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A VCM and CCM Controlled Photo Voltaic Cell Based DSTATCOM for Power Quality Improvement

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Abstract:

Solar energy being naturally available in abundance and non- polluting is one of the most promising sources. Excessive use of power electronics devices lead to power quality problems. Effects of poor power quality like sag, swell distortion in waveform, harmonics, reactive power generation has affected both grid as well as utility sectors. Harmonics are major problem diminishing the power quality. Active Power filter are powerful tool for mitigation of harmonics. The use of non-linear loads in the power system will lead to the generation of current harmonics which in turn deteriorates the power quality. This scheme provides fast voltage regulation at the load terminal during voltage disturbances and protects critical loads. In addition, during normal operation, the generated reference load voltages allow control of the source currents. Consequently, DSTATCOM injects reactive and harmonic components of load currents to make source power factor unity. By using this DSTATCOM device in the MATLAB SIMULINK model the problem occurred has been rectified and the graph has plotted.

Index Terms:

DSTATCOM, multifunctional, stiff source, power factor, voltage regulation, induction machine drive system.

I. INTRODUCTION:

Conventional energy sources based on oil, coal, and natural gas have proven to be highly effective drivers of economic progress, but at the same time damaging to the environment and to human health. Furthermore, they tend to be cyclical in nature, due to the effects of oligopoly in production and distribution. These traditional fossil fuel-based energy sources are facing increasing pressure on a host of environmental fronts, with perhaps the most serious challenge confronting the future use of coal being the Kyoto Protocol greenhouse gas (GHG) reduction targets. It is now clear that any effort to maintain atmospheric levels of CO2 below even 550 ppm cannot be based fundamentally on an oil and coal-powered global economy, barring radical carbon sequestration efforts. The distribution static compensator is a shunt active filter, which injects currents into the point of common coupling (PCC) (the common point where load, source, and DSTATCOM are connected) such that the harmonic filtering, power factor correction, and load balancing can be achieved. In practice, the presence of feeder impedance and nonlinear loads distorts the terminal voltage (PCC) and source currents. The load compensation using state feedback control of DSTATCOM with shunt filter capacitor gives better results [2]. The switching frequency components in the terminal voltages and source currents are eliminated by using state feedback control of shunt filter capacitor. in this situation, DSTATCOM should operate in CCM. However, due to grid faults, source voltage (stiff or non-stiff) can change at any time and then VCM operation is required. DSTATCOM regulates the load voltage by indirectly regulating the voltage across the feeder impedance. When a load is connected to nearly a stiff source, feeder impedance will be negligible [1]–[4]. Under these circumstances, DSTATCOM cannot provide sufficient voltage regulation at the load terminal [9].This paper proposes a new control algorithm based DSTATCOM topology for voltage regulation even under stiff source. It is achieved by connecting a suitable external inductor in series between the load and the source point. Point of common coupling (PCC) will be the point where external inductor and source are connected. DSTATCOM, connected at the load terminal, provides voltage regulation by indirectly regulating the voltage across the external inductor. Proposed control algorithm to obtain variable reference load voltage is formulated as a function of the desired source current.

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This voltage indirectly controls the current drawn from the source for a permissible range of source voltage. Therefore, the control algorithm makes source currents balanced, sinusoidal, and in phase with respective source voltages during normal operation. During voltage disturbances, a constant voltage is maintained at the load terminal. Hence, proposed topology and control algorithm make compensator multifunctional so that it provides fast voltage regulation at load terminal and additionally provides advantages of CCM while operating in VCM.It is anticipated that Photovoltaic system will be major source of energy fulfilling global energy needs. Photovoltaic system has been increasingly used in medium sized grid with domestic utilities. PV panels are connected in series and parallel to generate usable amount of voltage and current. By series connection voltage level can be built up and by parallel connection current density can be increased. In addition to that Converter configuration should be efficient and cost effective.

This paper presented here shows unique and effective methodology for planning a grid connected to renewable source of energy as solar energy and Harmonic Mitigation in system using Active Filter on utility side. Solar power is harnessed through PV panels and harmonic distortion is filtered using Shunt Active filter. The shunt active filter is a voltage source inverter (VSI), which is connected in parallel with load. Shunt Active Power Filter has the ability to keep the mains current balanced and sinusoidal after compensation for various Load conditions.

