

# Different Methods of Power Quality Improvement using DSTATCOM With T-Connected Transformer and Their Possibility According to Load

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**Abstract:-** In the modern electrical distribution consensus there has been an unexpected enhance of nonlinear loads for illustrations power deliver and rectifier gadget used in telecommunication associations and domestic relevance such as adjustable speed drives and power electronic functions and so on. These loads are responsible up to a great extent for deteriorating the efficiency and quality of the power. Distribution- STATCOM to compensate voltage swells inferior linear as well as nonlinear loads in a 3-phase 4-wire (3P4W) distribution arrangement. In this paper most familiar and diverse methods are used to control proposal DSTATCOM are an instantaneous active power method and symmetrical component assumption, improved instantaneous active along with reactive current component assumption, hysteresis current controller performance. A new synchronous reference frame method for DSTATCOM with T-connected is proposed and its results are being converse and compared with instantaneous active power theory.

**Keywords:-** Point of Common Coupling (PCC), Power quality improvement, Synchronous Reference Frame method, proportional integral.

## 1. INTRODUCTION

An electric distribution association is component of an electric method involving the immensity power source or

else sources and the client service switches. The bulk power sources are situated in otherwise close to the load region to be serving in the distribution organization and may possibly either generating stations and power substations supply over transmission lines. Harmonic currents in distribution system can basis harmonic distortion. Small power factor and extra losses as well as heating in the electrical tools. It also can origin vibration and noise in appliances and fault of the sensitive apparatus. There are different ways to enhance power quality problems in transmission and distribution systems. Among these the DSTATCOM is one of the most effective devices. A new PWM based control scheme has been implemented to control the electronic valves in the DSTATCOM [1]. 3- Phase 4-wire distribution organizations are exploited to deliver single-phase small voltage loads for instance computer unit. The voltage regulation is besides adverse in the distribution system by motive of the unexpected development and the mechanism of diverse categories of loads in the obtainable distribution system in sequence to organize the power quality predicaments. Instantaneous reactive power hypothesis is situating on the exchange of 3-phase quantity to 2-phase quantity in addition to the estimate of instantaneous active furthermore reactive power in this frame.  $E_a$  also  $E_b$ ,  $E_c$  with  $i_{La}$  and  $i_{Lb}$ ,  $i_{Lc}$  be exacting to the controller and these quantity are method to generate reference currents. The switching signals in maintain of the STATCOM is generated next to evaluate source current and reference current. The control algorithm of the IRPT is depicting in Figure1.

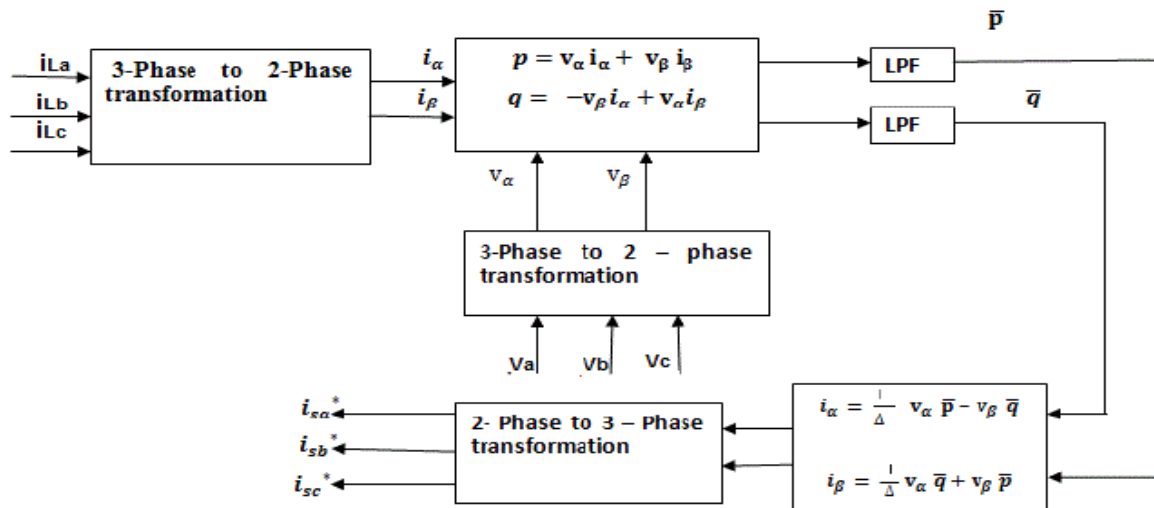


Fig 1:- Control Technique of IRPT

This theory is based on the transformation of three phase quantities to two phase quantities. The supply voltage is unbalanced or distorted then the load harmonic current derived from Instantaneous reactive power theory are not accurate that's reason synchronous reference theory are used in proposed work.

