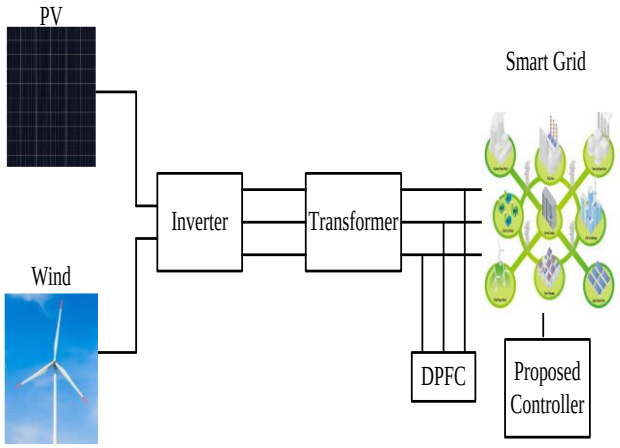


Fig .1. Proposed configuration with DPFC

The DPFC is gotten from the UPFC, which gets rid of the ordinary DC-interface between the shunt and course of action converters. All the while, it gives higher steady quality and lower cost. The dynamic power exchange between shunt and game plan converter is through transmission line at the third-harmonics frequency. Initially, power parameters are evaluated with the reference values. The MWT is utilized to extract the features of inputs to detect in PQ issues detection . The disturbance of PQ issues induces at the time of transfer the power from transformer to SG because of non-linear load in capacitive and inductive loads. Here the proposed controller's are EHO with DPFC. It is compared with the as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC. Based on the comparison, it is clear that the proposed controller with DPFC is efficient than UPQC.

3. Comparison Of Proposed Controllers

This research study proposes a comparison analysis of various controllers using DPFC and UPQC for power quality issues as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC and EHO using DPFC is presented as existing techniques.

A. UPQC control using ANFIS and FA

Power quality analysis by MWT and improvement in smart grid to give better power to consumers in operations, protection and asset management. Fig. 2 describes the PQ issues in the SG because of the load variation. The intension of the system is used to detect the PQ issues like voltage sag, swell, voltage disturbance and harmonics in the SG and control using UPQC controller. The PQ issues are induced in the SG depends upon the non-linear load like inductive and capacitive loads. The issues of voltage and current sag, swell are controlled using UPQC

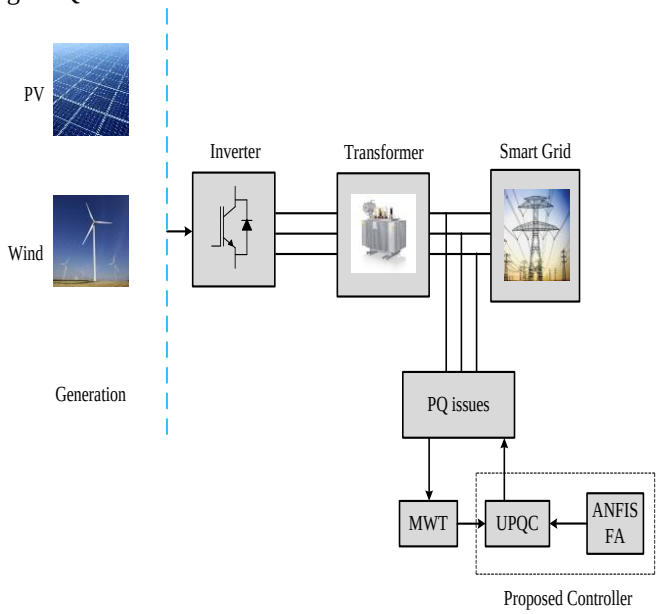


Fig. 2. PQ issues in SG with load variation

B. Trained the dataset for ANFIS by FA

To prepare the ANFIS model utilizing FA, scope of factors that need advancement by wellness capacity ought to be indicated first. The wellness work utilized to assess the exhibition of ANFIS prepared by FA. Every firefly contains a lot of two kinds of parameters, forerunner and ensuing. Two input variables used in this study as vectors (,) and the output variable ( ) are determined.

There are two important components, splendor and engaging quality . The brilliance at a specific separation complies with the reverse square law, which implies that decline as increments. The brilliance of a firefly fluctuates with estimation of a objective function,which can be defined as the Equation (1),

$$I(r) = I_0 e^{-\gamma r_{ij}^2} \quad (1)$$

The attractiveness of a firefly is proportional to its light brightness observed by adjacent fireflies; it can be expressed as the Equation (2),

$$\beta(r) = \beta_0 e^{-\gamma r_{ij}^2} \quad (2)$$

For any given two populations of fireflies x_i and x_j , if $f(x_j) > f(x_i)$, move firefly i towards j according to the Equation (3),

$$x_i^{t+1} = x_i^t + \beta(x_j^t - x_i^t) + a\varepsilon \quad (3)$$

The ANFIS algorithm various layer structures are explained in the section. By the way of using controller algorithm in the SG, control Dc-link voltage is achieved in anticipated system. The ANFIS and FA process are simply designed in simple way of flow chart. The flow chart illustrates in Fig. 3.

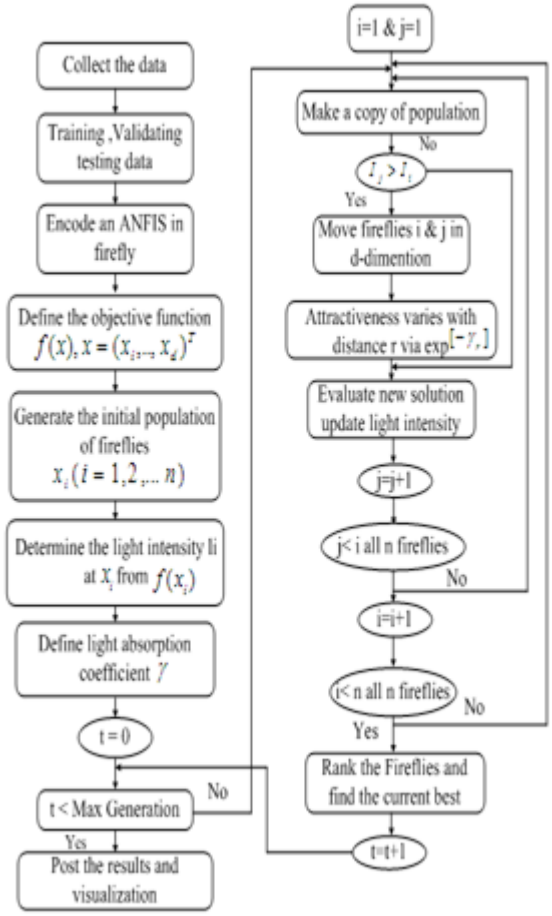


Fig. 3. Flow chart for ANFIS with FA

The flow chart describes the flow of the process of proposed for regulate the Dc-Link voltage; the main scope is improving the PQ of the system. The proposed model results are analyzed in the next section briefly.

