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Instantaneous Symmetrical Component Theory (ISCT) Controller for Mitigation of Harmonics in Micro-grid System

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***Abstract**: Now a days, the usage of non-linear loads are increased rapidly which increased the power quality (PQ) problems in electric power system like voltage sag and swell, harmonics, etc., in the mentioned problems, one of the major significant PQ problem is the harmonics. This paper proposes the power quality improvement by using Shunt Active Power Filter (SAPF) in AC Electric supply System feeding 3-phase balanced non-linear load. For reduction of harmonics in the system, the Instantaneous Symmetrical Component Theory (ISCT) based controller along with the other controllers named PI controller and Hysteresis current controller are which helps in the micro-grid system. In this, hysteresis current control compares the difference of compensating current, load current with filter current of DSTATCOM. In the proposed method, DSTATCOM has shown good performance in the system to eliminate harmonic component. The system performance is simulated in the MATLAB environment and it is evaluated by calculating the source current Total Harmonic Distortion(THD).*

***Keywords**: ISCT; DSTATCOM; PI Controller; Hysteresis Control; Total Harmonic Distortion (THD)*

I. INTRODUCTION

The integration of voltage and current qualitatively in electrical network ensures the quality of power. The necessary thing in this network is to analyze the voltage and current quality which leads to different power quality problems like sag, swell and poor power factor. From the following discussion, there is a relation between PQ and disturbances in voltage, current, frequency and power factor. Due to the lightning, equipment failure, faults, distortions in voltages, notches, the supply of the AC system becomes non-sinusoidal. The domestic applications will also affect the Power Quality (PQ) ensures the integration of voltage and current qualitatively.

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The equipment may lead to the failure or mal-operation due to the power quality problems. Some of the PQ issues that may arise because of the non-linear loads burden, harmonic currents, unbalanced currents and excessive currents in neutral currents.

Types and Causes of PQ problems:

The PQ problems are increasing day- by -day with the increase of electronic equipment. These are classified based on the nature of the disturbance [8]. They are a) transient state b) steady state.

Transient state: This power quality problem occurs in transient nature disturbances such as sags, swell, voltage variations for the shorter duration, power frequencies and fluctuations in voltage will come under this category. The causes for poor PQ such as faults, lightening, weather conditions come under the category of transient state.

Steady state: This power quality problem occurs in steady in nature disturbance such as voltage variations for the long duration, notches, deviation of the waveform, voltage unbalances.

Effects of PQ problems on customers:

PQ problem affect the customers in many ways by damaging the conducting material, causing financial loss for manufacturers, increasing production losses, corrupting data and power utilities. Power quality issues will also affect the protection equipment such as relays, fuses circuit breakers, earthing, grounding, isolators and it may lead to mal-operation of the protective equipment. Power quality also affect the electromechanical measuring instruments such as moving iron instruments, moving coil instruments, the monitoring systems such as critical loads, emergency, etc. The harmonic current increases the losses in electronic equipment and distribution system which in turn leads to the wastage of energy.

Classification of mitigation techniques for PQ improvement:

For improving PQ, there are many techniques are suggested by researchers. These techniques uses passive components, active components, reactors, FACT devices, series compensator, shunt compensator, custom power devices, UPQC'S, converters such as AC-DC, Matrix Converters. The series and shunt compensation can be done using active, passive filters and hybrid filter. By using these two filters, we can reduce PQ problems on load side.

II. DESIGN OF PROPOSED SYSTEM

In AC networks, the power quality issues are compensated by the Active Power Filter (APF) technology [2].The shunt active power filter is used to inject component equal and opposite to harmonic current. The injecting component of current can be obtained from the distorted waveform using the control techniques such as PQ theory, SRF theory, and instantaneous symmetrical component theory, etc. in the source current. The Fig.2.1 shows block diagram of micro-grid including controller.

