



e-ISSN: 2278-8875

p-ISSN: 2320-3765

International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

Volume 11, Issue 6, June 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.18

☎ 9940 572 462

☑ 6381 907 438

✉ ijareeie@gmail.com

@ www.ijareeie.com



Implementation of Reactive Power Compensation using Prototype D-STATCOM

Dr.S.Prabakaran

Associate Professor, Dept. of EEE, SCSVMV, Enathur, Kanchipuram, Tamilnadu, India

ABSTRACT: Most prominent AC loads consumes reactive power, which causes low power quality in the power system. In this framework, the shortcoming is made by utilizing the nonlinear burdens like inductive and capacitive burdens. Which will produce the voltage sags (i.e.) voltage issue. The DSTATCOM is a reimbursing model, which is used to control the movement of reactive power in the power system network. The complete back basis of the voltage shortcoming negotiating gadgets and power electronic application in compensating gadgets is made sense of in this paper and besides the voltage issue overcoming strategies like the DSTATCOM framework is furthermore talked about. The PI regulators are used for the execution of the models and are examined. Simulink yields are discussed and different case examinations are applied relying on the various burdens like resistive, inductive, and capacitive on the DSTATCOM Simulink models and the result are assessed. In the equipment framework, the proposed model DSTATCOM model will be done using PIC-Micro-Controller. The outcomes support the presented plan.

KEYWORDS: DSTATCOM, Nonlinear loads, Power quality, Reactive Power, Fault, PIC Controller.

I.INTRODUCTION

Power quality in network structure harms generally electrical and electronic gadgets that are related with it. Of late the use of power converters in power supplies, adjustable speed drives, is continually growing. This device draws the distortion stream from AC mains and addresses the demands. The gathering of loads includes direct (slack power factor loads), nonlinear (current or voltage source sort of distortion delivering loads), consolidated and unbalance kinds of loads. The power quality issues related with these loads consolidates voltage assortment twists, high reactive power inconvenience and load unbalancing [1].

The power quality issues, for instance, voltage drop, voltage swells, voltage change/voltage glimmer, voltage unbalance, flicks etc. One of the principal Power Quality Issue in the network is voltage drop (voltage decrease). The voltage drop in effective fall timing of in R.M.S voltage. Voltage drop caused due to a deficiency in the utility system, an enormous addition of the heat current like starting the engine motor or transformer energizing [2]. There are different methods to resolve the power quality issue in transmission and providing structures [3]. The power which engages to drive dynamic strength is known as reactive power [4]. In transmission structure power expects a significant part for instance 'active power and 'reactive power'. Expecting that any issue occurs in either transmission line or distribution line like voltage drop, skin effect, temperature influence, glimmers, weakening and more on, then 'influence contour's eventual extra. To wear the power adversity, DSTATCOM may be associated inside the distribution structure it'll be repay the power satisfactory problems [5-8]. DSTATCOM is a 'static voltage compensator' this is for the most part used in distribution line, associated in parallel.

II. ISSUE STATEMENT

Power quality issues wrap a wide extent of bends, for instance, voltage drops/develops, sparks, adversity/damages, drive transient and obstructions. Voltage drops can occur at any snapshot of time, with amplitudes going from 10-90% and a period will be going on for half cycles to one second. Voltage raise are not commonly so exceptionally significant as voltage drops since they are more surprising in dispersions systems. Voltage drop and swell can cause delicacy in hardware's structures to fall flat, or close, as well as make a huge current unbalance that could blow circuits or outing breakers. These effects can be expensive for the clients, going from minor quality assortments to creation excursion and equipment harm. There is a wide scope of methodologies/techniques to tackle voltage drop and swell issues, but the use of a custom power framework is seen as the most useful procedure.



III. SIGNIFICANT OF POWER QUALITY

PQ conveys the degree of closeness of practical power supply with ideal power supply.