C. DPFC control using CFA and PSO

In this section the brief description about the proposed system with DPFC utilized proposed technique for recognition and alleviation of the PQ issues in the power grid. The Power Quality issues detection refers to segmenting out Power Quality issues from the supply that method requires the feature extraction from the I/P Power quality issues extract by Multi Wavelet Transform (MWT)[9]. The mitigation of PQ issues by utilized proposed hybrid technique, which is combination of CFA and PSO method, which is used tomaintain the dc-link voltage of DPFC[10]. The PSO used for enhance the update function and recuperating the performance of the Cuttle Fish Algorithm. The structure of the proposed system is shown in Fig. 4.

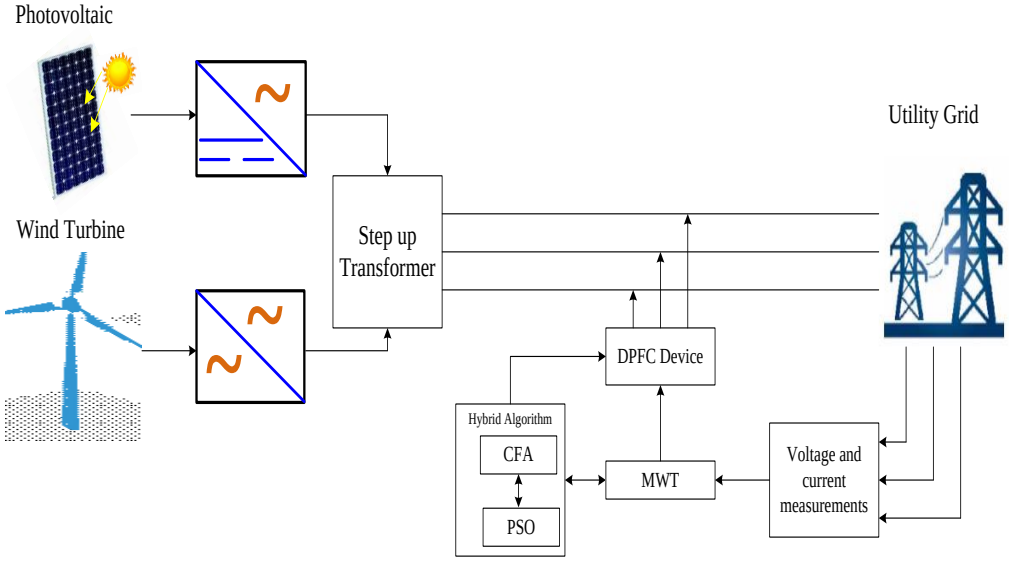


Fig. 4. The proposed structure of grid connected power system

MWT is utilized to extract features of inputs for PQ issues detection. The abnormal behaviors of PQ issues are controlled by the DPFC. The proposed technique controls the Voltage Source Inverter (VSI) of the DPFC and mitigates the PQ issues and maintained the DC-link voltage. From the comparison based on various methods DPFC using ANFIS and FA control technique is efficient.

D. The Power Flow Control using Proposed Hybrid Algorithm

Right now about the streamlining parameter and the procedure of the proposed CFA with PSO calculation. The CFA is using for controlling the DPFC power parameters and the PSO is improving the refreshing capacity of the CFA for recovering the presentation of the proposed framework.

E. Mechanisms of skin color change in Cuttlefish Algorithm

Proposed cuttlefish calculation CFA is planned dependent on these two procedures (reflection and visibility) and they utilized as an inquiry methodology to locate the new arrangements. The detailing of finding the new arrangement utilizing reflection and visibility is depicted in Equation (4),

$$S_{new} = \text{Reflection} + \text{Visibility} \quad (4)$$

Initialization

Introduce the populace (cells) of N introductory arrangements, spread over d-dimensional issue space aimlessly positions utilizing in Equation (5).

$$P[i].p[j] = \text{rand}(0,1) * (U_L - L_L) + L_L; \quad i = 1,2,\dots,N; j = 1,2,\dots,d \quad (5)$$

Group 1, Simulation of case 1 and 2

Right now, new arrangement is delivered dependent on the reflection and visibility of examples. The definitions of these procedures are depicted in Equations (6) and (7), individually.

$$reflection_j = R * G_i[i].P[j] \quad (6)$$

$$visibility = V * (BestP[j] - G_i[i].P[j]) \quad (7)$$

Here R and V are Evaluated from Equation s (8) and (9),

$$R = \text{rand}(0,1) * (r_1 - r_2) + r_2 \quad (8)$$

$$V = \text{rand}(0,1) * (v_1 - v_2) + v_2 \quad (9)$$

Group 2, Simulation of case 3 and 4

Right now new arrangement utilizing refreshed reflection and visibility of examples. The adjusted reflection is referenced in condition in Equation (10) .

$$\text{reflection}_j = R * \text{Best}.P[j] \quad (10)$$

Group 3, Simulation of case 5

In this group update the visibility pattern with out effecting Reflection . The modified visibility is mentioned in Equation (11),.

$$\text{visibility}_j = V * (\text{Best}.P[j] - AV_{Best}) \quad (11)$$

Group 4, Simulation of case 6

In this group, generate the random solution and find the best fitness value. The proposed hybrid algorithm flow chart is shown in Fig. 5.