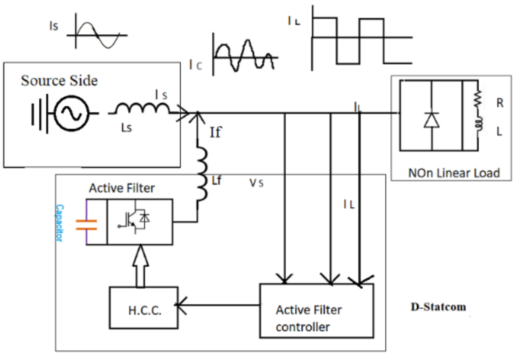

Fig:2.1. Block diagram of micro-grid including controller

The components in Shunt APF are DC-bus capacitor, power electronic devices and coupling inductors (L). At the PCC, the filter acts as a controlled non-sinusoidal current source that and the source current becomes free from harmonics.

III. MATHEMATICAL MODELING OF ISCT CONTROLLER

In the electric system, the main objective of Instantaneous Symmetrical Component Theory (ISCT) is load balancing, power factor correction and harmonic reduction in the electric system. The proposed control technique based on this component can practically compensate any kind of harmonics and unbalanced condition in the load, provided that we should have a more band width current source to examine the filter reference currents. These algorithms have been derived in this section. The instantaneous symmetrical components for any set of three-phase instantaneous currents or voltages are defined as follows,

$$\begin{bmatrix} \bar{i}_{a0} \\ \bar{i}_{a+} \\ \bar{i}_{a-} \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} i_a \\ i_b \\ i_c \end{bmatrix}$$

$$\begin{bmatrix} \bar{v}_{a0} \\ \bar{v}_{a+} \\ \bar{v}_{a-} \end{bmatrix} = \frac{1}{3}\begin{bmatrix} 1 & 1 & 1 \\ 1 & a & a^2 \\ 1 & a^2 & a \end{bmatrix}\begin{bmatrix} v_a \\ v_b \\ v_c \end{bmatrix}$$

$$i_{sa} + i_{sb} + i_{sc} = 0$$

$$< \bar{v}_{a+} = < \bar{i}_{a+} + \emptyset_+$$

$$< (\frac{1}{3}[v_{sa} + a\, v_{sb} + a^2\, v_{sc}]) = < \frac{1}{3}([i_{sa} + a\, i_{sb} + a^2\, i_{sc}]) + \emptyset_+$$

L.H.S = R.H.S

$$\text{L.H.S} = < [\frac{1}{3}\{V_{sa} + (-\frac{1}{2} + \frac{\sqrt{3}}{2})\, v_{sb} + (-\frac{1}{2} - \frac{\sqrt{3}}{2})\, v_{sc}\}]$$

$$= <[\frac{1}{3}\{(v_{sa} - \frac{v_{sb}}{2} - \frac{v_{sc}}{2}) + j\frac{\sqrt{3}}{2}(v_{sb} - v_{sc})\}]$$

$$= tan^{-}\frac{(\frac{\sqrt{3}}{2})(v_{sb} - v_{sc})}{(v_{sa} - \frac{v_{sb}}{2} - \frac{v_{sc}}{2})}$$

$$= tan^{-}(\frac{K_1}{K_2})$$

Where $K_1 = \frac{\sqrt{3}}{2}(v_{sb} - v_{sc})$, $K_2 = (v_{sa} - \frac{v_{sb}}{2} - \frac{v_{sc}}{2})$

$$\text{R.H.S} = <[\frac{1}{3}\{i_{sa} + (-\frac{1}{2} + \frac{\sqrt{3}}{2})\, i_{sb} + (-\frac{1}{2} + \frac{\sqrt{3}}{2})\, i_{sc}\}] + \emptyset_+$$

$$= < [\frac{1}{3}\{(i_{sa} - \frac{i_{sb}}{2} - \frac{i_{sc}}{2}) + j\frac{\sqrt{3}}{2}(i_{sb} - i_{sc})\}] + \emptyset_+$$

