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# A Review on D-STATCOM for Power Quality Enhancement

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***ABSTRACT***

*Power quality problems in electric systems are one of the important topics that occupy a wide area of interest to researchers and engineers. The increased use of power electronics circuits has led to improve efficiency and performance of the equipment; on the other hand, they withdraw a non-sinusoidal current and increase the harmonics which causes a decrease in the power quality. Also, these electronic devices are sensitive to power quality problems. However, advanced electronics can be employed to mitigate these problems. The Distribution static synchronous compensator (D-STATCOM) is one of the Custom Power Devices (CPDs) used for this purpose. D-STATCOM can be designed with different topologies, algorithms, and techniques of control to mitigate various power quality problems that face the power system. Selecting the D-STATCOM design depends on the power quality problem that needs to be mitigated. This paper presents a literature review of D-STATCOM from its beginnings to the present day.*

***Keywords:***

*FACTS; Reactive Power Compensation; D-STATCOM; CPDs.*



## 1. INTRODUCTION

Power quality (PQ) issues are an important cause of the decreased reliability and efficiency of the distribution system. As nonlinear loads are increasingly used in different applications such as office and home equipment, medical devices, fluorescent lighting, renewable energy, high-frequency transformers, and arc furnaces, harmonics are increased in the system and the power quality is reduced. Additionally, due to unbalanced loads, the voltage waveforms of distribution systems are distorted, eventually impacting the sensitive equipment's operation. Numerous PQ issues, including harmonic pollution, poor power factor, noise, sags, swells, impulses, unbalance, and voltage fluctuations have been reduced using Custom Power Devices[1].

Custom Power Devices are an advanced generation of mitigating means of power quality problems, developed after the superior performance shown by the Flexible AC Transmission Systems (FACTSs) at the transmission field, by increasing the stability of the power system, the transfer capacity, and the efficiency of transmission lines. Custom power devices based on leading-edge power electronics technology have already been recognized as the best solution to power quality problems[2].

CPDs mainly consists of two network reconfiguration and compensation type. Static Current Limiter (SCL), Static Transformer Switch (STS), Solid State Breaker (SSB), and uninterrupted Power Supply (UPS) are network reconfiguration forms, while Dynamic Voltage Restorer (DVR), Distribution STATCOM (D-STATCOM), and Unified Power Quality Conditioner (UPQC) are compensation forms, which are connected to the system in series, parallel and hybrid, respectively[3].

D-STATCOM is a synchronous voltage generator that can supply capacitive and inductive reactive powers. The D-STATCOM has a very short response time limited by the power-electronic devices and the detection time. Compared to some of the more famous voltage correction techniques, such as tap-changing transformers, the expected response time is significantly shorter[4].

Out of all CPDs, D-STATCOM is extensively used for mitigating power quality problems such as poor power factor, poor voltage regulation, harmonics, increased neutral current, and unbalanced currents[5].

D-STATCOM works in two control modes; either in current controlling mode to inject the proper harmonic and reactive components of load current to address current-based problems[6], or in voltage controlling mode, to regulate the voltage at the desired value, and protect the load from voltage-based problems[7].

The performance of D-STATCOM relies on a control algorithm used for estimating reference current components[8]. Practically the configuration selected for the D-STATCOM depends upon the power quality problem that needs to be mitigated[9].

The main objective of this paper is to present a sum of works that used a D-STATCOM in mitigating the power quality problem in electric power systems.

## 2. DISTRIBUTION STATIC COMPENSATOR

The D-STATCOM is a custom power device constructed on a voltage source converter (VSC) or a current source converter (CSC) and may function as a reactive power source in power systems. A D-STATCOM can regulate the voltage at the point of common coupling (PCC), by injecting or absorbing reactive power from a distribution network. The schematic diagram of a D-STATCOM is shown in Fig. 1. Mainly, the components of D-STATCOM include the following parts: voltage converter, DC energy unit storage, transforming the injection, and finally the controlling unit [10].

