

HARMONICS REDUCTION IN POWER SUPPLY USING DPFC

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ABSTRACT- Power prerequisites are expanding quickly. Power is utilized as a part of various nonlinear loads. Additionally control quality issues are expanded like sags, swells, and interruptions. This paper speak to for the enhancing of power quality by DPFC. . DPFC is altered from bound together unified flow controller .For acquiring DPFC from Unified power flow controller, the common dc connect is dispensed with amongst series and shunt converter and numerous single phase converters are utilized as a part of place of high evaluations three phase converter. The DPFC controls the line impedances, voltage of bus and impedance of line. It is more solid and lower expensive than the UPFC.

Key Words – DPFC, FACTS, Harmonics, Power quality, UPFC.

1. INTRODUCTION

Primary issues are power quality for some organizations [1].It is an arrangement of limits that enables electrical equipment to work appropriately with no loss [2].According to the customers, Power quality is characterized as any issues have been happened in voltage, current and frequency that makes the power failures [3].For refining the power quality, Facts devices and, custom power devices have been utilized [4], [5]. FACTS and DVR are custom power gadgets which have been utilized for power quality change .When the beginning of the cumbersome machines, inrush current has been expanded, and switching issues have been happened in grid system. Overvoltage, under voltage and interruptions are found in transmission line [6]. A STATCOM is utilized as a part of transmission line which can control the power and transport voltage where it is associated in line .The STATCOM was called as advanced SVC .STATCOM is a shunt associated device. [7]. The static synchronous series compensator (SSSC) is a series converter which infuses a reactive power in the transmission line. It is likewise utilized for controlling the reactive power. UPFC is mix of a STATCOM and a SSSC [8], associated with common dc connect to permit bidirectional flow of active power between the series output terminals of the SSSC and the shunt output terminals of the STATCOM [9].The UPFC isn't generally utilized , Because of high cost and unwavering quality . The DPFC is controlled like line impedance, transmission angle and bus voltage.

2. CONSTRUCTION OF DISTRIBUTED POWER FLOW CONTROLLER

In DPFC, shunt and series converters have been utilized which are free to each other. The shunt converter is same as a STATCOM. The DSSC idea, three stage converters are partitioned in to the various single stage converters. In DPFC, Converters are autonomous to each other and dc voltage is given by the self dc capacitor voltage. Arrangement of UPFC Figure 1.

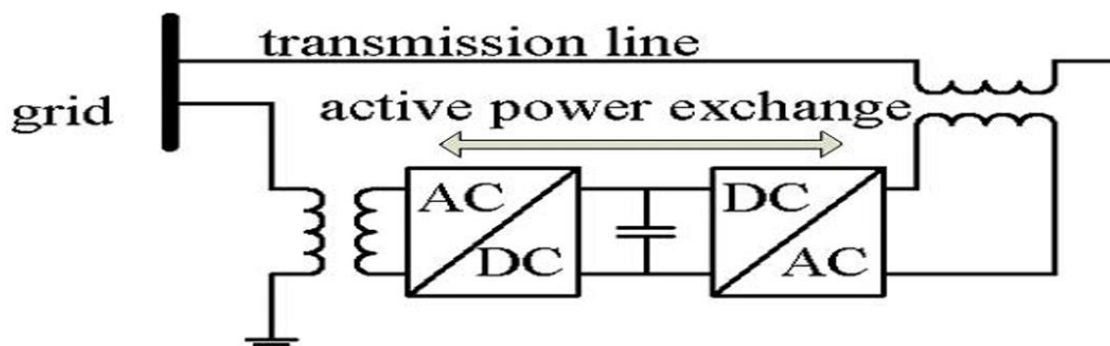


Fig.1 UPFC Configuration

3. DISTRIBUTED POWER FLOW CONTROLLER

In DPFC , shunt and series converters have been utilized which are free to each other and its particular capacitor voltage convey the vital voltage.

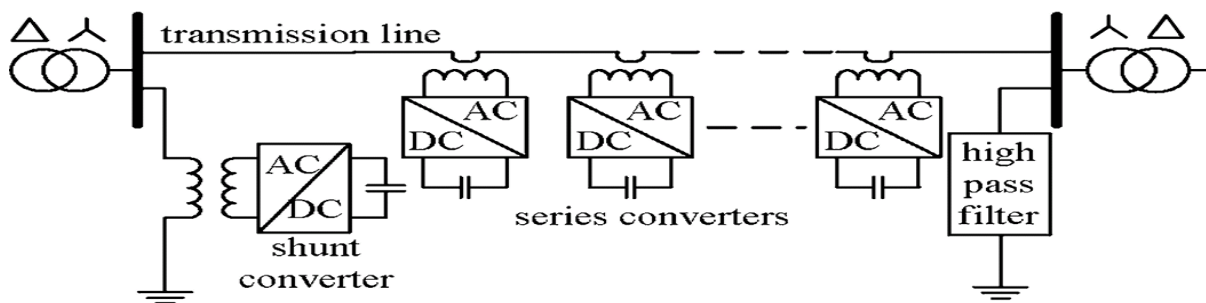


Fig2. DPFC Configuration.