$$= tan^{-}\frac{(\frac{\sqrt{3}}{2})(i_{sb} - i_{sc})}{(i_{sa} - \frac{i_{sb}}{2} - \frac{i_{sc}}{2})} + \emptyset_+$$

$$= tan^{-}\frac{K_3}{K_4} + \emptyset_+$$

where $K_3 = (\frac{\sqrt{3}}{2})(i_{sb} - i_{sc})$, $K_4 = (i_{sa} - \frac{i_{sb}}{2} - \frac{i_{sc}}{2})$

$$= tan^{-}(\frac{K_1}{K_2}) = tan^{-}(\frac{K_3}{K_4}) + \emptyset_+$$

$$= \tan(tan^{-}(\frac{K_1}{K_2})) = \tan(tan^{-}(\frac{K_3}{K_4})) + \emptyset_+$$

Therefore , $\frac{K_1}{K_2} = \frac{(\frac{K_3}{K_4}) + \tan\emptyset_+}{1 - (\frac{K_3}{K_4})\times\tan\emptyset_+}$

The above equation implies that

$$K_1 K_4 - K_2 K_3 \tan\emptyset_+ - K_2 K_3 - K_2 K_4 \tan\emptyset_+ = 0$$

Substitute the constants in the above equation .

$$\frac{\sqrt{3}}{2}(v_{sb} - v_{sc})(i_{sa} - \frac{i_{sb}}{2} - \frac{i_{sc}}{2}) - \frac{3}{4}(v_{sb} - v_{sc})(i_{sb} - i_{sc})\tan\emptyset_+ - \frac{\sqrt{3}}{2}(v_{sa} - \frac{v_{sb}}{2} - \frac{v_{sc}}{2})(i_{sb} - i_{sc}) - (v_{sa} - \frac{v_{sb}}{2} - \frac{v_{sc}}{2})(i_{sa} - \frac{i_{sb}}{2} - \frac{i_{sc}}{2})\tan\emptyset_+ = 0.$$

Arrange above equation in terms of i_{sa} , i_{sb} , i_{sc}

$$\{\frac{\sqrt{3}}{2}(v_{sb} - v_{sc}) + \frac{\tan\emptyset_+}{2}(v_{sb} + v_{sc} - 2\, v_{sa})\}\, i_{sa} + \{\frac{\sqrt{3}}{2}(v_{sc} - v_{sa}) + \frac{\tan\emptyset_+}{2}(v_{sc} + v_{sa} - 2\, v_{sb})\, i_{sb} + \{\frac{\sqrt{3}}{2}(v_{sa} - v_{sb}) + \frac{\tan\emptyset_+}{2}(v_{sa} + v_{sb} - 2\, v_{sc})\}i_{sc} = 0.$$

Divide above equation $by\ \frac{\sqrt{3}}{2}$

$$\{(v_{sb} - v_{sc}) + \frac{\tan\emptyset_+}{\sqrt{3}}(v_{sb} + v_{sc} - 2\, v_{sa})\}\, i_{sa} + \{(v_{sc} - v_{sa}) + \frac{\tan\emptyset_+}{\sqrt{3}}(v_{sc} + v_{sa} - 2\, v_{sb})\, i_{sb} + \{(v_{sa} - v_{sb}) + \frac{\tan\emptyset_+}{\sqrt{3}}(v_{sa} + v_{sb} - 2\, v_{sc})\, i_{sc} = 0.$$

Assume $\beta = \frac{tan\emptyset_+}{\sqrt{3}}$

$$\{(v_{sb} - v_{sc}) + \beta(v_{sb} + v_{sc} - 2v_{sa})\, i_{sa} + \{(v_{sc} - v_{sa}) + \beta(v_{sc} + v_{sa} - 2v_{sb})\, i_{sb} + \{(v_{sa} - v_{sb}) + \beta(v_{sa} + v_{sb} - 2\, v_{sc})\, i_{sc} = 0.$$