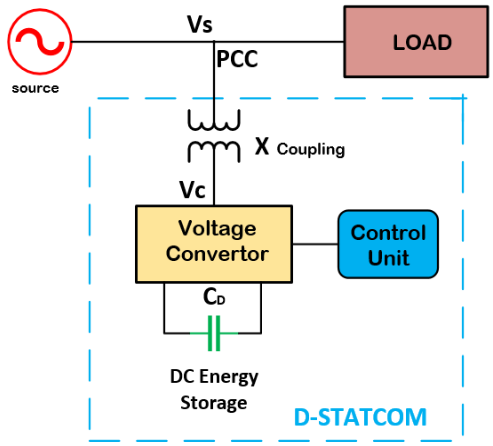



Fig. 1. D-STATCOM schematic diagram[10]

D-STATCOM output AC voltage side (Vc) is adjusting to the desired voltage. D-STATCOM absorbs reactive power if the system voltage (Vs) magnitude at PCC is higher than the desired voltage; while if the voltage magnitude at PCC is smaller than the desired voltage, reactive power is injected into the system to increase its voltage; and if the system voltage is equal to the desired voltage, the D-STATCOM is not injecting or absorbing any reactive power [11]. D-STATCOM can compensate a bus voltage or a line current depending on the power quality problem. It can also compensate for active power disturbances by adjusting the angle termed (δ), between D-STATCOM voltage and the system voltage, if integrated with energy storage systems like battery energy storage (BES)[12], flywheel energy storage (FES) [13], super magnetic energy storage (SMES) [14], or supercapacitors energy storage (SCES) [15], consequently operating region is expanded to four quadrants, as depicted in Fig.2 [16]. The active and reactive power injected or absorbed by the D-STATCOM can be calculated using equations (1) and (2) respectively.

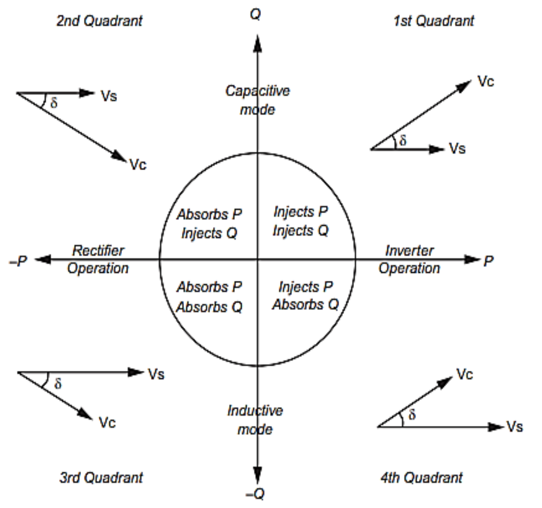



Fig. 2. The D-STATCOM operating in the four quadrants [16]

$$P = \frac{V_s\, V_c}{X_{couplig}} \sin\delta \quad \text{……….} \quad (1)$$

$$Q = \frac{V_s(V_s - V_c \cos\delta)}{X_{coupling}} \quad \text{………} \quad (2)$$

Where the value of P represents the active power, Q represents the reactive power of D-STATCOM, Vs is system voltage, Vc is D-STATCOM voltage, and δ is the system transfer angle.

D-STATCOMs can be mainly sorted by their circuit structure into three classifications namely power source type, converter topology, and advanced configuration, as shown in Fig. 3 [17].

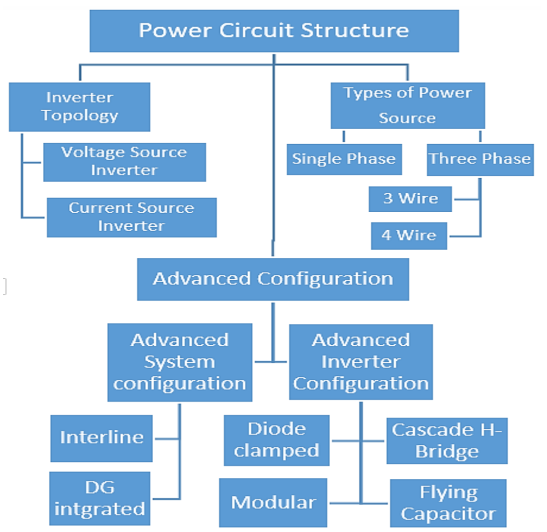



Fig. 3 D-STATCOM classification using power circuit structures[17]

## 3. LITERATURE REVIEW

The concept of custom power devices was first introduced by Hingorani in 1995, and since that time, much research has been conducted in studying D-STATCOM and looking at expanding its applications and developing control strategies to improve its performance in mitigating various power quality problems. In the next paragraphs, literature review of the oldest research to the newest includes various issues private to D-STATCOM to make an image of the research gaps that have been studied at various times.