II. DSTATCOM CONFIGURATION:

A neutral point clamped voltage source inverter (VSI) topology is chosen as it provides independent control of each leg of the VSI [7]. A single phase equivalent circuit of DSTATCOM in distribution network is shown in Fig. 1.VSI represented by u V dc is connected to load terminal through an LC filter (L_f- C_{fc}).

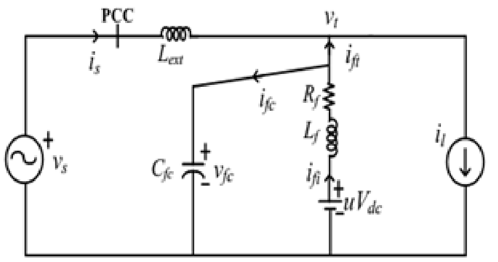

Fig.1.Single Phase Equivalent Circuit Of DSTATCOM in Distribution Network.

The load terminal is connected to the PCC through an external series inductance Lext. Vdc is the voltage maintained across the each dc capacitor and u is a control variable which can be +1 or -1 depending upon switching state. If i, if t, and if c are currents through VSI, DSTATCOM, and Cfc respectively. Vs and Vt are source and load voltages respectively. Loads have both linear and nonlinear elements with balanced or unbalanced features. Load and source currents are represented by I and is respectively.

III. SELECTION OF EXTERNAL INDUCTOR:

Under normal operation, external impedance (Zext) does not have much importance, whereas it plays a critical role during voltage disturbances. The value of external impedance is decided by the rating of the DSTATCOM and amount of sag to be mitigated. At any time, the source current in any phase by assuming balanced source voltage is given as

$$\bar{I}_s = \frac{V_s\angle 0 - V_t\angle -\delta}{R_{ext}+jX_{ext}} \qquad (1)$$

Where, Vs, Vt, Rext, Xext, and are rms source voltage, rms load voltage, external resistance, external reactance, and load angle respectively. For most practical case X_ ext >> R_ext. As a worst case design the reactive source current (Im [Is]) which is supplied by the compensator, will be maximum when is minimum. For this, source will supply only losses in the VSI. Therefore, it will be very small. Hence, Im [Is] is given as

$$I_m[\bar{I}_s] = \frac{V_t - V_s}{X_{ext}} \qquad (2)$$

During voltage disturbances, the aim is to protect the sensitive loads with focus is on to improve the DSTATCOM capability to mitigate deep sag. Therefore, keeping it into account, the load voltage during voltage sag is taken as 0.9 pu (per unit) which is sufficient to protect the load. Assuming that the reactive current that a compensator can inject is 20 A and load needs to be protected from sag of 40%, then the value of external reactance is found to be

$$X_{ext} = \frac{0.9-0.6}{20} \times 230 = 3.45\Omega \qquad (3)$$

External reactance of 3.45 that corresponds to an inductance of 11 mH for a 50 Hz supply is used.

IV. PROPOSED CONTROL ALGORITHM:

Proposed control algorithm aims to provide fast voltage regulation at the load terminal during voltage disturbances

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while retaining the advantages of CCM during normal operation. Firstly, currents that must be drawn from the source to get advantages of CCM are computed. Using these currents, magnitude of voltages that need to be maintained at load terminal is computed. If this voltage magnitude lies within a permissible range then same voltage is used as reference voltage to provide advantages of CCM. If voltage lies outside the permissible range, it is a sign of voltage disturbance and a fixed voltage magnitude is selected as reference voltage. A two loop controller, whose output is load angle, is used to extract load power and VSI losses from the source. Finally, a discrete model is derived to obtain switching pulses. All these steps are presented in detail in this section.

A. Computation of Reference Voltage Magnitude (Vt*)
During normal operation, load voltage must be regulated in such a way that following advantages provided by CCM operation are achieved:
1. Source currents are balanced and sinusoidal.
2. Unity power factor (UPF) at PCC.
3. Source supply load average power and VSI losses.