Adding and subtracting v_{sa} ,v_{sb} and v_{sc} in β terms and expressing

$$v_{s0} = (\frac{v_{sa} + v_{sb} + v_{sc}}{3})$$

$$\{(v_{sb} - v_{sc}) - 3\beta(v_{sa} - v_{s0})\}\, i_{sa} + \{(v_{sc} - v_{sa}) - 3\beta(v_{sb} - v_{s0})\}\, i_{sb} + \{(v_{sa} - v_{sb}) - 3\beta(v_{sc} - v_{s0})\}\, i_{sc} = 0.$$

$p_s = v_{sa}\, i_{sa} + v_{sb}\, i_{sb} + v_{sc}\, i_{sc} = p_{lavg}$

$$\begin{bmatrix} (v_{sb} - v_{sc}) + \beta\,(v_{sb} + v_{sc} - 2\,v_{sa}) \\ (v_{sc} - v_{sa}) + \beta\,(v_{sc} + v_{sa} - 2\,v_{sb}) \\ (v_{sa} - v_{sb}) + \beta(v_{sa} + v_{sb} - 2\,v_{sc}) \end{bmatrix} \begin{bmatrix} i_{sa} \\ i_{sb} \\ i_{sc} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ p_{lavg} \end{bmatrix}$$

$[A]\,[i_{sabc}] = [p_{lavg}]$

$[i_{sabc}] = [A]^{-1}[p_{lavg}]$

$$= \frac{1}{\Delta_A}\begin{bmatrix} a_{c11} & a_{c12} & a_{c13} \\ a_{c21} & a_{c22} & a_{c23} \\ a_{c31} & a_{c32} & a_{c33} \end{bmatrix}^T \begin{bmatrix} 0 \\ 0 \\ p_{lavg} \end{bmatrix}$$

$$= \frac{1}{\Delta_A}\begin{bmatrix} a_{c11} & a_{c21} & a_{c31} \\ a_{c12} & a_{c22} & a_{c32} \\ a_{c13} & a_{c23} & a_{c33} \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ p_{lavg} \end{bmatrix}$$

Where a_{cij} is the cofactor of i_{th} row and j_{th} column and ΔA is the matrix A determinant. Due to presence of zero elements in first two rows of column vector with power elements, the cofactors in first two columns need not to be computed. These are indicated by dots in the following matrix.

$$[i_{sabc}] = \begin{bmatrix} i_{sa} \\ i_{sb} \\ i_{sc} \end{bmatrix} = \frac{1}{\Delta_A}\begin{bmatrix} \cdot & \cdot & a_{c31} \\ \cdot & \cdot & a_{c32} \\ \cdot & \cdot & a_{c33} \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ p_{lavg} \end{bmatrix} = \frac{1}{\Delta_A}\begin{bmatrix} a_{c31} \\ a_{c32} \\ a_{c33} \end{bmatrix} [p_{lavg}]$$

The determinant of matrix A is computed as below.

$\Delta_A = [(v_{sc} - v_{sa}) + \beta\,(v_{sc} + v_{sa} - 2\,v_{sb})]\; v_{sc} - [(v_{sa} - v_{sb}) + \beta\,(v_{sa} + v_{sb} - 2\,v_{sc})]v_{sb} - [(v_{sb} - v_{sc}) + \beta\,(v_{sb} + v_{sc} - 2\,v_{sa})]\; v_{sc} + [(v_{sa} - v_{sb}) + \beta\,(v_{sa} + v_{sb} - 2\,v_{sc})]\; v_{sa} + ((v_{sb} - v_{sc}) + \beta\,(v_{sb} + v_{sc} - 2\,v_{sa}))\; v_{sb} - [(v_{sc} - v_{sa}) + \beta\,(v_{sc} + v_{sa} - 2\,v_{sb})]v_{sa}$