In 1996, S. Ramsay et al. examined the application of (D-STATCOM) for the regulation of voltage on voltage-limited, long feeders. They proved that the D-STATCOM used in distribution systems could increase the load, distance, or both served by voltage-limited feeders compared with conventional methods. Also, the fast response of D-STATCOM showed excellent voltage regulation performance, which improves the quality of power supplied to customers fed from long feeders, or who have sensitive loads [18].

In 1999, G. Moon described the model of voltage and current control technique of the D-STATCOM depending on the space vector PWM and the predictive scheme. One advantage of PWM in terms of current control techniques such as Ramp hysteresis, as well as PI with ramp. are comparatively discussed. For power factor correction, the simulation for the techniques mentioned showed less harmonic distortion in the current and faster transient responses for a proposed technique than the rest current controllers [19].

In 2000, G.F. Reed et al. conducted research and tested the D-STATCOM of (5MVA, 4.16 kV) implemented to mitigate voltage flicker due to a 4000 HP shredder motor at a steel recycling facility (Seattle Iron and Metals Corporation). The research results showed that a fast compensation of the reactive power provides voltage regulation, and power factor control, mitigating the voltage flicker, and other distribution system disturbances to improve power quality fed for the new facility and the interconnecting utilities[20].

In 2001, M. Haque conducted research to determine the steady-state performance of D-STATCOM and dynamic voltage restorer (DVR) and compare it to different values of voltage drop, system failure levels, and load levels. The simulation results indicated that (D-STATCOM) can correct much more voltage drops compared to that (DVR) [21].

In 2004, S. Bashi et al. studied a prototype design of a D-STATCOM-based 12-pulse to mitigate voltage sag in an unbalanced distribution system instead of the widely used SVC by correcting the power factor and acting as a load compensator. The PI controller was used to control reactive power flow to and from the DC capacitor. The (D-STATCOM) model has been developed using (PSCAD/ EMTDC) software. The simulation results prove that (D-STATCOM) can mitigate drop and improve the system's power quality [22].

In 2006, J. Wang et al. a new control method for D-STATCOM that depends on the detection of source current at imbalance conditions. Where the load and D-STATCOM are taken as the overall load. Comparing to the decoupled control usually utilized for D-STATCOM at unbalanced conditions, a proposed control scheme has a lower calculation process, a simpler structure, and is more suitable to implement. The simulation results showed that the D-STATCOM application of the control method suggested can perform good performance in imbalanced conditions[23].

In 2008, Z. Xi et al. conducted research on a system consisting of D-STATCOM with an Ultracapacitor (UCAP). The simulation results prove the validity of integrating (D-STATCOM) with (UCAP) with a capacity of 1 Farad to regulate the voltage of the distribution system and mitigate the voltage drop. In the event of system faults, UCAP-based energy storage will help maintain constant D-STATCOM voltages and avoid over currents and D-STATCOM tripping. It is concluded also that the UCAP is the practical solution in terms of size and design to supply real power compared to other energy storage devices [24].

In 2010, N. Ismail et al. studied the procedure for enhancing poor power factor, voltage sag, and harmonic distortion using D-STATCOM with LCL Passive Filters in the distribution system. Simulations were performed using SIMULINK and the results showed that the voltage drop was mitigated by introducing (D-STATCOM) into the distribution system. When an LCL filter was added to D-STATCOM, the THD was reduced within the IEEE standard ratio, and the power factor increased to approximately one [25].

In 2013, S. Mohamed et al. studied (E-STATCOM) which is STATCOM integrated with the (BES). PI controller has suggested controlling the operation of E-STATCOM connected at a weak point of the ring system of Mosul city. Some types of disturbances have been simulated in the system. The results show improvements in the transient and dynamic stability of the power system by keeping the reactive power constant during the disturbances and decreasing the active power oscillation during and after these disturbances. Adding E-STATCOM causes THD of the bus voltage within IEEE-519 standards. The response time was very short about two cycles [26].