To achieve all aforementioned objectives, instantaneous symmetrical component theory [15] is used to get reference source currents. DSTATCOM makes the load voltages balanced and sinusoidal, but still may contain some switching harmonics which will give unacceptable reference source currents when directly used. Therefore, positive sequence component of load voltages (v+ta1, v+tb1, and v+tc1) are extracted and used to compute reference source currents (i*sa, i*sb, and i*sc) as follows:

$$i_{sa}^{*} = \frac{v_{ta}^{+}}{\Delta_1^{+}}\left(P_{lavg} + P_{loss}\right)$$
$$i_{sb}^{*} = \frac{v_{tb}^{+}}{\Delta_1^{+}}\left(P_{lavg} + P_{loss}\right)$$
$$i_{sc}^{*} = \frac{v_{tc1}^{+}}{\Delta_1^{+}}\left(P_{lavg} + P_{loss}\right) \quad (4)$$

Where, $\Delta^{+}_{1}=\sum_{j=a,b,c}(V_{tj1}^{+})^2$, P_{lavg} is average load power and is calculated using a moving average filter (MAF). Total losses in the inverter, P_{loss}, computed using a PI controller, helps in maintaining averaged dc link voltage ($V_{dc1} + V_{dc2}$) at a predefined reference value ($2V_{dcref}$) by drawing a set of balanced currents from the source and is given as follows:

$$P_{loss} = K_{pdc}\, e + K_{idc} \int e\, dt \quad (5)$$

Where, K_{pdc}, K_{idc}, and $e = 2V_{dcref} - (V_{dc1} + V_{dc2})$ are proportional gain, integral gain, and voltage error of the PI controller respectively. The reference currents to be drawn from the source are computed using (4), reference voltages at the load terminal can be derived. Applying KVL in the circuit shown in Fig. 1

$$\bar{V} = \bar{I}_s Z_{ext} + \bar{V}_t \quad (6)$$

Source voltage and source current will be in phase for the UPF operation. Also, source voltage is taken as reference. Therefore

$$V_s = I_s(R_{ext} + j\,X_{ext}) + V_t\angle - \delta\,.$$

From the above equation, the load voltage can be computed as follows:

$$V_t = \sqrt{(V_s - I_s R_{ext})^2 + (I_s X_{ext})^2} \quad (7)$$

Based on standards, load voltage has a permissible range of variations between 0.9 to 1.1 Pu. Therefore, as long as Vt, obtained using (7) lies between 0.9 to 1.1 Pu, is used as reference load voltage (V*t) and the advantages of CCM operation are achieved. Here, Vt is indirectly controlled by the desired source current. During sag and swell, the load voltage magnitude will be between 0.9 to 0.1 Pu and 1.1 to 1.8 Pu respectively for half cycle to 1 minute [16]. Therefore, reference load voltage magnitudes are set to 0.9 Pu and 1.1 Pu during sag and swell respectively. The reason to keep load voltages at these values is to maximize the DSTATCOM disturbance withstanding ability while keeping load voltage at the safe limits for satisfactory operation. Therefore, following conclusions can be drawn:

$$\begin{aligned} &If\ 0.9\,pu \le V_t \le 1.1\,\text{pu then } V_t^* = V_t \\ \text{Else}\quad &\text{If } V_t > 1.10\text{ pu then } V_t^* = 1.1\text{ pu} \\ &\text{else if } V_t < 0.9\text{ pu then } V_t^* = 0.9\text{ pu} \end{aligned} \quad (8)$$

B. Computation of Load Angle (δ):

The block diagram of controller to compute load angle is shown in Fig. 2. It ensures that the load average power and losses in the VSI are supplied by the source [7]. Alternately, Ploss responsible for maintaining dc link voltage must be equal to shunt link power Psh. Comparing Ploss and Psh, an error is generated which is passed through a PI controller to computeδas follows:

$$\delta = K_{pa}(P_{loss} - P_{sh}) + K_{ia}\int(P_{loss} - P_{sh})\, dt \quad (9)$$

Where, K_{pa} and K_{ia} are proportional and integral gains of the inner PI controller respectively. The value of shunt link power, P_{sh}, is computed using a MAF as follows:

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$$P_{sh} = \frac{1}{T}\int_{t_1}^{t_1+T}(V_{ta}\, i_{fta} + v_{tb} i_{ftb} + v_{tcc} i_{ftc})\, dt \qquad (10)$$

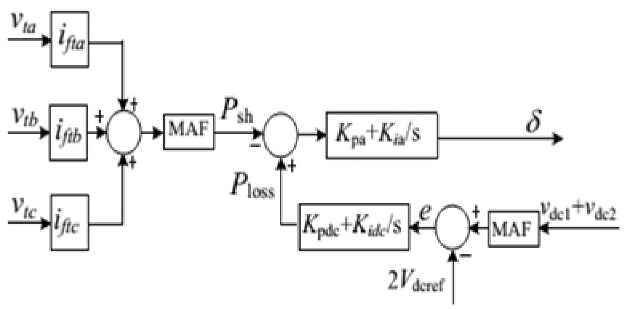

Fig.2. Controller to Calculate δ and Ploss.