1. In the event that the power quality is better, the gadget associated in the framework will work appropriately, without influencing its result.

2. In the event that the power quality isn't great then the load related to the framework will prompts breakdown in the gadget or, more than likely it might diminish its lifetime and execution.

To defeat the aftereffects of poor PQ and to additionally substitute the utility show the electric power are divided into two components of PQ issues to decide the persuasive techniques.

The Static Compensator device consists of the following main parts:

A) Constant Filter

The primary work of constant channel is to keep the distorted voltage content made by the VSC to permissible level. Low pass channels are used to drop the twists created in the VSC. These channels are made by the blend of resistors, capacitors and inductors.

B) Voltage Source Inverter

A VSI is a power electronic structure contains a capacity framework commercial exchanging devices, which can deliver a sinusoidal voltage at any normal recurrence, greatness and stage point. In the STATCOM application, the VSI is used to briefly supplant the release voltages or to deliver the piece of the release voltage which is missing. There are four essential sorts of trading gadgets. They are metal oxide semiconductor field influence semiconductor (MOSFET), door switch off thyristors (GTO), protected entryway bipolar semiconductors (IGBT) and coordinated entryway commutated thyristors (IGCT). Each type enjoys its own benefits and hindrances [9].

C) Voltage Variation: The voltage assortment is directly associated with genuine and receptive power assortment. The voltage assortment is conventionally named [10].

- Voltage Sag
- Voltage Swell
- Voltage Flicker/Voltage Fluctuation
- Voltage Unbalance

D) Harmonics: The contortion is created due to the action of force electronic converters or non-direct loads. The mis-shaped voltage and current should be confined to the OK level at the sign of AC source connected to the framework. The distorted voltage inside limit, each source of misshaped current can allow only a confined responsibility. The quick exchanging gives a tremendous reduction in lower request consonant current compared and the line commutated converter, yet the outcome current will have high recurrence current and can be successfully examined through [11-15].

E) DC-AC INVERTER:

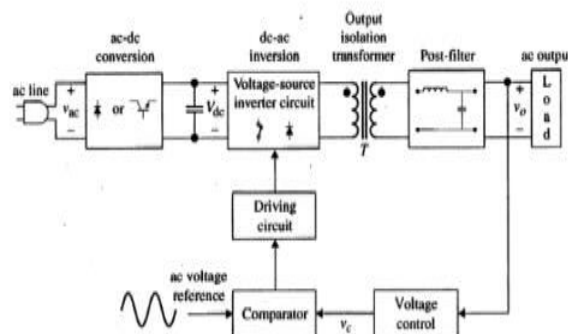


Figure 1: Power Electronic Circuit with DC-AC Inverter.



:The twisting can be accessible in any system where inverters are used. The central matter of using an inverter is to make an AC yield from the dc source. Theoretically the outcome voltage waveform should be sinusoidal, but continuously process there is assuredly going to be contortion in view of sounds present in the system which results into twisted yield waveforms. As needs be, inverters are used in a system to make yield waveforms which are totally sinusoidal and adversity free.

IV. EXISTING SYSTEM

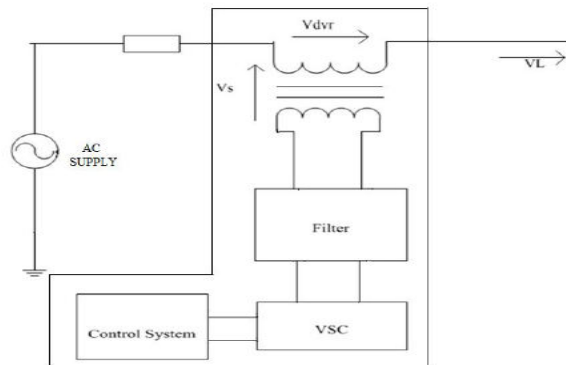


Figure 2: Existing system model with DVR system

The AC voltage provided by VSI is moved forward by utilizing transformer to the ideal voltage level. The twisting association of in transformer relies upon venture down transformer associated in conveyance line. It is associated either in star/open star winding or delta/open star winding. The previous association permits infusion of zero grouping parts too while the last association doesn't permit it. Here three stage single transformers are utilized. How much voltage list/grow repaid by DV relies on the rating of transformer and inverter.