**II. PROPOSED TECHNIQUE**

The DSTATCOM unit is an inverter with DC link capacitor which gets its control pulses from a controller circuit. The central benefit of the DSTATCOM is that the compensating current does not depend resting on the voltage level of the Point of Common Coupling. The concerts of intended synchronous reference frame algorithm in sustain of DSTATCOM manage. DSTATCOM includes a T-connected transformer and single phase APF is considered for compensation of reactive power, phase current harmonics and neutral current under diverse utility voltage circumstance. T-connected transformer has advantage of using single phase transformers. Therefore cores are economical to build and easy to assemble. Therefore transformer is small in size, low height and low weight compare to any other transformer available. The T-connected of winding is making out by the phasor diagram depicting in Figure 2.

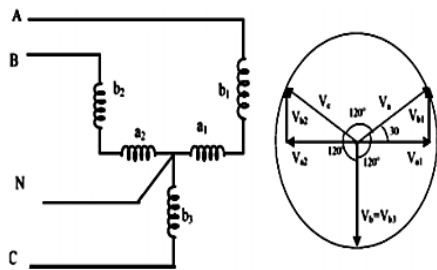


Fig 2:- T-connected Transformer Correlation

• *Voltage Source Converter Sustained DSTATCOM*

This paper presents the operating principle of DSTATCOM. It is not anything but a STATCOM but utilized

by the Distribution method. The core element of the DSTATCOM is a power VSC specifically supported on elevated power electronics technology as shown. The VSC exchanges the dc voltage transversely the storage appliance addicted to locate of three-phase ac output voltages. These voltages are in phase in addition to attach within the ac system at some period in the reactance of the union transformer [3]. Modification of the phase as well magnitude of the DSTATCOM output voltages authorizes competent control of active with reactive power switch over among the D-STATCOM and the ac system. The central purpose of DSTATCOM display high speed controlling of reactive power to make available voltage stabilization in power system[4]. The DSTATCOM secure the distribution system given that voltage sags also flicker source via reactive current demand.

**III. DOMINANCE OF SYNCHRONOUS REFERENCE FRAME THEORY**

The conformist SRF algorithm can be applied to take out the harmonics surrounded in the carry in voltages otherwise currents. Intended for current harmonic compensation the indistinct currents are primary transfer addicted to two-phase stationary coordinate with  $\alpha-\beta$  conversion. The stationary frame quantities are transfer into synchronous rotating frames using cosine moreover sine purposes as of the Phase Locked Loop (PLL). The sine and cosine functions facilitate to retain the synchronization through deliver voltage also current. The instantly SRF algorithm is besides known as d-q technique and it is supports lying on a-b-c to d-q-0 transformation (park transformation). Now the Proportional Integral (PI) controller is apply to remove the steady state error of the DC factor of the inverter and preserves the dc side capacitor voltage constant [2]. The dc capacitor voltage is sense and evaluated with reference voltage to estimate the error voltage. In unity to the PI controller output is deducted from the direct axis (d axis) of harmonic factor for reduce the steady state error.