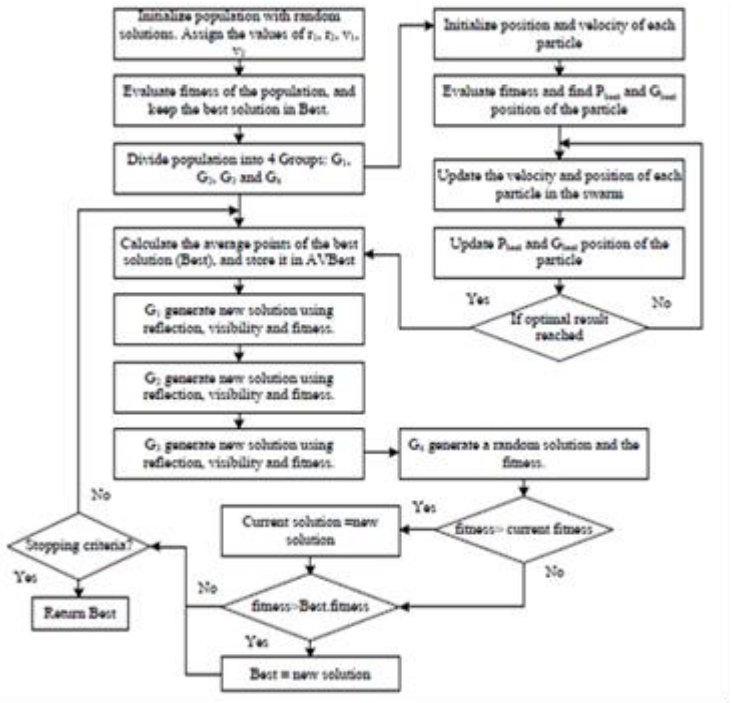


Fig. 5. Flow chart for Proposed Hybrid Algorithm

F. EHO algorithm based DPFC

The DPFC formed stunning structure for recognizing verification and moderation of the Power Quality problems by using the reasonable Elephant Herding Optimization figuring. The force quality issues are significant issues in power frameworks. The control proposed technique for DPFC framework is appeared in Fig. 6. To moderate the force quality issues by taking the DPFC to Mitigate .The improvement system needs to describe the PQ issues and a while later mitigate the PQ with the utilization of the proposed adjusted Elephant Herding Optimization computation utilize DPFC.

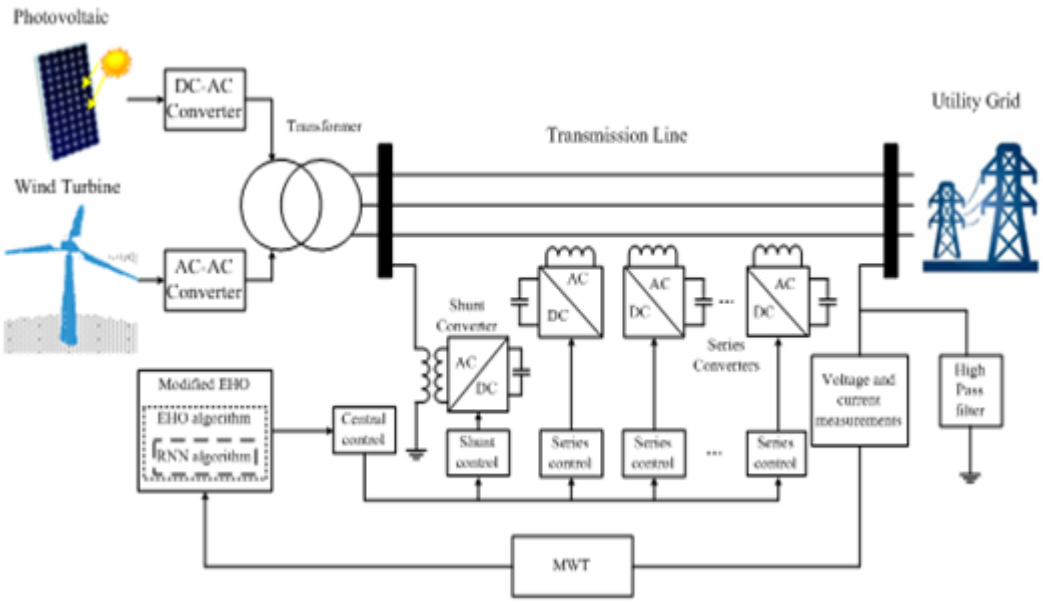


Fig. 6. The proposed Configuration of the grid power system

G. Flow Chart of Proposed Modified Elephant Herding Optimization Algorithm

In this section we discuss about flow chart of proposed modified Elephant Herding Optimization algorithms is illustrated in Fig. 7.

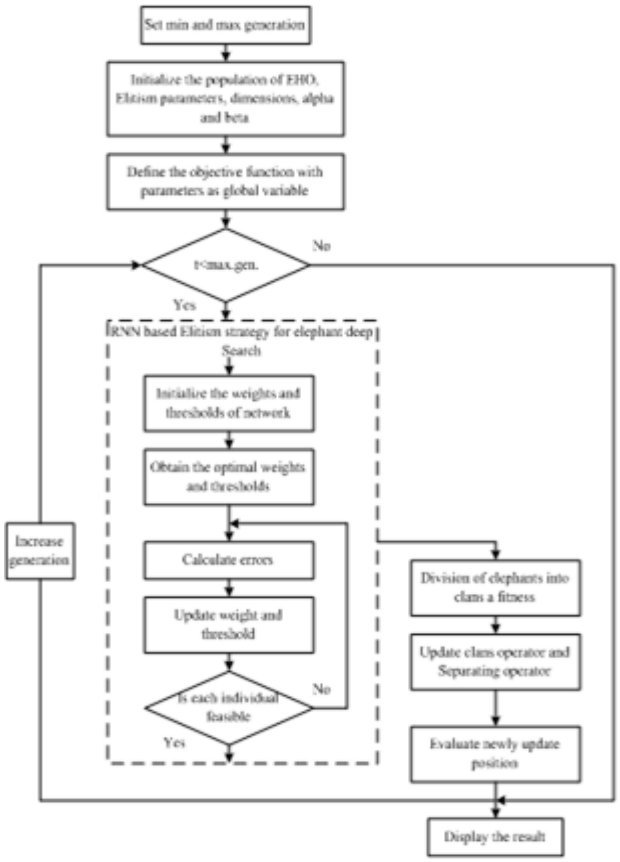


Fig. 7. The flow diagram of proposed modified EHO algorithm

H. Elephant Herding Optimization based Control Pulse Generation

Herding activities of elephants is considered as two operators; the first one is clan updating operator and second is separating operator, the detailed steps of EHO are given as follows.