The exchanging beat created for VSI depends on SVPWM. It is a straightforward strategy and better than other PWM methods. Ordinarily, three stage inverters use SPWM procedure. In any case, issue like huge clamor top at transporter recurrence is available in such strategy.

V. PROPOSED SYSTEM

The shunt related D-STATCOM with battery energy limit is joined with the equivalent side of the structure where the nonlinear burden at the PCC in the organization system is estimated. The D-STATCOM compensator yield is changed by the controlled technique, to stay aware of the power quality guidelines in the network framework. This ongoing control procedure is joined in the control strategy that shows the valuable movement of the D-STATCOM compensator in the power structure.

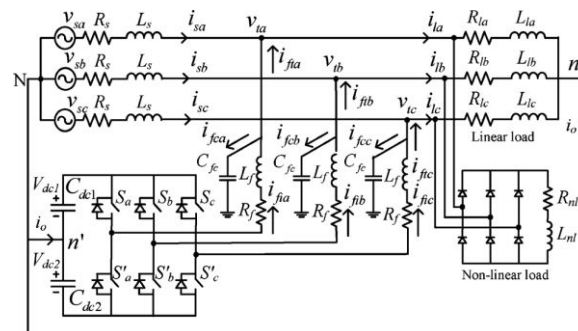


Figure 3: Proposed system model with DSTATCOM



The dispersion static compensator (DSTATCOM) is a direction related reactive power compensation device that can make and moreover absorbing reactive power, applying IGBT (Insulated Gate Bipolar Transistor) as solid rapid interchange part and control thought considering width balance". It can create controllable real and reactive power at its outcome stations when its feedback source is taken from a DC energy source (or) energy stacking framework at its feedback terminals.

Circuit diagram of a DSTATCOM- framework is It uses a three-stage, four-wire, two-level, unbiased point-cut VSI. This plan allows free control to each leg of the VSI the single-stage indistinguishable depiction of Voltage is a swap limit, and can be either +1or-1 depending on swap state. Channel inductance and check are L_f and R_f , independently. Shunt capacitor takes out high-exchange. In any case, discrete exhibiting of the system is acquainted with get a discrete voltage control guideline, and it is demonstrated the way that the PCC voltage can be figured out how to the best worth with appropriately picked limits of the VSI.

Then, a strategy to design VSI intricacies is presented. A relative vital (PI) controller is used to deal with the dc capacitor voltage at reference esteem.