In 2014, F. Shahnia et al. studied the effectiveness of applying a DVR and D-STATCOM to improve the voltage unbalance problem in urban and rural feeders containing rooftop PVs. A stochastic analysis was executed by Monte Carlo to test their effectiveness for PV and load rating and location in the system. A control algorithm and converter topology are suggested for the DVR and D-STATCOM based on the pole-shift technology developed to control the voltage in the output of the DVR and D-STATCOM converters. Through simulation, D-STATCOM has been shown to have better overall results compared to DVR. These devices also succeeded in reducing the voltage imbalance to less than the standard limits [27].

In 2015, A. Gupta and A. Kumar, conducted research using the variational technique to find an optimal size and location of D-STATCOM for radial distribution systems, to reduce the amount of loss, and to improve the voltage profile. The research was conducted using the software MATLAB associated with the IEEE of 33-bus system. The (D-STATCOM) distribution of the radial distribution network was compared using the voltage stability index and the power loss index with the result of two other research. The results showed a significant reduction in losses and an improvement in the voltages profile and the size of D-STATCOM obtained by the proposed method is lower than reported in these two researches. [28].

In 2017, A. Majed et al studied the application of a soft computing technique namely Differential Evolution to realize Harmonic Elimination PWM (HE-PWM) for direct control of the D-STATCOM. The method was compared with phase-shifted PWM (PS-PWM) using PLECS and MATLAB program. The analysis revealed that a coupling inductor about (2-3 times) bigger is wanted for PS-PWM to perform a harmonic like HE-PWM at the same switching frequency. The low-order harmonics have been successfully eliminated. Moreover, the HEPWM direct control has a very fast dynamic response [29].

In 2018, W. Rohouma et al. presented research on D-STATCOM uses inductors as energy storage through a Matrix Converter with a model predictive controller (MPC) technique. D-STATCOM provided load compensation without the use of electrolytic capacitors (which have some failures). And that the proposed compensator has a longer expected service life and greater reliability compared to VSI-based compensators. The simulation results showed that inductors instead of capacitor elements achieved good compensation for reactive power [30].

In 2019, I. Mehouachi et al. proposed a design for a high-powered new model D-STATCOM that uses an isolated–dual converter topology. Transformer paralleling has been achieved by coupled inductors based on a single magnetic core. Grid currents were controlled using linear quadrature optimization control to reduce the steady-state error and improve the transient response. DC vector voltages stay stable, and the delivered currents are shared equally between the two isolated VSCs. The feasibility of the suggested design was investigated through a practical experiment and concluded it is unnecessary to oversize the converters' power ratings[31].

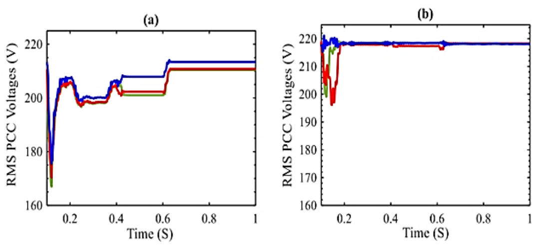
In 2020, S. Duarte et al. studied the estimation of the voltage imbalance related to the suppliers and consumers in the distribution system by using a time domain strategy. Based on this assessment, the D-STATCOM-based 3phase-4wire is allowed to compensate for the voltage unbalances of the negative and zero sequences caused by the consumers only. The performance of the proposed algorithm that controls (D-STATCOM) has been verified to compensate for consumer-induced voltage imbalance through various types of scenarios that power networks commonly encounter such as single phase fault, imbalanced static resistive load, the start of a big induction motor, and switching of capacitor bank [32].

In 2020, E. Kantar and E. Tedeschi designed (D-STATCOM) with a 4-wire inductor-capacitor-inductor (LCL) filter to compensate for the neutral current, balance the load, compensate for the reactive power, and eliminate the harmonics. The LCL filter design was introduced for high ripple attenuation by integrating two resonance damping technologies, Active Damping and Passive Damping. Both methods have been shown to effectively address the resonance phenomenon caused by the LCL filter while maintaining the connecting point voltages, as well as the THD at less than 3% for nonlinear and unbalanced loads [33].

In 2021, M. Ullah and A. Hanif, has studied an integrated controlling scheme based on the second-order super twisting algorithm and sliding mode control for the D-STATCOM convertor. The algorithm of super twisting along with standard sliding mode control has been used to remove the chattering effect which is the drawback of sliding mode control while keeping its other features such as faster response time, robustness, and insensitivity to load variation. The simulation results showed that the proposed control can effectively detect and mitigate voltage sags and swells and compensate for the active and reactive power through a short time and that the THD in all simulation cases is less than 5%[34].