Clan updating operator

Therefore, for each elephant in the clan , its next position is influenced by a matriarch . After separating the worst values from the population, the fittest values are updated using clan updating operator and worst values are discarded. For the elephant in the clan , it can be updated as Equation (12),

$$x_{ci,j}^{new} = x_{ci,j} + \alpha \times \left(x_{ci}^{best} - x_{ci,j}\right) \times r \quad (12)$$

Where, $x_{ci,j}^{new}$ and $x_{ci,j}$ are newly updated and old position for the elephant j in the clan ci , respectively. The scale factor is $\alpha \in [0,1]$ for the fittest elephant, it can be updated as Equation (13),

$$x_{ci,j}^{new} = \beta \times x_{ci}^{center} \quad (13)$$

The center of the clan ci is describe as x_{ci}^{center} and for the d^{th} element, it can be calculated as Equation (14),

$$x_{ci,d}^{center} = \frac{1}{n_{ci}} \times \sum_{j=1}^{n_{ci}} x_{ci,j,d} \quad (14)$$

Here $x_{ci,d}^{center}$ show the d^{th} component and D is its total element. The quantity of elephants in the clan ci is n_{ci} . The d^{th} elephant character $x_{ci,j}$ is $x_{ci,j,d}$.

Separating Operator

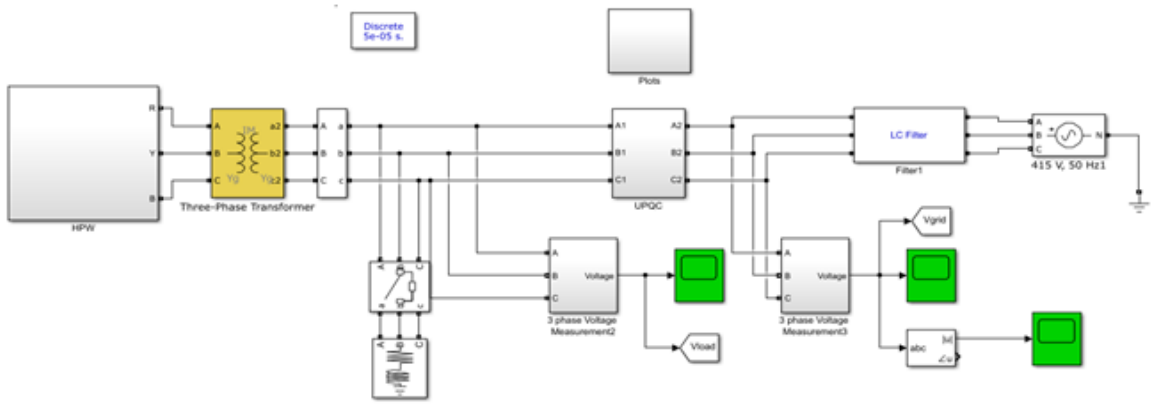
The separating operator is utilized to isolate the most exceedingly awful and fittest worth. The most noticeably awful elephant is isolated from family by utilizing isolating administrator of EHO. Let us expect that the elephant people with the most noticeably terrible wellness will actualize the isolating administrator at every age as appeared in condition in Equation (15),

$$x_{ci}^{worst} = x^{\min} + \left(x^{\max} - x^{\min} + 1\right) \times rand \quad (15)$$

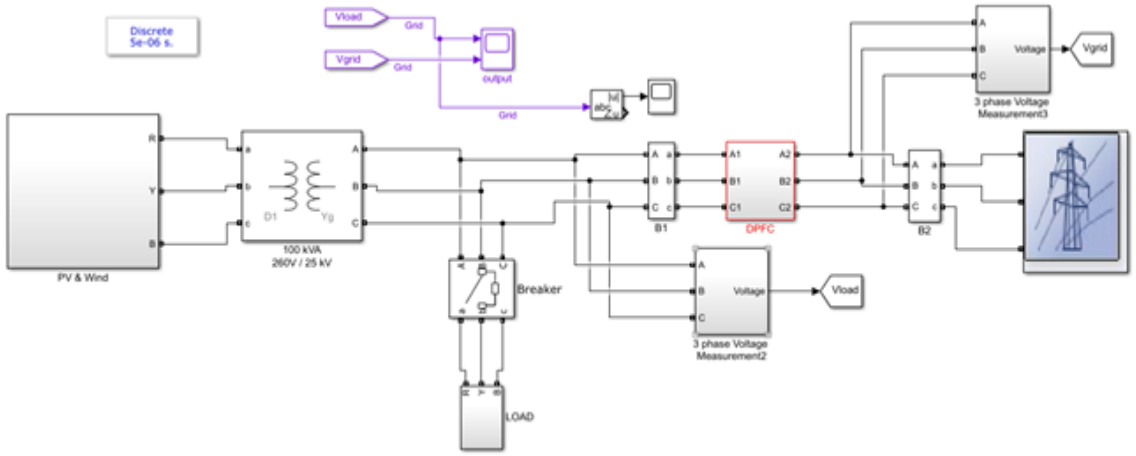
Here, x^{max} and x^{min} are respectively upper and lower bound of the position of elephant individual. The worst elephant individual in the clan ci is described as x_{ci}^{worst} .

4. Results and Discussion

In this paper, comparison analysis of SG based proposed controllers are utilized to achieve the control of the PQ issues. The simulation waveforms are presented and this result shows the performance of DPFC. The performance of the proposed system with UPQC & DPFC is done in the MATLAB. In this paper, the proposed an ANFIS with FA based on DPFC control scheme, which is compared with UPQC instead of DPFC, CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC and EHO with DPFC. Two cases were taken in these techniques which is low voltage and high voltage. Simulink model of the proposed methods using DPFC and UPQC is illustrated in Fig. 8 (a) and (b) respectively.