VI. RESULTS AND DISCUSSION

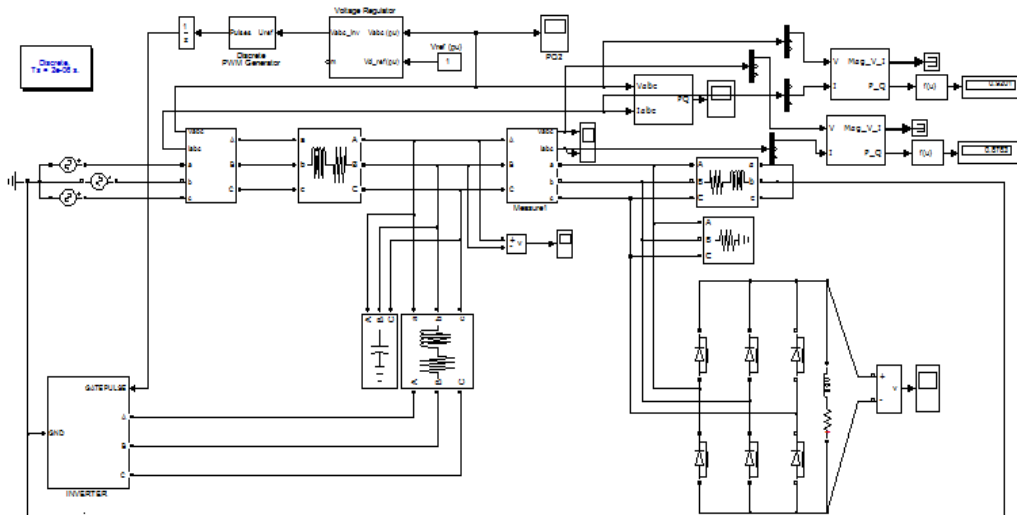
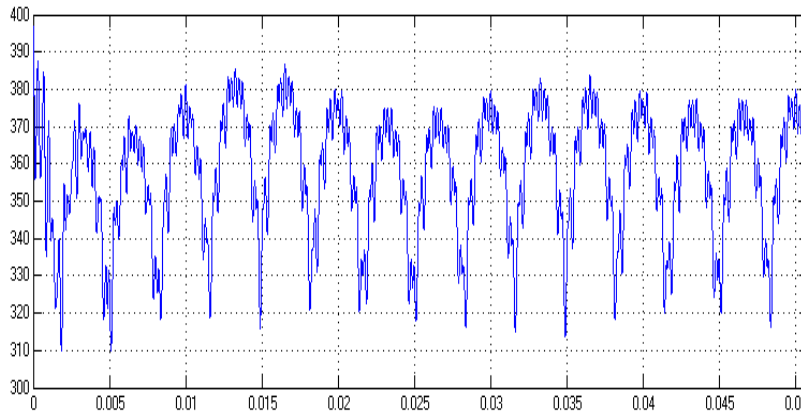


Figure 4: Simulinkmodel with DSTATCOM system



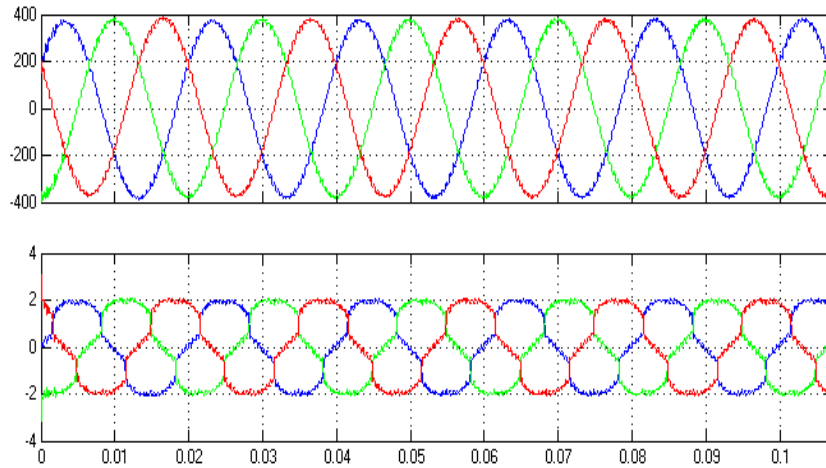


Figure 5: Voltage distortion without DSTATCOM

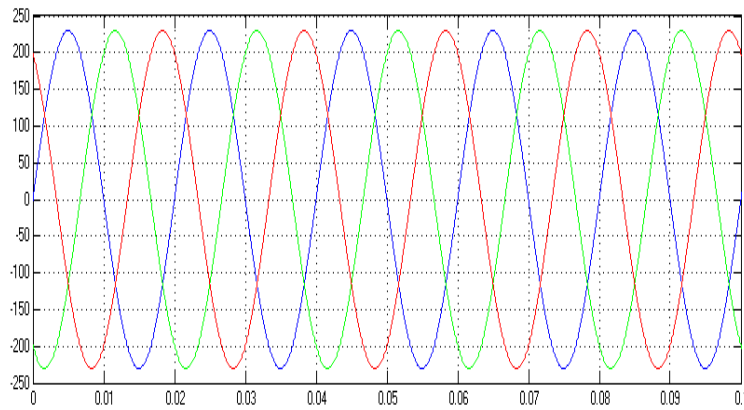


Figure 6: Power quality improved voltage with DSTATCOM

By reproduction, the estimation is finished and it is demonstrated: Byworking the model utilizing DSTATCOM, THD can be diminished this shows that the power nature of the framework is moved along.