3.1 WORKING OF DISTRIBUTED POWER FLOW CONTROLLER

A. EXCHANGE OF ACTIVE POWER THROUGH REMOVED DC CONNECTION

For exchanging of active power, transmission work as the common dc connection in the middle of series and shunt ac terminals within distributed power flow controller. In this way, it is possible to exchange the active power through the ac terminals.

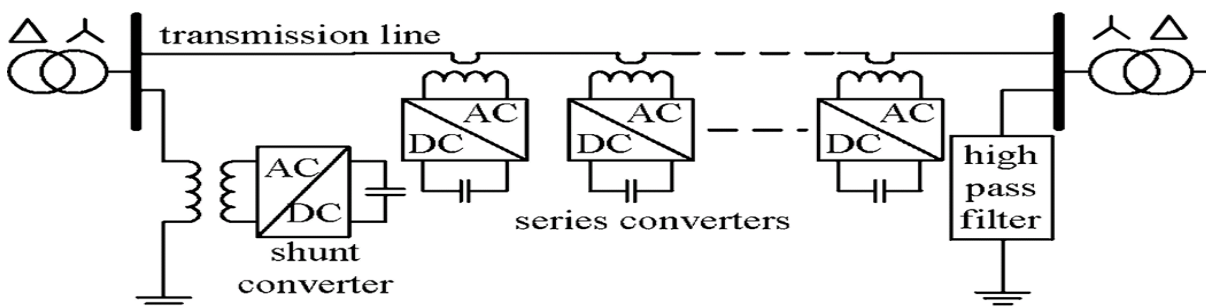


Fig3. Active power interchange among Distributed power flow controllers.

In this method, fundamental idea is power theory of non-sinusoidal components. As per the Fourier analysis, a non-sinusoidal current and voltage can be expressed by the sum of sinusoidal functions in various frequencies with various amplitudes. Coming about because of the non-sinusoidal voltage and current, the active power is characterized as the mean estimation of the result of voltage and current. Since the integrals of all the cross result of terms with various frequencies are zero, the active power can be expressed by Where V_i and I_i are the voltage and current at the i th harmonic frequency, respectively, and ϕ_i is the angle between the voltage and current. Equation (1) clarifies the active power at various frequencies is disengaged from other.

$$P = \sum_{i=1}^{\infty} V_i I_i \cos \phi_i \tag{1}$$

Inside the DPFC, The shunt converters get active power at fundamental frequency from the grid and furthermore infusing the current in grid at a harmonic frequency. . With presumption of a lossless converter, the active power delivered at fundamental frequency is equivalent to the power accepting at the harmonic frequency. Fig.3 demonstrates exchanging the active power between shunt and series a converters.

B. By using 3rd harmonic components in each phase

In DPFC, filters are utilized to pass the harmonic components and block the fundamental components. In view of novel natures of third-harmonic frequency components, the third harmonic is chosen to exchange the active power inside the DPFC. In the three-phase power system, third harmonic in each phase is indistinguishable, which is alluded to like "zero-sequence." The zero-sequence harmonic is obstructed by star-delta transformers.

Thus, there is no need of additional filter to keep the harmonic leakage to the staying of the network. Due to the exorbitant high pass filter, as appeared in Fig.3, can be changed by a cable that is associated between the neutral point of the star-delta transformer on the right side in Fig .2 and the ground. For third harmonic current delta winding seems open circuited and through the harmonic current will concentrate in the ground link through star-delta as appeared in fig.3. So vast high pass filter is supplanted.