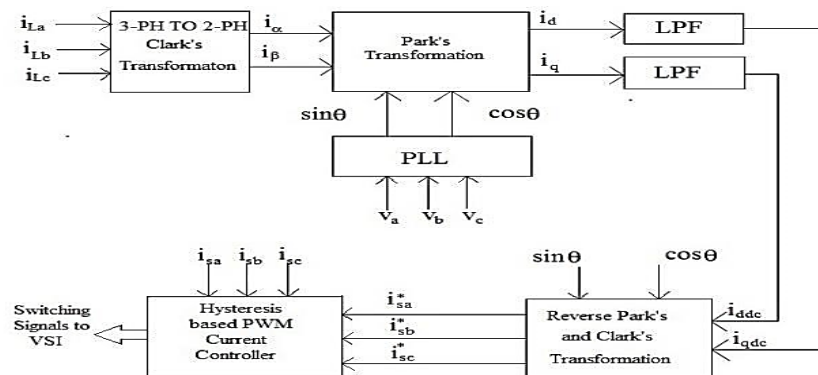


Fig 3:- Synchronous Reference Frame method

• *Pulse Width Modulation Technique*

The needed execution of PWM current control is situating on derives the switching from the evaluation of the current error among a fixed band. In pulse modulation, the carrier wave is not in form of a continuous sine or cosine wave, but it is in form of pulses and it anyone parameter out of amplitude and phase width in addition to pulse position modifies with the instantaneous assessment of the modulating signal [5]. Pulse Width Modulation is a category of pulse modulation in pulse

width modulation, the width of carrier pulses or its time deviation is changed in unity among the instantaneous implication of the modulating signal instigation Figure.4 it is clear that in the modulated wave, the pulse width is more where the amplitude of modulating wave is more and the width of modulated wave is less where the amplitude of the modulating wave is low. In pulse width modulation, the information of modulating signal is contained in the trailing edge of pulse.

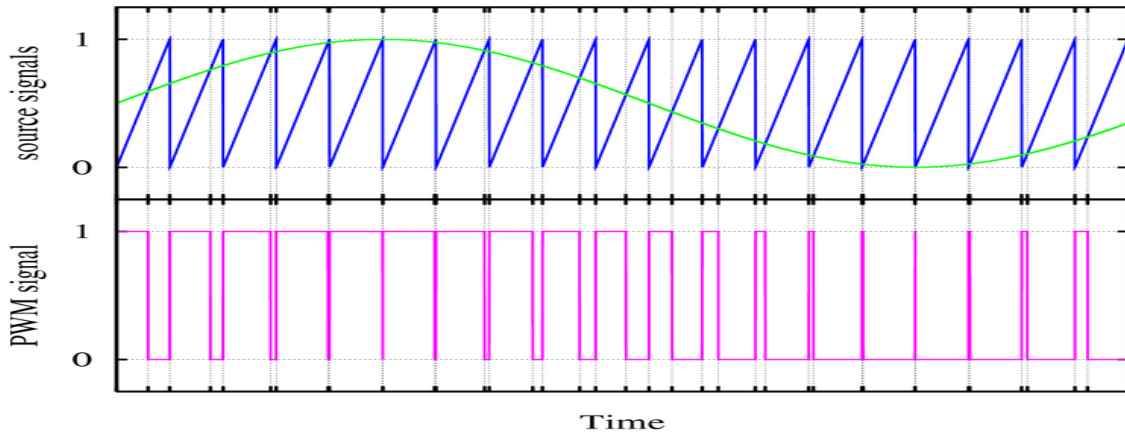


Fig 4:- Producing PWM Signal

**IV. SIMULATION RESULTS**

This paper has accessible the power quality difficulties such as distortions also harmonics. The plan and relevance of distribution static compensator for harmonics and inclusive results be presented. SRF organize method was implement in this proposed distribution static compensator. The performance of the proposed topologies and an improvement of suggested controller can be observed through simulation results is shown in figure The simulation and

implementation of DSTATCOM with T-connected transformer and single phase Active Power Filter has been carried out. The performance of D-STATCOM for the source current harmonics reduction and neutral current compensation with different loaded condition and different utility voltage condition is shown. No compensation is provided then THD is 22.43%. When the compensation is provided to system that is T-connected transformer and DSTATCOM are connected in the system the positive and negative sequence harmonics when THD becomes 2.64%.