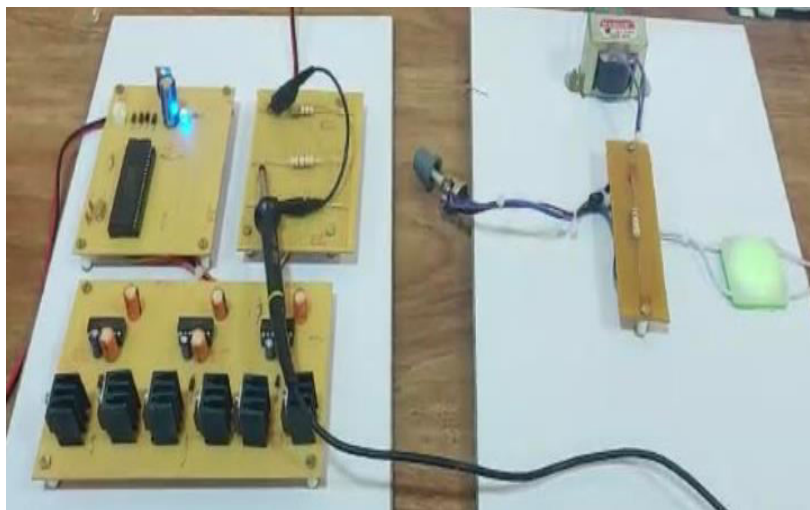
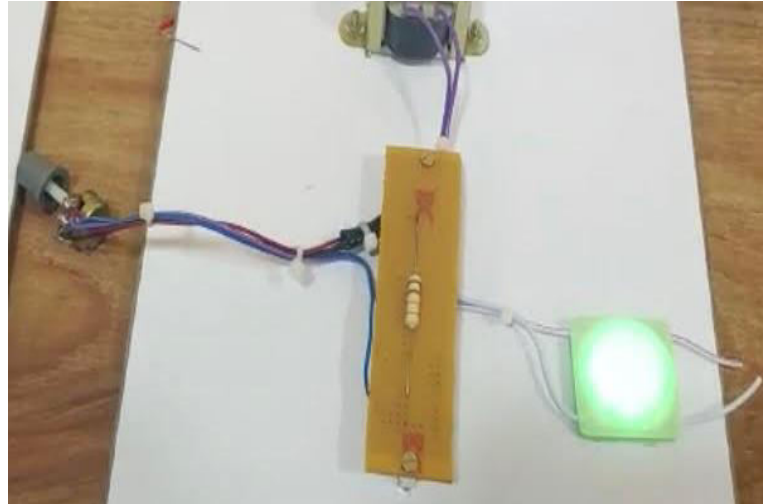


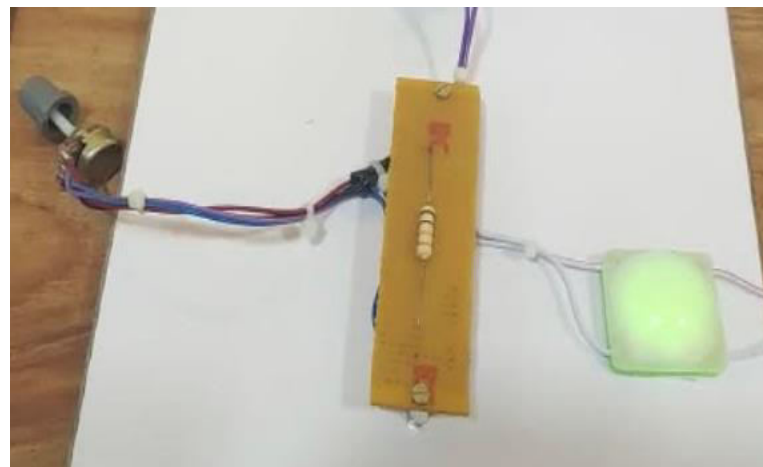
Figure 7: Hardware kit model for proposed system with fault