In 2022 B. Khan researched to find an optimal placement and sizing of the D-STATCOM in a radial distribution system with 78 buses in Ethiopia to minimize losses and improve stability and profile of voltage using the improved bacterial foraging search algorithm (IBFA). The results showed considerable improvement by (IBFA) in reducing power loss, voltage profile, and stability as compared with the results of the conventional (BFA) and the scenario of the base case[35].

In 2022 A. Abdelsalam proposed a design to modify (D-STATCOM) with a proposed current controller for micro grid applications. The modified Design is incorporated into the system to accurately deal with balanced, unbalanced, and excursion loads for both inductive and nonlinear loads. Also, it handled the stability problems of the MG at fault-caused islanding incidents. The simulation results showed the superiority of the proposed design in improving the power factor, voltages at PCC, source current and reduction of harmonics currents, besides the stability operation at islanding is maintained compared with conventional D-STATCOM as depicted in Fig. (4-6) [36].




(a) conventional, (b) modified[36]
Fig. 4 Voltages at PCC with D-STATCOM

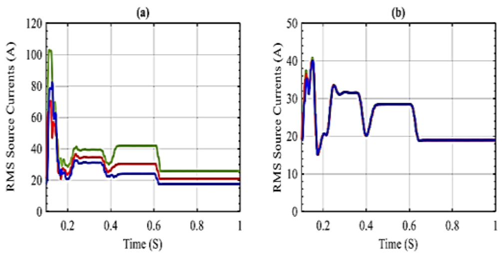



Fig. 5 Source current with D-STATCOM (a) conventional, (b) modified [36]

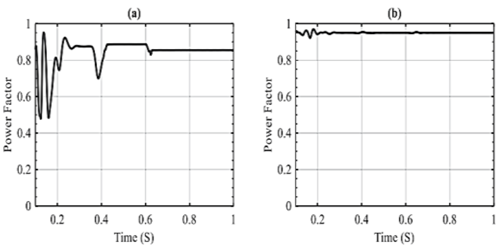



Fig. 6 system P.F with D-STATCOM (a) conventional, (b) modified [36]

In 2022 A. Özer proposed a novel control algorithm for a DSTATCOM to voltage regulation of Self- excited induction generator (SEIG)-based wind energy conversion systems. An enhanced phase-locked loop based on current synchronous detection (CSD) algorithm is proposed to estimate the individual phase voltages, and filter the SEIG voltage from harmonics by the moving average filter, DC offset by a delayed signal cancellation, and the frequency deviation. The proposed algorithm has been checked under nonlinear and linear load conditions. The results clearly showed the effectiveness and the superiority of the proposed algorithm compared second- order generalized integrator-based CSD control algorithm[37].

Table (1) presents the significant samples of D-STATCOM research, including different converter topologies, control methods, and objectives.

D-STATCOM has two working modes, single mode, and dual mode. In single mode, the topology of (3-ph 3-w) is used to mitigate PQ problems based on voltage (No. 12-26, 29, 30 in Table.1), while to mitigate PQ problems based on current the topology of (3-ph 4-w) is used (No. 2-11 in Table.1). Also, it can use the last to mitigate PQ problems related to voltage if D-STATCOM works in dual mode, so it combines the functions of the two topologies in one and reduces the cost[17][38].

The multi-level converters are used in D-STATCOM (No. 9-13 in Table.1) to improve performance due to the advantages of multi-level converters compared to traditional two-level converters such as a low harmonics content. Reducing the size of the required filters, increasing the compensability by raising the converter rating, reducing the voltage stress on the power electronics switches, and also could dispense to the coupling transformer at high levels which lower the cost. The implementation of the Selective Harmonic Elimination PWM method on multilevel converters (No. 30 in Table.1) provides high-quality output voltage waveform and accurate control of the harmonic output voltage while keeping the switching frequency of the semiconductors at a low level in comparison to other modulation techniques [39].

It is very useful to use artificial intelligence techniques because it provides an adaptivity for the DSTATCOM working during various disturbances used (No. 22-27 in Table.1), unlike traditional controllers (such as PI) whose performance deteriorates greatly at large disturbances or changing network parameters [40].