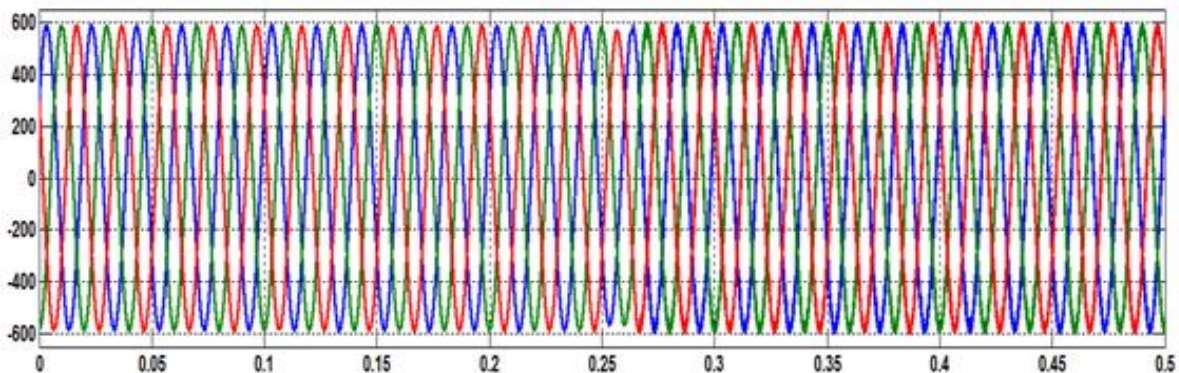


Fig 5:- Source Voltage ( $V_{abc}$ )

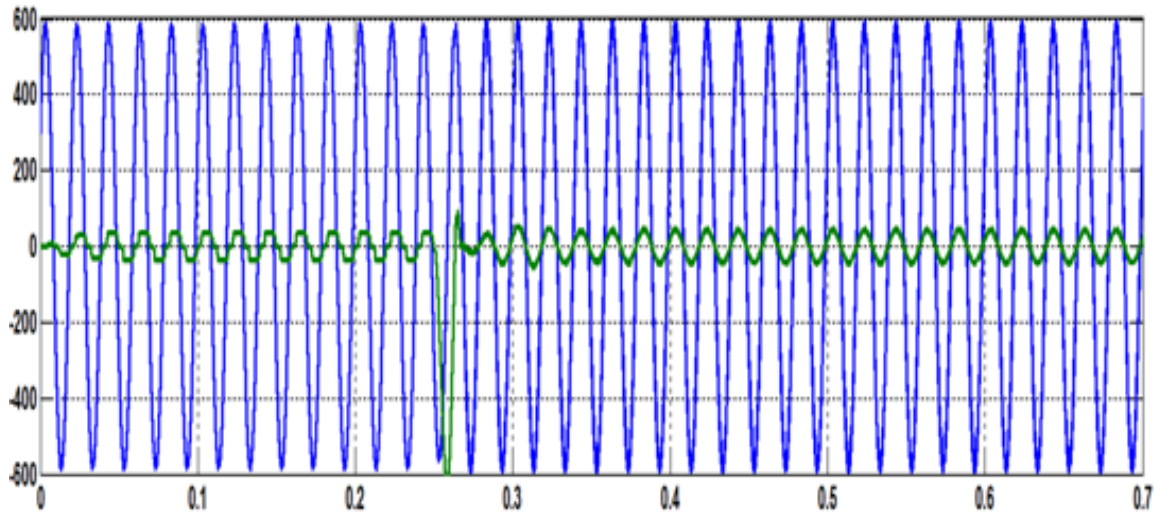


Fig 6:- Source Voltage ( $V_{ab}$ ), uncompensated in addition to compensated Source Current