Input AC source with fault is created by using potentiometer. LED strip is used to indicate the voltage fault indication



Light in the LED strip indicate not fault and reduction in LED light glow shows the fault.



In this the hardware designspecifies that the voltage distortion is compensated using DTATCOM system which is fed to PIC controller.

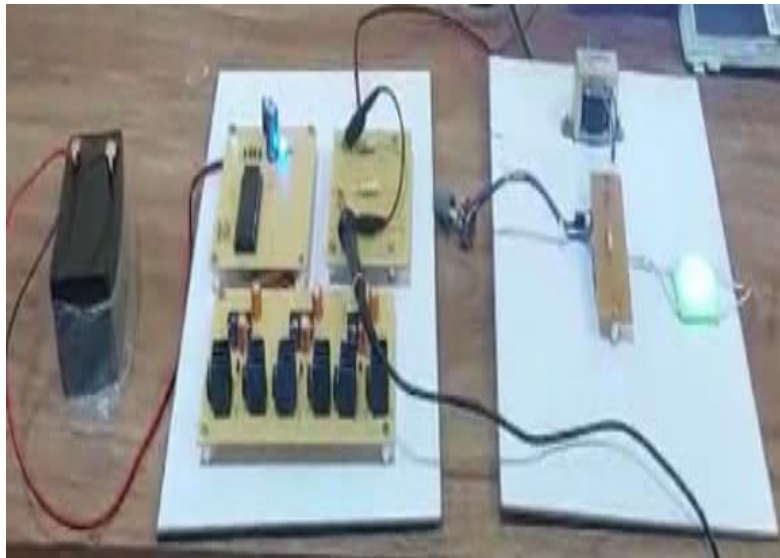


Figure 8: Hardware kit model for proposed system without fault

VII.CONCLUSION

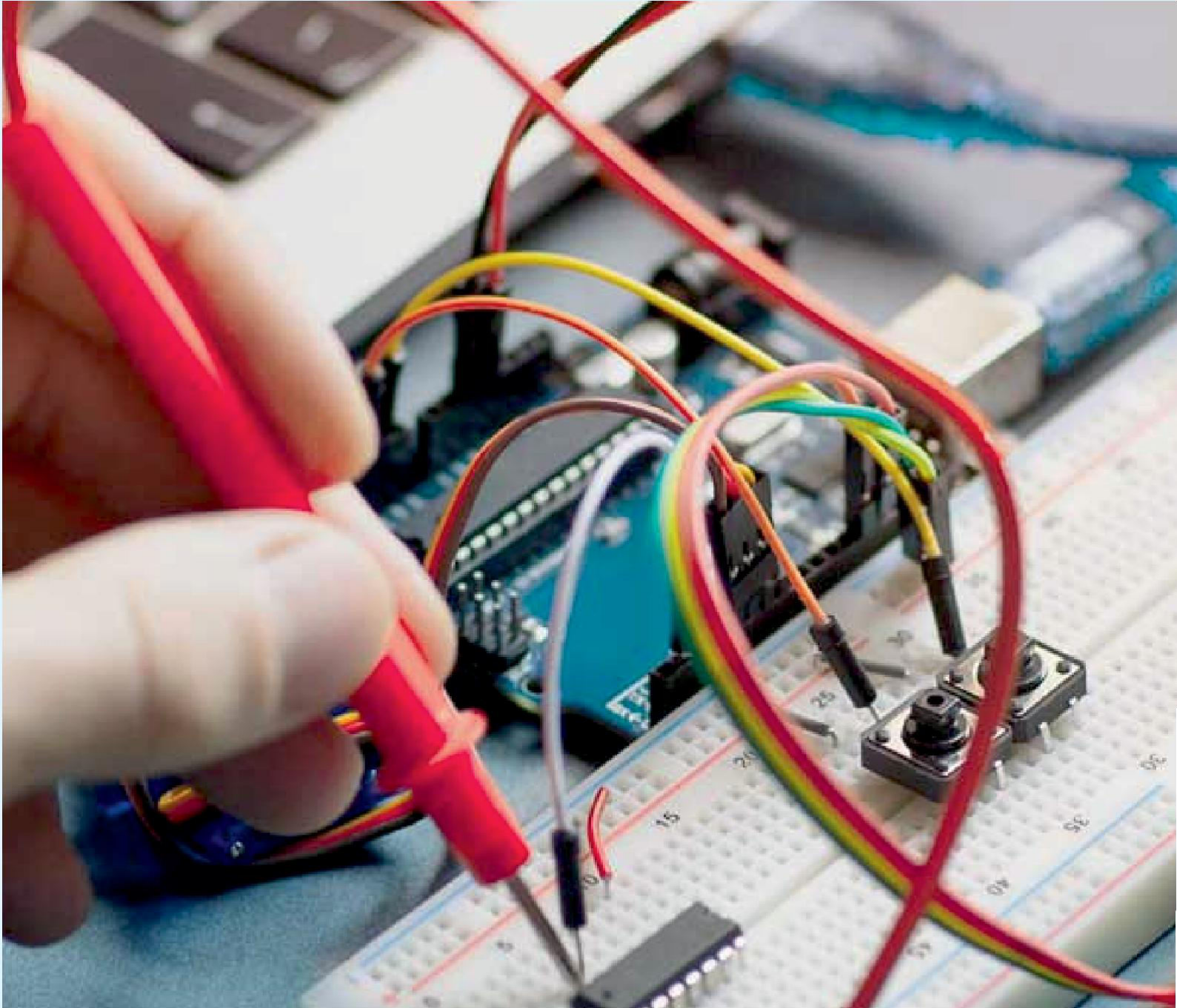
The DSTATCOM, which relies upon VSI, has been the most preferred answers for development of power quality as PFC and to stay aware of evaluated PCC voltage. The 3-stage DSTATCOM has been used for the voltage issue defeating for non-linear loads. A couple of components of DSTATCOM like removal of mutilations and load changing have been shown in SVAR and PFC modes with DC voltage guidelines of DSTATCOM is similarly controlled to be assessed regard with undershoot or overshoot during variety of load. The DSTATCOM with responsive voltage compensator model is presented. In this paper changes in voltage and current are estimated without the DSTATCOM and with the model. THD assessment is furthermore achieved for result; it will lessen the shots of the outcome.