(a)



(b)

Fig. 8. Simulink model for (a) proposed controller based on UPQC and (b) proposed controller based on DPFC

Table- I: Implementation of system parameters

Parameter	Types of Cases	Values
PV parallel string	Case 1	66
Series connected modules per string		5
Frequency		60Hz
Magnetization Resistance		500 p.u
Magnetization Inductance		500 p.u
Breaker Resistance		100 ohm

Load resistance		100 ohm
PV parallel string	Case 2	300
Series connected modules per string		32
Frequency		60Hz
Magnetization Resistance		500 p.u
Magnetization Inductance		500 p.u
Breaker Resistance		100 ohm
Load resistance		100 ohm
Nominal mechanical output power	Wind	5000W
Base wind speed		12 ms
Base rotational speed		1.2 p.u
Maximum power at base wind speed		0.73 p.u

Case 1:Analysis of input voltage is 400V

Case 2:Analysis of input voltage is 20000V

Case 1: Analysis of input voltage is 400V

In this section, the performance analysis of the low-level input voltage in the PV system is determined. Here the input is taking 400V, irradiance and temperature is 1000 wb/m2& 25 0C. Various power quality issues are being assessed using the proposed technique are compared with other Existing methods like such as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC .The analysis curves of voltage sag, swell, disturbance and fluctuation are given in Fig. 9 (a), (b), (c) and (d) respectively.

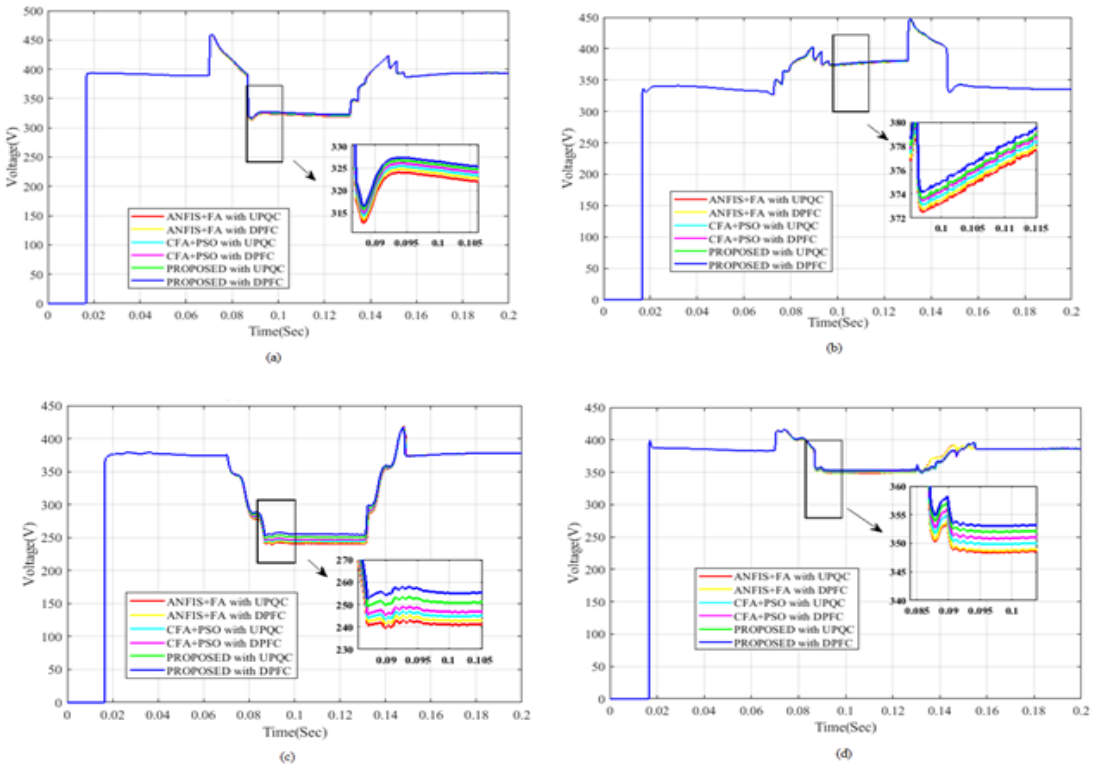


Fig. 9. Analysis of PQ issues in (a) Voltagesag (b) Voltage swell (c) Disturbance and (d) Fluctuation in case 1