$= [v_{sc}^2 + v_{sa}\,v_{sc} - 2\,v_{sb}\,v_{sc} - v_{sa}\,v_{sb} - v_{sb}^2 + 2\,v_{sb}\,v_{sc} - v_{sb}\,v_{sc} - v_{sc}^2 + 2\,v_{sa}\,v_{sc} + v_{sa}^2 + v_{sb}\,v_{sa} - 2\,v_{sc}\,v_{sa} + v_{sb}^2 + v_{sc}\,v_{sb} - 2\,v_{sa}\,v_{sb} - v_{sc}\,v_{sa} - v_{sa}^2 + 2\,v_{sb}\,v_{sa} + (v_{sc} - v_{sa})\; v_{sc} - (v_{sa} - v_{sb})v_{sb} - (v_{sb} - v_{sc})\,v_{sc} + (v_{sa} - v_{sb})\,v_{sa} + (v_{sb} - v_{sc})v_{sb} - (v_{sc} - v_{sa})\,v_{sa}.$

$= \beta.0 + v_{sc}^2 - v_{sa}\,v_{sc} - v_{sb}\,v_{sa} + v_{sb}^2 - v_{sb}\,v_{sc} + v_{sc}^2 + v_{sa}^2 - v_{sa}\,v_{sb} + v_{sb}^2 - v_{sb}\,v_{sc} - v_{sa}\,v_{ac} + v_{sa}^2.$

$= v_{sa}^2 + v_{sb}^2 - 2\,v_{sa}\,v_{sb} + v_{sb}^2 + v_{sc}^2 - 2\,v_{sb}\,v_{sc} + v_{sc}^2 + v_{sa}^2 - 2\,v_{sc}\,v_{sa}.$

$= (v_{sa} - v_{sb})^2 + (v_{sb} - v_{sc})^2 + (v_{sc} - v_{sa})^2.$

$= v_{sab}^2 + v_{sbc}^2 + v_{sca}^2$

Adding and subtracting of $v_{sa}^2 + v_{sb}^2 + v_{sc}^2$

$\Delta_A = 3\,(v_{sa}^2 + v_{sb}^2 + v_{sc}^2) - (v_{sa}^2 + v_{sb}^2 + v_{sc}^2 + 2\,v_{sa}\,v_{sb} + 2\,v_{sb}\,v_{sc} + 2\,v_{sc}\,v_{sa})$

$= 3(v_{sa}^2 + v_{sb}^2 + v_{sc}^2) - (v_{sa} + v_{sb} + v_{sc})^2.$

$= 3\sum_{j=a,b,c} v_{sj}^2 - 9\,v_{s0}^2.$

$= 3\left[\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2\right].$

Where v_{s0} is zero sequence component of source voltage

$$v_{s0} = \frac{v_{sa} + v_{sb} + v_{sc}}{3}$$

Determinant of matrix A can also be expressed as

$\Delta_A = 3[v_{sa}^2 + v_{sb}^2 + v_{sc}^2 - 3\,v_{s0}\,\frac{v_{sa} + v_{sb} + v_{sc}}{3}]$

$= 3\,[v_{sa}^2 + v_{sb}^2 + v_{sc}^2 + 3\,v_{s0}^2 - 2 \times 3\,v_{s0}^2$

$= 3[\,v_{sa}^2 + v_{sb}^2 + v_{sc}^2 + v_{s0}^2 + v_{s0}^2 + v_{s0}^2 - 2\,v_{s0}\,(v_{sa} + v_{sb} + v_{sc})\,]$

$= 3[\,(v_{sa}^2 - v_{s0}^2) + (v_{sb}^2 - v_{s0}^2) + (v_{sc}^2 - v_{s0}^2)]$

The co-factors of a_{c31}, a_{c32} and a_{c33}

$a_{c31} = [\,-\,(v_{sc} - v_{sa}) - \beta\,(v_{sc} + v_{sa} - 2\,v_{sb}) + (v_{sa} - v_{sb}) + \beta\,(v_{sa} + v_{sb} - 2\,v_{sc})]$

$= v_{sa} - v_{sb} - v_{sc} + v_{sa} + \beta\,(-v_{sc} - v_{sa} + 2\,v_{sb} + v_{sa} + v_{sb} - 2\,v_{sc})$