A positive value of Psh means power flow from DSTATCOM to load terminal, whereas negative value of Psh represents power flow from load terminal to DSTATCOM. In steady state, VSI losses are compensated by taking power from the source. Hence, Psh will be negative in steady state. Moreover, capacitor voltage decreases from its reference voltage in steady state. Deviation of capacitor voltage from reference voltage represents losses in the VSI. Hence, Ploss will be negative during steady state. Therefore, at all time, Psh and Ploss should be equal. Hence, difference of Psh and Ploss should be minimized. Output of inner PI controller, shown in Fig. 2, is delta which ensures that shunt link power Psh drawn from source equals to losses in the capacitor Ploss.

C.Generation of Instantaneous Reference Voltage:

By knowing the zero crossing of phase-a source voltage, selecting suitable reference load voltage magnitude from (8) and computing load angle from (9) the three phase reference voltages are given as follows:

$$v_{trefa} = \sqrt{2}V_t^* \sin(\omega t - \delta)$$
$$v_{trefb} = \sqrt{2}V_t^* \sin\left(\omega t - \frac{2\pi}{3} - \delta\right)$$
$$v_{trefc} = \sqrt{2}\, V_t^* \sin\left(\omega t + \frac{2\pi}{3} - \delta\right) \qquad (11)$$

Where, ω is the frequency

D. Generation of Switching Pulses:

Each phase of the VSI can be controlled independently and hence, a discrete model of single phase has been derived to generate switching pulses. Dynamics of filter inductor and capacitor can be presented by following equations:

$$\frac{dv_{fc}}{dt} = \frac{1}{c_{fc}} i_{fi} - \frac{1}{c_{fc}} i_{ft}$$
$$\frac{di_{fi}}{dt} = -\frac{1}{l_f} v_{fc} - \frac{R_f}{l_{fi}} + \frac{V_{dc}}{l_f}\, u\,. \qquad (12)$$

Matrix representation of (12) is given as follows:

$$\dot{x} = Ax + Bz \qquad (13)$$

$$A = \begin{bmatrix} 0 & \frac{1}{c_{fc}} \\ -\frac{1}{l_f} & -\frac{R_f}{l_{fi}} \end{bmatrix},\ B = \begin{bmatrix} 0 & -\frac{1}{c_{fc}} \\ \frac{V_{dc}}{l_f} & 0 \end{bmatrix}$$

$$x = [v_{fc} i_{fi}].^t\ ,\quad z = [u\ \ i_{fi}]^t\,.$$

Where,(13), given in continuous form, can be represented in discrete time form as follows:

$$x(k+1) = Gx(k) + H\, z(k) \qquad (14)$$

Where, matrix G and H are given as

$$G = \begin{bmatrix} G_{11} & G_{12} \\ G_{21} & G_{22} \end{bmatrix},\quad H = \begin{bmatrix} H_{11} & H_{12} \\ H_{21} & H_{22} \end{bmatrix}$$

From (14) capacitor voltage will be

$$v_{fc}(k+1) = G_{11} v_{fc}(k) + G_{12} i_{fi}(k) + H_{11} u_k + H_{12} i_{ft}(k). \qquad (15)$$

The reference voltage, Vt ref, is maintained at the load terminal. A cost function, J, is chosen as

$$J = [v_{tref}(k+1) - v_{fc}(k+1)]^2 \qquad (16)$$

Cost function is

$$v_{fc}(k+1) = v_{tref}\,(k+1) \qquad (17)$$

Finally, reference discrete voltage control law from (15) and (17) is given as

$$u^*(k) = {v_{tref}(k+1) - G_{11} v_{fc}(k) - G_{12} i_{fi}(k) - H_{12} i_{ft}(k)}/{H_{11}} \qquad (18)$$

U*(k) is regulated around a hysteresis band h to generate switching pulses of VSI using hysteresis control.