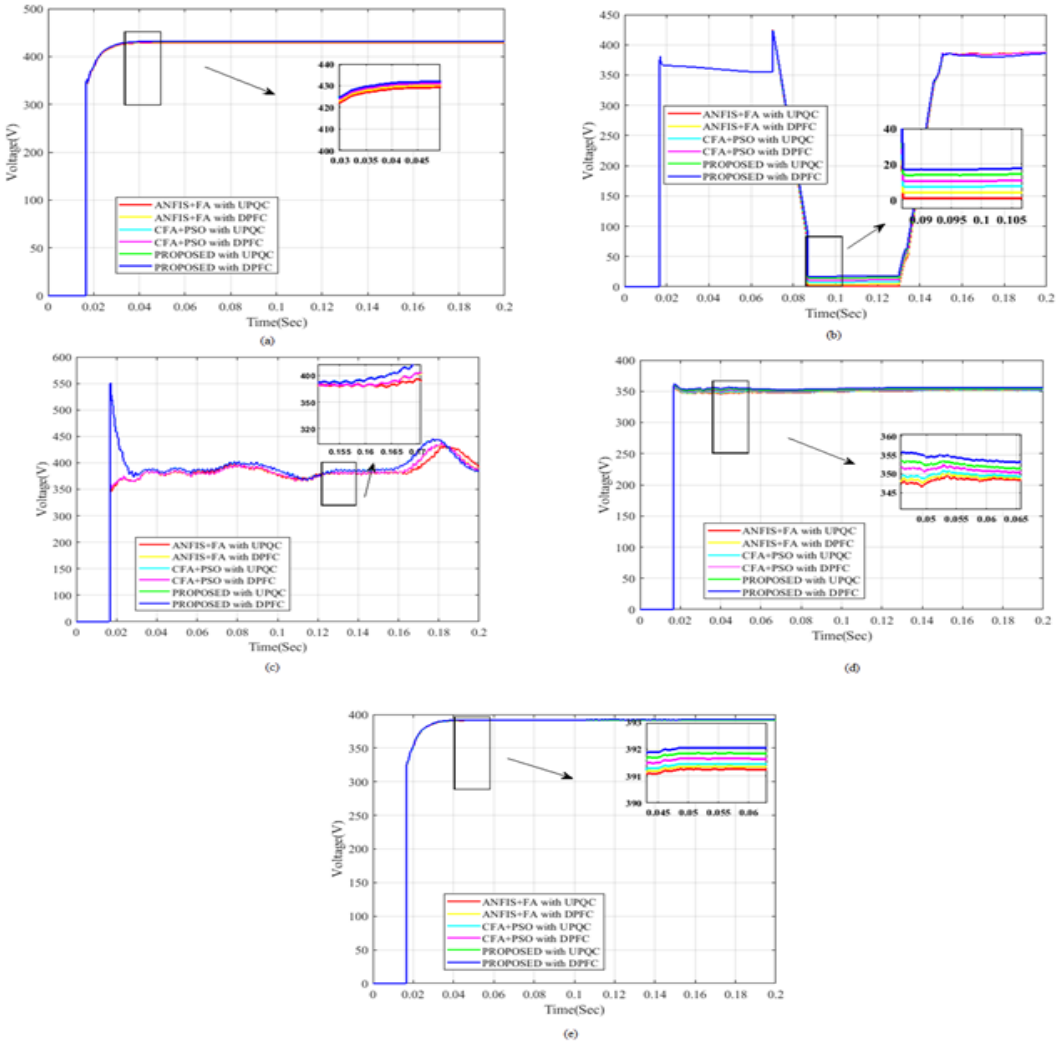


Fig .10. Analysis of PQ issues (a) Harmonic distortion (b) Interruption (c) Notching (d)Unbalance and (e) Voltage spike in case 1

The performance analysis of harmonic distortion, interruption, notching, unbalance and voltage spike for the proposed and existing techniques as Fig. 10 (a), (b), (c), (d) and (e) respectively.The above figures shows that, the proposed technique is better various PQ issues solving compared with other techniques.

Case 2:Analysis of input voltage is 20000V

In this section, performance analysis of high level input voltage applied in PV system using proposed modified EHO with RNN technique based DPFC device. Here the PV irradiance and temperature is 1000 wb/m2& 25 0C respectively. Then the proposed technique is compared with existing methods such as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC .

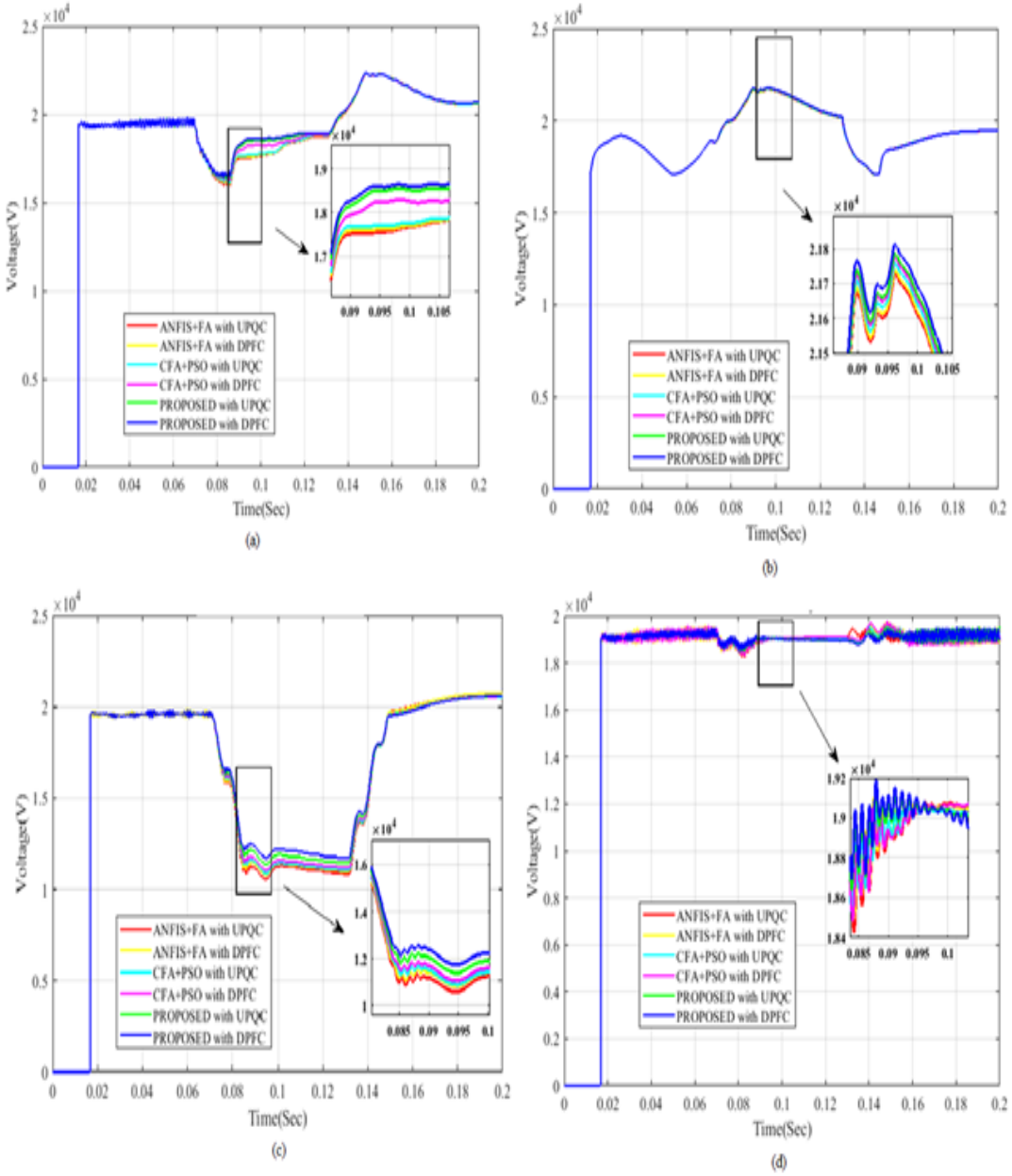


Fig.11. Analysis of PQ issues in (a) Voltage sag (b) Voltage Swell (c) Disturbance and (d) Fluctuation in case 2