$= (2\,v_{sa} - v_{sb} - v_{sc} + 3\beta\,(v_{sb} - v_{sc})$

$= 3\,(v_{sa} - v_{s0}) + 3\,\beta\,(v_{sb} - v_{sc})$

Similarly

$a_{c32} = [\,-\,(v_{sa} - v_{sb}) - \beta\,(v_{sa} + v_{sb} - 2\,v_{sc}) + (v_{sb} - v_{sc}) + \beta\,(v_{sb} + v_{sc} - 2\,v_{sa})\,]$

$= (\,-\,v_{sa} + v_{sb} + v_{sb} - v_{sc}) + \beta\,(-v_{sa} - v_{sb} + 2\,v_{sc} + v_{sb} + v_{sc} - 2\,v_{sa})$

$= (2\,v_{sb} - v_{sc} - v_{sa}) + 3\beta\,(v_{sc} - v_{sa})$

$= 3\,(v_{sb} - v_{s0}) + 3\beta\,(v_{sc} - v_{sa}).$

And

$a_{c33} = [\,(v_{sc} - v_{sa}) + \beta\,(v_{sc} + v_{sa} - 2\,v_{sb}) - (v_{sb} - v_{sc}) - \beta(v_{sb} + v_{sc} - 2\,v_{sa})$

$=(2\,v_{sc} - v_{sa} - v_{sb}) + 3\,\beta\,(v_{sa} - v_{sb})$

$= 3(v_{sc} - v_{s0}) + 3\,\beta\,(v_{sa} - v_{sb}).$

Knowing the value of cofactors,

$$\begin{bmatrix} i_{sa} \\ i_{sb} \\ i_{sc} \end{bmatrix} = \frac{1}{3\,[\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2\,]}$$

$$\begin{bmatrix} 3(v_{sa} - v_{s0}) + 3\beta\,(v_{sb} - v_{sc}) \\ 3(v_{sb} - v_{s0}) + 3\beta\,(v_{sc} - v_{sa}) \\ 3(v_{sc} - v_{s0}) + 3\beta\,(v_{sa} - v_{sb}) \end{bmatrix} [p_{lavg}]$$

$$= \frac{1}{[\,\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2\,]}$$

$$\begin{bmatrix} (v_{sa} - v_{s0}) + \beta\,(v_{sb} - v_{sc}) \\ (v_{sb} - v_{s0}) + \beta\,(v_{sc} - v_{sa}) \\ (v_{sc} - v_{s0}) + \beta\,v_{sa} - v_{sb}) \end{bmatrix} [p_{lavg}]$$

The required source current from the above equation

$$i_{sa} = \frac{(v_{sa} - v_{s0}) + \beta\,(v_{sb} - v_{sc})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\; p_{lavg}$$

$$i_{sb} = \frac{(v_{sb} - v_{s0}) + \beta\,(v_{sc} - v_{sa})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\; p_{lavg}$$

$$i_{sc} = \frac{(v_{sc} - v_{s0}) + \beta\,(v_{sa} - v_{sb})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\ p_{lavg}$$

Apply K.C.L at P.C.C

$$i_{fa}^{*} = i_{la} - i_{sa} = i_{la} - \frac{(v_{sa} - v_{s0}) + \beta(v_{sb} - v_{sc})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\ p_{lavg}$$

$$i_{fb}^{*} = i_{lb} - i_{sb} = i_{la} - \frac{(v_{sb} - v_{s0}) + \beta(v_{sc} - v_{sa})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\ p_{lavg}$$

$$i_{fc}^{*} = i_{lc} - i_{sc} = i_{la} - \frac{(v_{sc} - v_{s0}) + \beta(v_{sa} - v_{sb})}{\sum_{j=a,b,c} v_{sj}^2 - 3\,v_{s0}^2}\ pllavg$$