REFERENCES

- [1]. SkRubeenaYasmeen, G Koti Reddy, Back – Propagation Control Algorithm for Power Quality Improvement using DSTATCOM, International Journal of Innovative Science and Research Technology ISSN No:-2456 –2165, Volume 3, Issue 1, January – 2018.
- [2]. Haque , M.H., “ Compensation of Distribution Systems Voltage sags by DVR and D-STATCOM”, Power Tech Proceedings,2001 IEEE Porto, Volume 1, PP. 10-13, September 2001.
- [3]. K. R. Padiyar, “Power System Dynamics Stability and Control”, New Age International Publishers, - Second Edition. Hyderabad, India: B.S. Publications, 2000.
- [4]. R.Govindarajan, Dr.S.Meikandasivam, Dr.D.Vijayakumar, “Energy Management Techniques in Smart Grid”, International Journal of Applied Engineering Research, Volume 10, Number 15, pp.35720- 35724, 2015.
- [5]. Shahgholian, J. Faiz, "Static synchronous compensator for improving performance of power system: A review", Int. Review of Elec. Eng., Vol. 4, No. 2, pp. 2333-2342, Oct. 2010.
- [6]. Statcom for arc furnace and flicker compensation, CIGRE Technical Brochure 237, 2003.
- [7]. S. Abazari, Gh. Shahgholijan, O. Ghanaati, "Optimal choice and allocation of FACTS devices to decrease power network loss's using genetic algorithms", Majlesi J. of Elec. Eng., 3(1), pp. 45–52, Summer 2010.
- [8]. R.Govindarajan, S.Meikandasivam, D.Vijayakumar, “Energy monitoring system using Zigbee and Arduino”, International Journal of Engineering & Technology, Vol. 7, No. 4, pp. 608-611, 2018.
- [9]. Akagi H., Kanazawa Y. and Nabae A., “Instantaneous Reactive Power Compensators comprising Switching Devices without Energy Storage Components”, IEEE Transactions on Industry Applications, Vol. 20, No. 3, pp. 625-630, 1984.
- [10]. Daher, S.; Schmid, J.; Antunes, F.L. Multi level inverter topologies for stand-alone PV systems. IEEE Trans. Ind. Electron. 2008, 55, 2703–2712
- [11].R.Govindarajan, Dr.S.Meikandasivam, Dr.D.Vijayakumar, “Cloud Computing Based Smart Energy Monitoring System”, International Journal of Scientific and Technology Research, Volume 08, Issue 10, pp. 886-890, October 2019



- [12].LeniBabu Cherian1, DrBindu, “Power Quality Improvement Using DVR”, IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE).
- [13].Yuvaraj and Dr. S.N.Deepa, “ Improving grid power quality with FACTS Devices on Integration of Wind Energy System” Student Pulse April 2011 Vol. 3, Issue 4
- [14].International Research Journal of Engineering and Technology (IRJET)- Reactive power compensation using STATCOM Volume: 04 Issue: 04 | Apr -2017-
- [15].R.Govindarajan, S.Meikandasivam, D.Vijayakumar, “Low cost Arduino based smart energy monitoring system using internet of things”, Journal of Engineering and Applied Sciences, Vol. 14, No. 1, pp. 170- 177, 2019.
- [16].P. Murugesan , S.Prabakaran Processing of Power Quality Issues through an Adaptive Peak Filter “Jour of Adv Research in Dynamical & Control Systems ” vol 10 Special Issue 15-2018
- [17].SK Rani, S Prabakaran ANN Based DC Link Control of STATCOM in Wind Integrated Distribution System for Power Quality Conditioning “Engineering, Technology & Applied Science Research ”10 (4), 5896-5902-2020
- [18].R.Govindarajan, S.Meikandasivam and D.Vijayakumar “Performance Analysis of Smart Energy Monitoring Systems in Real-time,” Engineering, Technology & Applied Science Research, vol. 10, no. 3, pp. 5808–5813, Jun. 2020.
- [19].14. Dr. N. Ashok Kumar BEHAVIOR OF ANALYSIS OF TCSC “International Research Journal of Modernization in Engineering Technology and Science” Volume:03/Issue:06/June-2021.
15. N.Ashok kumar M.Rathinakumar M.Yogesh J.Dinesh Comparative Study on the Effectiveness of TCSC and UPFC Facts Controllers “International Journal of Computer Applications” Volume 67– No.5, April 2013.



INNO  SPACE
SJIF Scientific Journal Impact Factor

Impact Factor: 8.18



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



International Journal of Advanced Research

in Electrical, Electronics and Instrumentation Engineering

 9940 572 462  6381 907 438  ijareeie@gmail.com



www.ijareeie.com

Scan to save the contact details