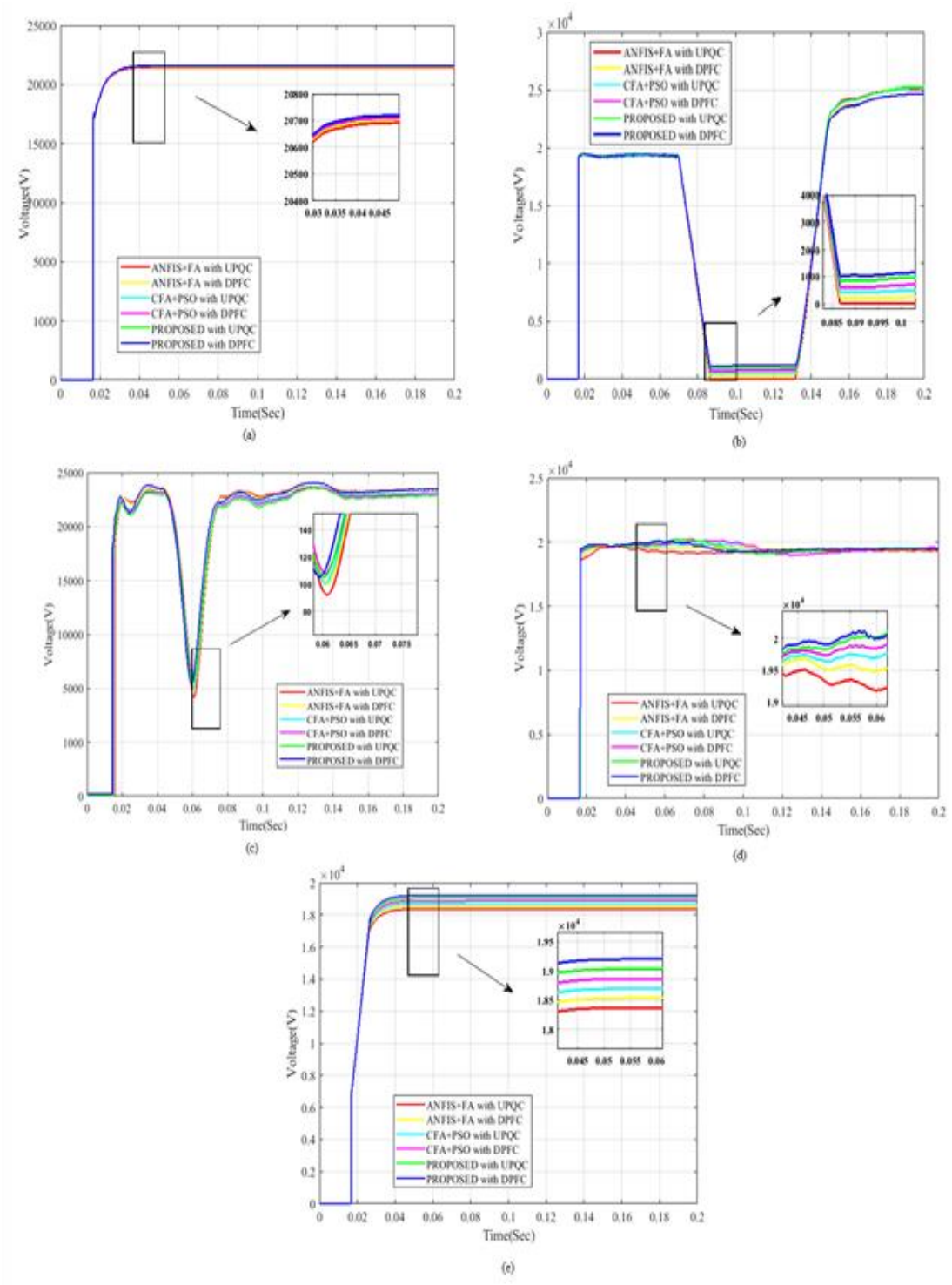


Fig.12. Analysis of PQ issues (a) Harmonic distortion (b) Interruption (c) Notching (d) Unbalance and (e) Voltage spike in case 2

Fig. 11 (a), (b), (c) and (d) shows the analysis of voltage sag, swell, disturbanceand fluctuation at high voltage level. The analysis of harmonic distortion, interruption, notching, unbalance and voltage spike for the proposed and existing techniques are given in an Fig. 12 (a), (b), (c), (d) and (e) respectively. The mitigation performance of the proposed and existing methods has been shown from all statistics to magnify a particular area of PQ problems. From this, we can see the comparison of the proposed technique which has been various power quality issues mitigation for superior to other existing methods.

Table.2: Values of THD for various problemsin case 1

PQ issues	**THD (%)**

	ANFIS+FA with UPQC	**ANFIS+FA with DPFC**	**CFA+PSO with UPQC**	**CFA+PSO with DPFC**	**Proposed EHO with UPQC**	**Proposed EHO with DPFC**
Sag	10.59	9.17	8.90	7.33	6.72	5.45
Swell	13.13	10.98	9.74	8.21	7.30	6.46
Disturbance	10.37	9.01	8.35	7.45	5.67	4.47
Fluctuation	10.34	8.81	7.21	6.57	6.34	5.83
Harmonic Distortion	11.89	9.26	7.90	6.58	5.21	4.53
Interruption	9.82	8.24	6.45	5.78	5.37	4.53
Notching	10.52	9.13	7.45	6.87	5.88	4.74
Unbalance	9.48	8.51	7.02	6.53	6.22	5.60
Spike	10.65	9.84	8.12	6.23	6.71	5.49

Table.3: Values of THD for various problems in case 2

PQ issues	**THD (%)**					
	ANFIS+FA with UPQC	**ANFIS+FA with DPFC**	**CFA+PSO with UPQC**	**CFA+PSO with DPFC**	**Proposed EHO with UPQC**	**Proposed EHO with DPFC**
Sag	10.34	9.32	6.89	5.50	5.5	4
Swell	12.07	10.90	8.46	7.63	7.01	6.05
Disturbance	10.54	8.52	8.23	7.75	6.78	5.03
Fluctuation	10.67	9.58	7.56	6.24	5.03	4.31
Harmonic Distortion	11.63	9.56	8.02	6.45	5.23	4.72
Interruption	9.92	8.85	7.25	5.65	5.67	4.85
Notching	10.31	9.21	5.32	6.23	5.12	4.70
Unbalance	9.83	7.73	7.01	6.18	5.33	4.82
Spike	10.75	9.48	8.90	6.57	5.28	4.33