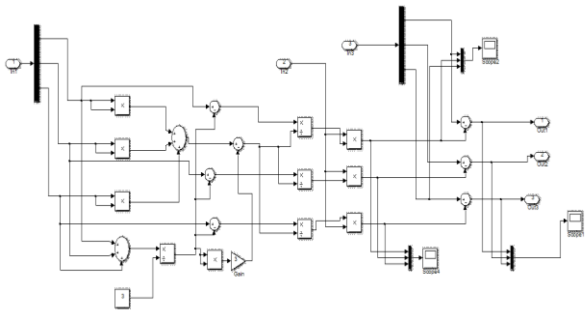

Fig:4.3.ISCT Controller

IV. SIMULATION DIGRAM & RESULTS

In the simulation diagram 3-phase sinusoidal waveform with 440V line to line voltage at 50Hz frequency is taken as a source and 3- phase diode rectifier is considered as a load. The proposed diagram 3-phase system connected with non-linear load using D-STATACOM as shown in Fig.4.1 is developed in MATLAB/SIMULANK environment.

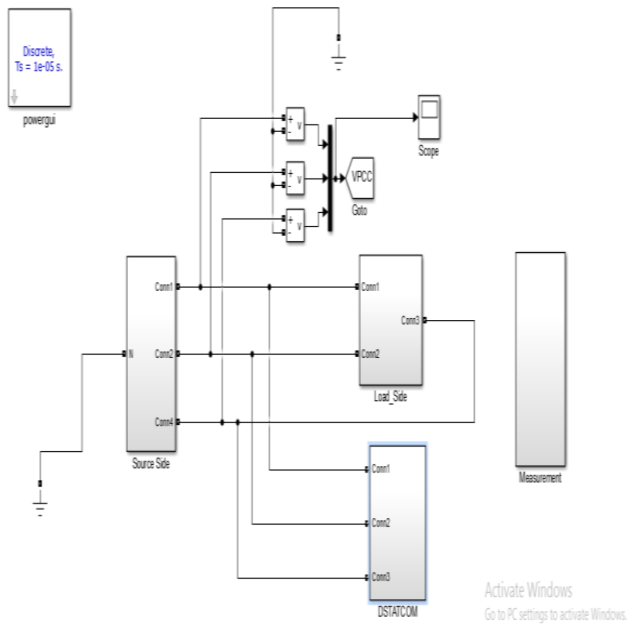

Fig:4.1.Simulation diagram of 3-phase system connected with non-linear load

The Voltage Source Inverter (VSI) with DC link control is shown in Fig.4.2. and also in Fig.4.3 ISCT controller is shown.

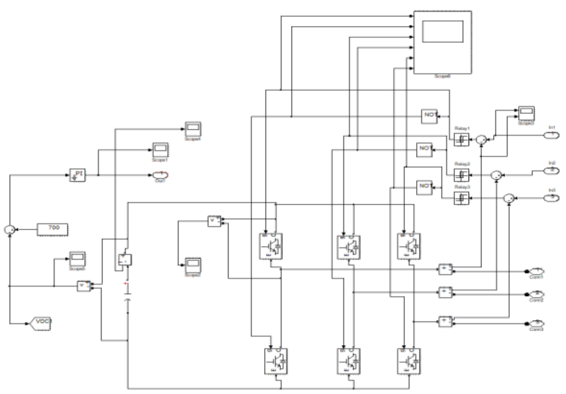

Fig:4.2 Voltage Source Inverter(VSC) with DC Link control

After the simulation, the obtained results are shown in figures from Fig.4.4 to Fig.4.10.