V. PHOTOVOLTAIC (PV) SYSTEM:

In the crystalline silicon PV module, the complex physics of the PV cell can be represented by the equivalent electrical circuit shown in Fig.3. For that equivalent circuit, a set of equations have been derived, based on standard theory, which allows the operation of a single solar cell to be simulated using data from manufacturers or field experiments.

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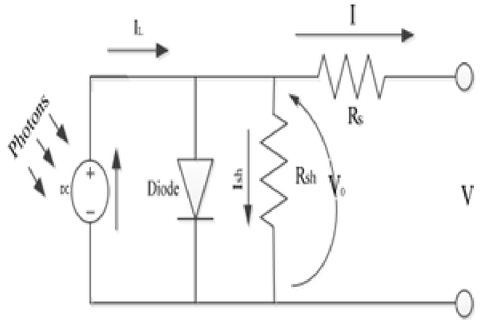

Fig.3. Equivalent Electrical Circuit of a PV Module.

The series resistance RS represents the internal losses due to the current flow. Shunt resistance Rsh, in parallel with diode, this corresponds to the leakage current to the ground. The single exponential equation which models a PV cell is extracted from the physics of the PN junction and is widely agreed as echoing the behavior of the PV cell

$$I = I_L - I_{sc}\left(exp\frac{(V+R_sI)}{V_t}-1\right)-\frac{(V+R_sI)}{R_{sh}} \quad (19)$$

The number of PV modules connected in parallel and series in PV array are used in expression. The Vt is also defined in terms of the ideality factor of PN junction (n), Boltzmann's constant (KB), temperature of photovoltaic array (T), and the electron charge (q). Applied a dynamical electrical array reconfiguration (EAR) strategy on the photovoltaic (PV) generator of a grid-connected PV system based on a plant-oriented configuration, in order to improve its energy production when the operating conditions of the solar panels are different. The EAR strategy is carried out by inserting a controllable switching matrix between the PV generator and the central inverter, which allows the electrical reconnection of the available PV modules.

VI.MATLAB/SIMULINK RESULTS:

Here simulation is carried out in several cases, in that 1) Proposed DSTATCOM Topology for PQ Improvement Features. 2) Proposed DSTATCOM Topology Applied to Renewable Energy Source.

Case 1: Proposed DSTATCOM Topology for PQ Improvement Features:

Proposed Novel Multifunctional Distributed Compensation Scheme can mitigate several power quality (PQ) problems.

In current control mode (CCM), it injects harmonic and reactive components of load currents to make source currents balanced, sinusoidal, and in phase with load voltages. In voltage control mode (VCM), it regulates load voltage at a constant value to protect sensitive loads from voltage disturbances such as sags, swells, transients, and/or fluctuations. However, the objectives of these two modes are different and it can be Achieve by proposed DSTATCOM.

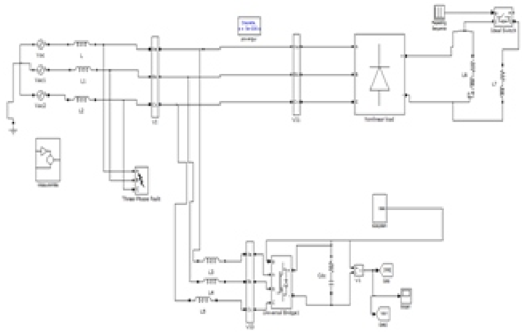

Fig.4 Mat lab/Simulink Model of Proposed DSTATCOM Topology for PQ Improvement Features

Figure.4. gives the Simulation model of system with M-DSTATCOM. In a distribution system with a non-linear load connected to the system will generates harmonics. A nonlinear load in a power system is characterized by the introduction of a switching action and consequently current interruptions. This behavior provides current with different components that are multiples of the fundamental frequency of the system. These components are called harmonics. The amplitude and phase angle of a harmonic is dependent on the circuit and on the load it drives.

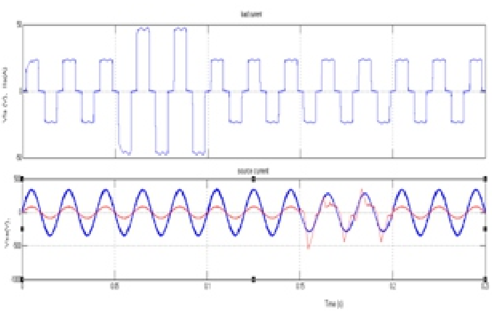

Fig.5. Phase-A Wave Forms Before, During, and After Load Change. (A) Load Current. (B) Source Voltage and Source Current of Proposed DSTATCOM Topology with Stiff Source.