Table.4: Statistical Analysis for PQ improvement

Statistical Investigations	**Case 1**					
	ANFIS+FA with UPQC	**ANFIS+FA with DPFC**	**CFA+PSO with UPQC**	**CFA+PSO with DPFC**	**Proposed EHO with UPQC**	**Proposed EHO with DPFC**
Mean	0.9704	0.9853	0.9567	0.8864	0.8452	0.8297
Median	0.8944	0.9557	0.9283	0.8843	0.7289	0.7872
Std.Deviation	0.0492	0.0799	0.0921	0.0355	0.0897	0.0850
Accuracy	89.714286	83.285714	86.786112	96.428571	98.87136	98.857143

Sensitivity	78.5714286	86.6666667	88.783517	92.3076923	93.12718	94.5152
Specificity	92.85714286	92.30769231	93.8921081	93.33333333	93.87412	94.85714286
	Case 2					
Mean	0.9527	0.9520	0.9235	0.9088	0.8690	0.8767
Median	0.9535	0.9977	0.9873	0.9926	0.8578	0.8782
Std. Deviation	0.0236	0.0046	0.0567	0.0526	0.0793	0.0680
Accuracy	85.714286	67.78532	88.9238	85.714286	95.92831	96.428571
Sensitivity	83.33334	81.56	90.62378	91.66667	93.98231	94.1176471
Specificity	87.5	76.92307692	78.93273	81.25783	92.84134	93.567

Table 1 and 2 shows the THD values for various issues for the proposed and existing techniques has been evaluated in case 1 & 2. Table 3 shows the statistical analysis of power quality improvement. In this table value of mean, median, standard deviation, accuracy, sensitivity and specificity of proposed and existing methods are given. From the results we conclude that the DPFC can show the better performance than other flexible ac transmission system. From the overall performance analysis proposed controller have less THD compared to other techniques.

5. Conclusion

The DPFC emerges from the UPQC and acquires the control ability of the UPFC, which is the concurrent change of the line impedance, the transmission edge and the transport voltage size. Consequently this paper was proposed the examination investigation of DPFC based control methods for decreasing the PQ issues in power appropriation framework by wiping out the PQ Issues. Power is transmitted through the transmission line at the third-consonant recurrence. The DPFC idea has been confirmed by a trial arrangement and it is demonstrated that DPFC is effective than UPQC. The examination investigation is done for the current control plans and assessment results were checked.. From the general examination, it is demonstrated that the proposed ANFIS-UPQC gadget has better pay capacity for the administration of acquire power quality issues broke down. With the use of DPFC the reliability of the transmission system is extremely high. And also in economical point of view the DPFC is much better than the UPQC. The controls of the PQ values were compensated and the output voltage response was proposed with an EHO based on DPFC control scheme, which is compared such as ANFIS with FA based UPQC, ANFIS with FA based DPFC , CFA with PSO based UPQC,CFA with PSO based DPFC and modified EHO with RNN technique based UPQC . The proposed method is implemented in MATLAB/Simulink platform.

References

1. Subramaniyan, Priyavarthini, Aravind Chellachi Kathiresan, Chilakapati Nagamani, Saravana Ilango Ganesan "PV-fed DVR for simultaneous real power injection and sag/swell mitigation in a wind farm" Vol.11, pp. 2385 – 2395, 2018.
2. Ray,DasandMohanty,"Fuzzy-Controller-Designed-PV-Based Custom Power Device for Power Quality Enhancement", IEEE Transactions on Energy Conversion, Vol.34, pp.405-414, 2018.
3. Dash and Ray, "Power quality improvement utilizing PV fed unified power quality conditioner based on UV-PI and PR-R controller", An International Journal of CPSS Transactions on Power Electronics and Applications, Vol.3, pp.243-253, 2018.
4. Anda, Martin, and Justin Temmen, "Smart metering for residential energy efficiency: The use of community based social marketing for behavioral change and smart grid introduction", An International Journal of Renewable Energy, Vol.67, pp.119-127, 2014.
5. Fang Xi, Satyajayant Misra, Guoliang Xue and Dejun Yang, "Smart grid—the new and improved power grid: A survey", IEEE Transactions on communications surveys and tutorials, Vol.14, No.4, pp.944-980, 2012.
6. Michael Fairbank, Shuhui Li, Xingang Fu, Eduardo Alonso and Donald Wunsch, "An adaptive recurrent neural-network controller using a stabilization matrix and predictive inputs to solve a tracking problem under disturbances", An International Journal of Neural Networks, Vol.49, pp.74–86, 2014.

7. Mahesh Babu, Ravi Srinivas and Tulasi Ram, "Power Quality Improvement Based on PSO Algorithm Incorporating UPQC", Journal of Engineering and Technology, Vol.9, No.1, pp.1-16, 2018.
8. Moghbel, Masoum, Fereidouni and Deilami, "Optimal Sizing, Siting and Operation of Custom Power Devices with STATCOM and APLC Functions for Real-Time Reactive Power and Network Voltage Quality Control of Smart Grid", IEEE Transactions on Smart Grid, Vol.99, 2017.
9. .Pouria Goharshenasan Khorasani, Mahmood Joorabian and Seyed Ghodratollah Seifossadat, "Smart grid realization with introducing unified power quality conditioner integrated with DC microgrid", An International Journal of Electric Power Systems Research, Vol.151, pp.68-85, 2017.
10. Wajahat Ullah Tareen, Saad Mekhilefa, Mehdi Seyedmahmoudian and Ben Horan, "Active Power Filter (APF) for mitigation of power quality issues in grid integration of wind and photovoltaic energy conversion system", An International Journal of Renewable and Sustainable Energy Reviews", Vol.70, pp.635-655, 2017.
11. Veerasekhar, Narasimhulu and Malleswara reddy, "Power Quality Improvement in a Smart Grid Using MPFC", An International Journal of Emerging Technology and Advanced Engineering, Vol.3, No.9, pp.376-382, 2013.
12. Nirmala, Sajida, Jan Bhasha "Power Quality Improvement And Mitigation Of Voltage Sag And Current Swell Using Distributed Power Flow Controller", An International Journal of Engineering Research and Applications, Vol. 4, pp.41-47, 2014.
13. Sampathkumar, A., Murugan, S., Rastogi, R., Mishra, M. K., Malathy, S., & Manikandan, R. (2020). Energy Efficient ACPI and JEHDO Mechanism for IoT Device Energy Management in Healthcare. In Internet of Things in Smart Technologies for Sustainable Urban Development (pp. 131-140). Springer, Cham.