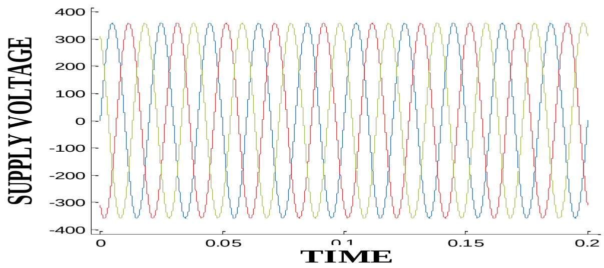

Fig:4.4 V_{RMS} phase voltage of the source

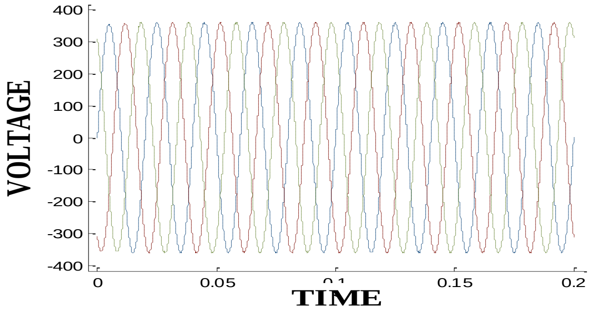

Fig:4.5 PCC Voltages

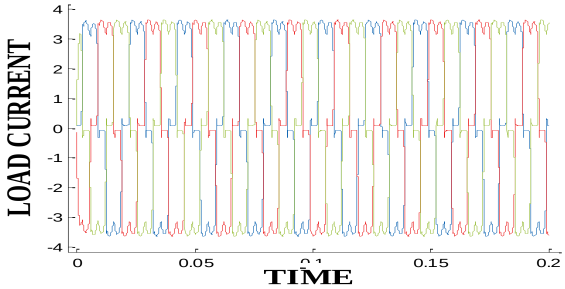

Fig:4.6 Load Current

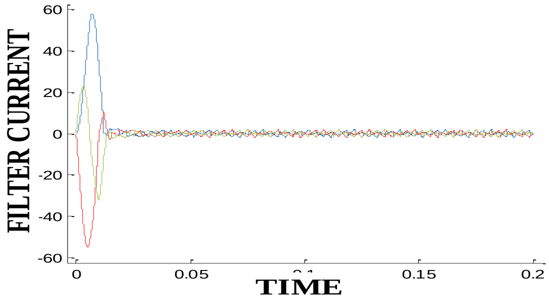

Fig:4.7 Filter Current

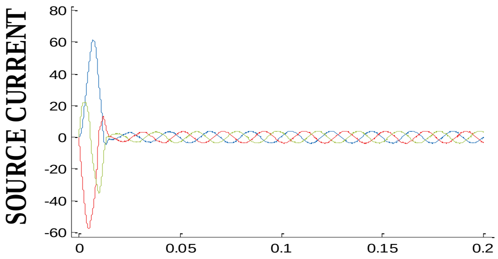

Fig:4.8 Source Current

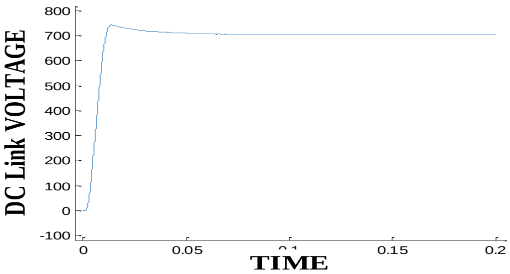

Fig:4.9 DC Link Voltage

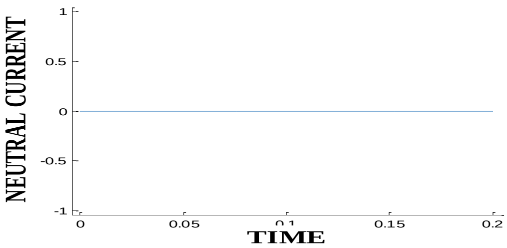

Fig:4.10 Neutral Current

V. CONCLUSION

The non-linear loads cause the harmonics and lead to power quality issues in the electric system. There are various control techniques available for mitigation of harmonics, out of which the above mentioned ISCT controller is preferred to mitigate harmonics. In order to minimize the error in a DC Link and also to generate accurate gate pulses in DSTATCOM, we have used PI Controller and Hysteresis current control. The THD is reduced to 5.12% by the above technique.

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