Table 1: Sample of D-STATCOM research, including converter topologies, control methods, objectives

| **No.** | Ref. | Design objective | Converter topology | Control method | Modulation strategy |
|---|---|---|---|---|---|
| **1** | [41] | Voltage regulation | single phase | Phase space | PWM |
| **2** | [42] | Current harmonics and neutral current mitigated | 3ph-4w-2L-VSC | Instantaneous symmetrical component | Hysteresis-based PWM |
| **3** | [43] | Current harmonics, current unbalances | 3ph-4w-2L-VSC | Instantaneous symmetrical component | Hysteresis-based PWM |
| **4** | [44] | Reactive power, current harmonics load balance, neutral current, voltage regulation | 3ph-4w-2L-VSC | Synchronous reference frame | SPWM |
| **5** | [45] | Voltage regulation, neutral current, | 3ph-4w-2L- | Instantaneous | Hysteresis- |

| | | | | | |
|---|---|---|---|---|---|
| | | current unbalance | VSC | reactive power | based PWM |
| **6** | [46] | Reactive power, neutral current, current harmonics, load balance, voltage regulation | 3ph-4w-2L-VSC | Unity power factor | SPWM |
| **7** | [47] | Unbalance, neutral and current harmonics | 3ph-4w-2L-VSC | Neural Network -Conductance Estimation | PWM |
| **8** | [48] | voltage regulation, load balance, current harmonics | 3ph-4w-2L-VSC | Instantaneous reactive power | SPWM |
| **9** | [49] | Current harmonics, neutral and unbalance current | 3ph-4w-5L-VSC | Instantaneous symmetrical component | Linear quadratic regulator |
| **10** | [50] | Reactive power | 3ph-4w-5L-VSC | sliding mode | Hysteresis-based PWM |
| **11** | [51] | Voltage unbalance | 3ph-4w-3L-VSC | Instantaneous symmetrical component | Hysteresis-based PWM |
| **12** | [52] | Harmonics, voltage sag | 3ph-3w-3L-VSC | synchronous reference frame | CPS-PWM |
| **13** | [53] | Harmonic elimination | 3ph-3w-5L-VSC | Synchronous Detection Method | PD/POD/APOD PWM |
| **14** | [54] | Voltage flicker | 3ph-3w-2L-VSC | Synchronous reference frame | SPWM |
| **15** | [55] | Harmonics, voltage unbalances | 3ph-3w-2L-VSC | Instantaneous symmetrical component | Hysteresis-based PWM |
| **16** | [56] | Voltage regulation | 3ph-3w-2L-VSC | Adaptive based on AIS | SPWM |
| **17** | [57] | Power factor correction, load balance, harmonic elimination | 3ph-3w-2L-VSC | Modified I cosφ | ----- |
| **18** | [58] | Load compensation, harmonics, voltage regulation | 3ph-3w-2L-VSC | Backpropagation | SPWM |
| **19** | [59] | Load compensation, harmonics, voltage regulation | 3ph-3w-2L-VSC | Leaky LMS adaptive filter | ----- |
| **20** | [60] | Load compensation | 3ph-3w-2L-VSC | Instantaneous reactive power-Deadbeat | SPWM |
| **21** | [61] | Harmonics, load balance, power factor correction, voltage regulation | 3ph-3w-2L-VSC | peak detection | ----- |
| **22** | [62] | Load compensation, power factor correction, voltage regulation | 3ph-3w-2L-VSC | LMS based ADALINE | Hysteresis-based PWM |
| **23** | [63] | Load compensation, harmonics, voltage regulation | 3ph-3w-2L-VSC | Neural Network based anti Hebbian | PWM |
| **24** | [64] | Power factor correction, voltage regulation | 3ph-3w-2L-VSC | Neural Network based adjustable step LMS | ----- |
| **25** | [65] | Voltage flicker | 3ph-3w-2L-VSC | Intelligent fuzzy | PWM |
| **26** | [66] | Voltage sag, reduced harmonic, DC voltage, load current | 3ph-3w-2L-CSC | Fuzzy-PI | PWM |
| **27** | [67] | Currents unbalanced, current harmonic, power factor correction | 3ph-4w-2L-VSC | Wavelet-fuzzy-neural network | PWM |
| **28** | [68] | Load balance, reactive power control, harmonics elimination, neutral current | 3ph-4w-2L-VSC | Predictive based SRF | PWM |
| **29** | [69] | Load compensation, harmonics, | 3ph-3w-2L- | Instantaneous | SPWM |

| | | | | | |
|---|---|---|---|---|---|
| | | voltage regulation | VSC | reactive power | |
| **30** | [70] | Voltage and voltage harmonic | 3ph-3w-2L-VSC | synchronous reference frame | selective harmonic elimination |