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Initially, a three phase and non-linear load is connected. For achieved multifunctional DSTATCOM operation there phase fault is connected at source side. And at load side an ideal switch breaker is connected. Which is closed at t = 0.05 s. Then load is increased but source currents are balanced and sinusoidal and CCM mode is achieved. It can be seen that both voltage and currents are in phase with each other, maintain unity power factor. Increased load current will not effect on source performance and vice versa. It showed in phase-a, is shown in fig.5 (a).

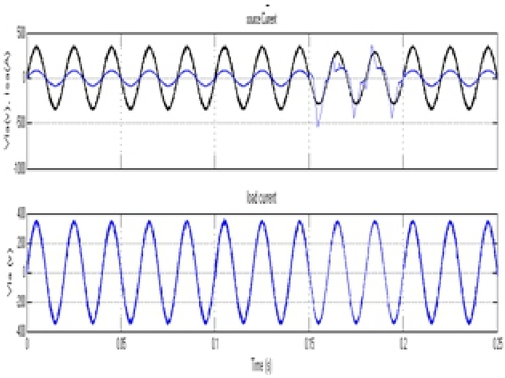

Fig.6. Phase-a waveforms before, during, and after sag. (a) Source voltage and source current. (b) Load voltage of Proposed DSTATCOM Topology with stiff source.

At t = 0.15 s, fault is created by three phase fault at source side. But a fast voltage regulation is provided at load side. It can be seen in fig.6; here voltage control mode is performed.

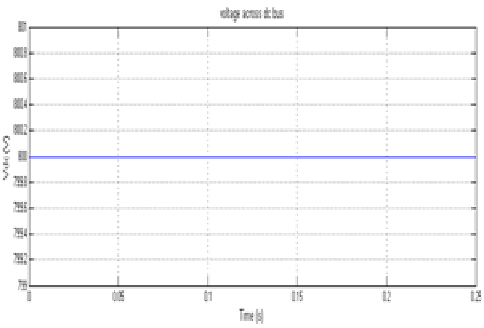

Fig.7. shows the load angle shows the voltage at dc bus which is regulated around 800 V during entire operation.

Case 2: Proposed DSTATCOM Topology Applied to Renewable Energy Sources.

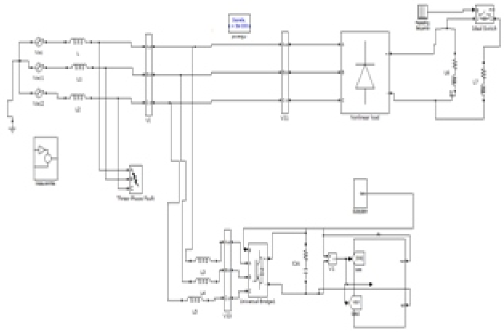

Fig.8.Matlab/Simulink Model of Proposed DSTATCOM Topology for PQ Improvement Features with Renewable Energy Sources.

Recently, developments in power electronics and semiconductor technology have lead improvements in power electronic systems. Pulse Width Modulation variable speed drives are increasingly applied in many new industrial applications that require superior performance for controlling the power flow for this industrial application requires Facts device, which is operated under distribution system is nothing but distributed compensation scheme.

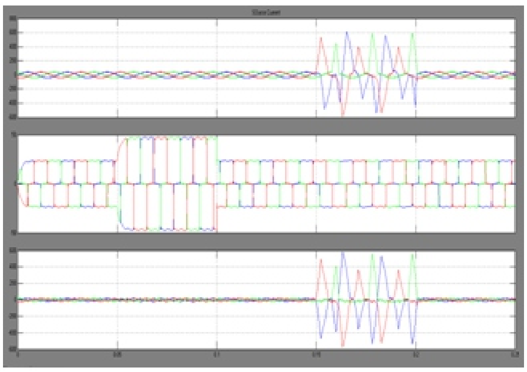

Fig.9.Simulation Results for Source Current, Load Current and Injected Current.