- *Total Harmonic Distortion (THD) Analysis*

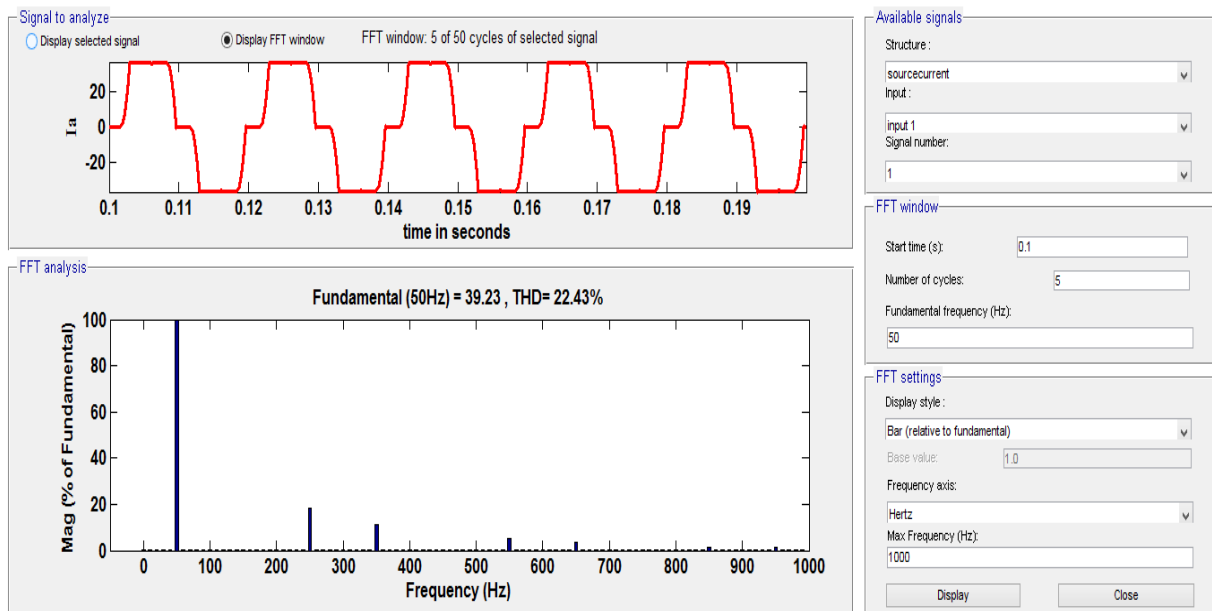


Fig 7:- FFT study of Uncompensated Waveform

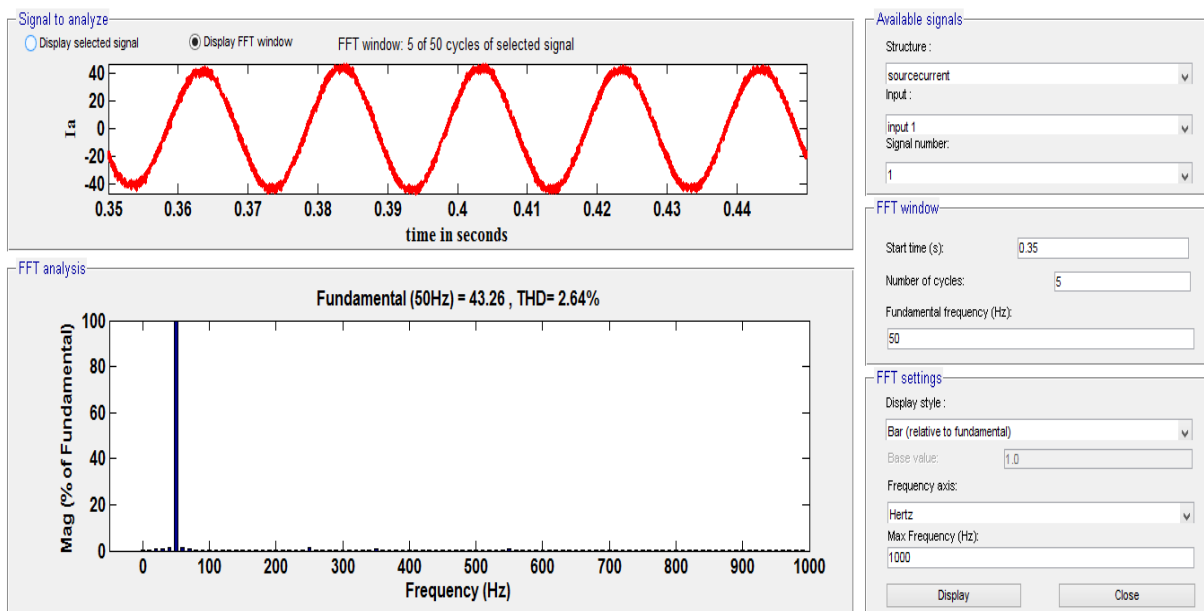


Fig 8:- FFT study of compensated Waveform

## V. CONCLUSION

In this paper a DSTATCOM unit is developed for power quality improvement with T-connected transformer. Instantaneous reactive power theory and synchronous reference frame algorithm was extended of the generating control pulses for the DSTATCOM unit. This DSTATCOM unit makes available power factor modification and real with reactive power compensation and voltage regulation. A comparative study has been done for the two control algorithms to achieve the above objectives. From comparative study it is clear that synchronous reference frame algorithm is better in performance compared to instantaneous reactive power theory control algorithm. The DSTATCOM unit with SRF algorithm provides better performance. THD becomes 2.64%. This is within the acceptable limit of THD given by IEEE.

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