## 4. Future Work

The D-STATCOM is a very effective means for mitigating PQ problems of voltage and current in distribution systems. But still, the primary barrier to D-STATCOM's installation in systems is the high cost. So, it is extremely desirable to do more studies to lower the cost of D-STATCOM without compromising the capabilities for PQ improvement. Also, there is a need for additional research to find the optimal size and location of D-STATCOM in the power systems.

Renewable energy penetrates the utility grid and growing daily, and the irregular nature of these resources has an impact on the quality of delivered power. The power generation of these sources is impacted by weather phenomena including varying wind speeds and fluctuating solar insolation. The D-STATCOM could be a suitable solution to these issues; hence, it is necessary to investigate the potential applications of D-STATCOM in renewable energy-based power systems.

## 5. CONCLUSION

Custom power devices are used to mitigate power quality problems. D-STATCOM is an effective CPD in the alleviation of voltage sag and swell, poor power factor, harmonic currents, neutral current, unbalanced voltages, and load unbalancing. D-STATCOM integrates with several components in different ways to meet the power quality requirements of customers. D-STATCOM's design is based on the power quality problem concerned. Several designs that were used in research papers to address various power quality problems were reviewed and classed based on converter topology, the control algorithm, and the switching technique. This paper concluded that the topology of a 3phase-4wires, multi-level voltage source converter, controlled by Artificial intelligence methods, and switching with selective harmonic elimination PWM techniques, are considered the best options used in D-STATCOM.

Appendix A.
Define of Abbreviations

| Abbreviation | Defining |
|---|---|
| 3ph | Three phase |
| 3w-4w | Three wire -Four wire |
| 2L -3L-5L | (Two -Three –Five) levels |
| PWM | Pulse width Modulation |
| SPWM | Sinusoidal PWM |
| CPS-PWM | Carrier Phase Shift-PWM |
| ADALINE | Adaptive Linear |
| AIS | Artificial Immune System |
| LMS | Least Mean Square |
| SRF | Synchronous reference frame |
| PI | Proportional-Integral |
| PD | Phase Disposition |
| POD | Phase Opposition Disposition |
| APOD | Alternate Phase Disposition |

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# مراجعة للمعوض التزامني الساكن التوزيعي لتحسين جودة القدرة

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***الملخص***

*تعد مشكلات جودة القدرة في أنظمة القدرة الكهربائية من الموضوعات المهمة التي تشغل مجالًا واسعًا من اهتمام الباحثين والمهندسين. أدى الاستخدام المتزايد لدارات إلكترونيات الطاقة إلى تحسين كفاءة وأداء المعدات، ومن ناحية أخرى، فإنها تسحب تيارًا غير جيبي وتزيد من التوافقيات التي تسبب انخفاض في جودة الطاقة. كما أن هذه الأجهزة الإلكترونية بطبيعتها حساسة لمشاكل جودة القدرة. وبالرغم من ذلك فإنه يمكن استخدام الإلكترونيات المتقدمة للتخفيف من هذه المشكلات. يعتبر المعوض التزامني الساكن التوزيعي ( D-STATCOM) أحد أجهزة القدرة المخصصة المستخدمة لهذا الغرض. يمكن تصميم D-STATCOM باستخدام تركيبات وخوارزميات وتقنيات تحكم مختلفة للتخفيف من مشكلات جودة القدرة المختلفة التي تواجه نظام القدرة. يعتمد اختيار تصميم D-STATCOM على مشكلة جودة القدرة التي يعاني منها النظام. يعرض هذا البحث مراجعة للادبيات التي تناولت D-STATCOM من بداية تطويره وحتى الوقت الحاضر.*

***الكلمات الداله :***

*نظام نقل التيار المتردد المرن، تعويض القدرة المتفاعلة، اجهزة القدرة المخصصة، المعوض التزامني الساكن التوزيعي.*