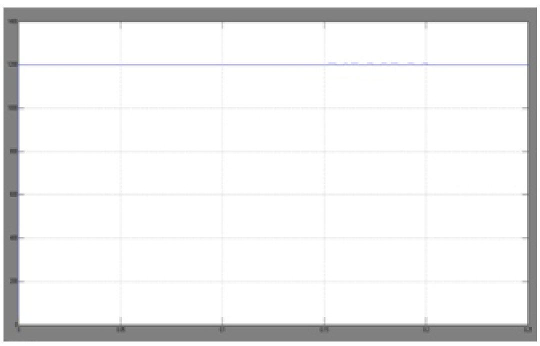

Fig.10.Photovoltaic Voltage.

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VII.CONCLUSIONS:

In this paper, a new converter topology has been proposed which has superior features over conventional topologies in terms of the required power switches and isolated dc supplies, control requirements, cost, and reliability with a new control algorithm based multifunctional DSTATCOM is proposed to protect the load from voltage disturbances under stiff source. It has been achieved by placing an external series inductance of suitable value between the source and the load. In addition, instantaneous reference voltage is controlled in such a way that the source currents are indirectly controlled and advantages of CCM operation are achieved while operating in VCM for permissible range of source voltage. Moreover protects the Induction machine drive through DSTATCOM under power quality concerns with near to optimal features with efficient operation.

REFERENCES:

[1] Chandan Kumar and Mahesh K. Mishra, "A Multifunctional DSTATCOM Operating Under Stiff Source," IEEE Transactions on Industrial Electronics, vol.61, no.7, pp.3131-3136, July 2014".

[2] A. Bhattacharya and C. Chakraborty, "A shunt active power filter with enhanced performance using ANN-based predictive and adaptive controllers," IEEE Trans., Ind. Electron., vol. 58, no. 2, pp. 421–428, Feb. 2011.

[3] S. Rahmani, A. Hamadi, and K. Al-Haddad, "A Lyapunov-function based control for a three phase shunt hybrid active filter," IEEE Trans. Ind. Electron., vol. 59, no. 3, pp. 1418–1429, Mar. 2012.

[4] Mahesh K. Mishra and K. Karthikeyan, "An investigation on design and switching dynamics of a voltage source inverter to compensate unbalanced and nonlinear loads," IEEE Trans. Ind. Electron., vol. 56, no. 8, pp. 2802–2810, Aug. 2009.

[5] J. Liu, P. Zanchetta, M. Degano, and E. Lavopa, "Control design and implementation for high performance shunt active filters in aircraft power grids," IEEE Trans. Ind. Electron., vol. 59, no. 9, pp. 3604–3613, Sep. 2012.

[6] A. Bhattacharya, C. Chakraborty, and S. Bhattacharya, "Parallel connected shunt hybrid active power filters operating at different switching frequencies for improved performance," IEEE Trans. Ind. Electron., vol. 59, no. 11, pp. 4007–4019, Nov. 2012.

[7] Q.-N. Trinh and H.-H. Lee, "An advanced current control strategy for three-phase shunt active power filters," IEEE Trans. Ind. Electron., vol. 60, no. 12, pp. 5400–5410, Dec. 2013.

[8] Mahesh K. Mishra, A. Ghosh, and A. Joshi, "Operation of a DSTATCOM in voltage control mode," IEEE Trans. Power Del., vol. 18, no. 1, pp. 258–264, Jan. 2003.

[9] H. Fujita and H. Akagi, "Voltage-regulation performance of a shunt active filter intended for installation on a power distribution system," IEEE Trans. Power Electron., vol. 22, no. 3, pp. 1046–1053, May 2007.

[10] R. Gupta, A. Ghosh, and A. Joshi, "Performance comparison of VSC based shunt and series compensators used for load voltage control in distribution systems," IEEE Trans. Power Del., vol. 26, no. 1, pp. 268– 278, Jan. 2011.

[11] F. Gao and M. Iravani, "A control strategy for a distributed generation unit in grid-connected and autonomous modes of operation," IEEE Trans., Power Del., vol. 23, no. 2, pp. 850–859, Apr. 2008.

[12] Y.-R. Mohamed, "Mitigation of dynamic, unbalanced, and harmonic voltage disturbances using grid-connected inverters with LCL filter," IEEE Trans. Ind. Electron., vol. 58, no. 9, pp. 3914–3924, Sep. 2011.

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