4. CONTROL CIRCUIT FOR DPFC

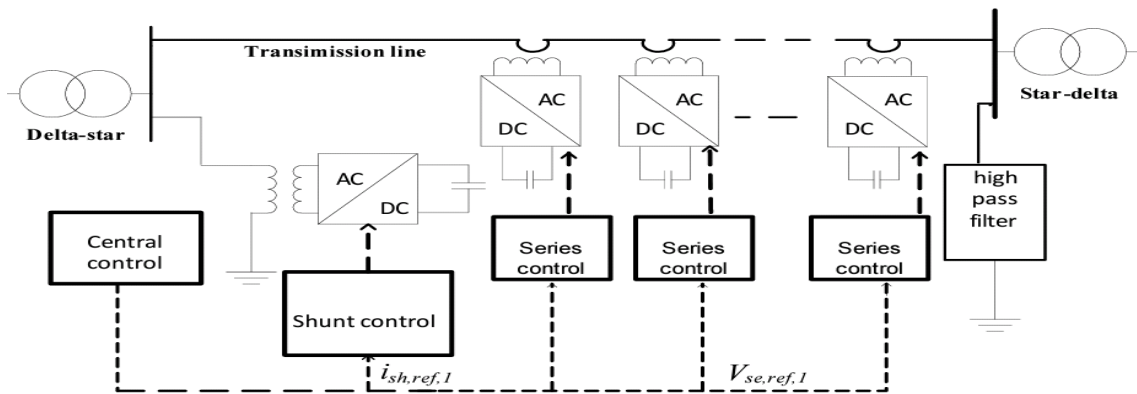


Fig.4 DPFC control block diagram

There are used three types of controller Shunt, series and central controller.

A .Shunt control

Working of shunt control, infuse the current at constant third harmonic in transmission line. Around then, it ingests active power from the grid at fundamental frequency to remain the capacitor DC voltage of the shunt converter at a constant value and infusing reactive current at the fundamental inside the grid.

B .Series Control

Each single-phase converter has its own series control through the transmission line. The principle utilization of the series controller to keep up its own particular capacitor dc voltage and to create series voltage at the fundamental frequency which is checked by the central control. These controllers have first order low pass filter and third order band pass filter.

C. Central Control

It is produced reference signals for the shunt and series converters of the DPFC. All the reference signals are created at the fundamental frequency as per the framework necessity. It is checked the power flow, power oscillation low frequency damping and asymmetrical components adjusting for the series and shunt converter's reactive current signal.

5. ADVANTAGES OF DPFC OVER UPFC

The DPFC have the merits over the UPFC, which are as follows

(a)High dependability: In DPFC system, the shunt and series converters are autonomous to each other. So when a failure happens in the converter, does not impact other converters.

(b)High control ability: The DPFC likewise control every one of the parameters of power system, for example, line impedance, transmission angle, and bus voltage magnitude.

(c)Low Cost: The DPFC, its cost is low in contrast with UPFC in light of lower rating single phase converters are utilized as a part of place three phase converter.

6. SIMULATION & RESULT OF DPFC

The entire model explain below is presented in Fig.5. The system holds a three-phase source associated to a nonlinear load through transmission lines. . The simulation waveforms of load voltages of system without DPFC and with DPFC as given in Figure 5(a) and 5(b).

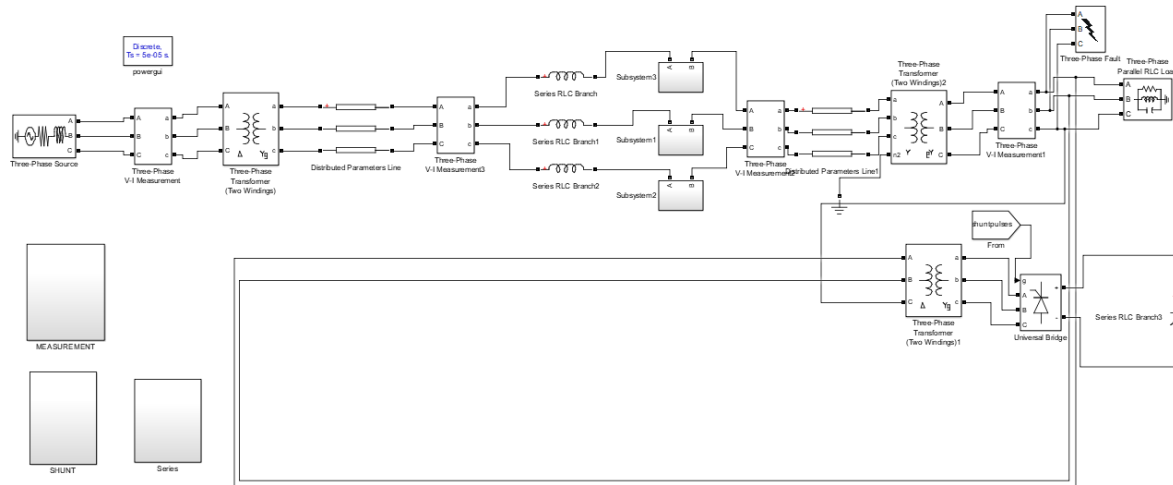


Fig.5: A simulation model of DPFC for voltage sag and swell mitigation

As shown in Fig. is simulated the performance of DPFC, The three phase fault has been occurred close the load. The time period of fault is 0.5-0.7 second's. As shown in Fig.5 (a), a voltage sag is received, when fault is happened lacking DPFC. When added the DPFC, voltage sag is mitigated, as shown in Fig.5 (b).

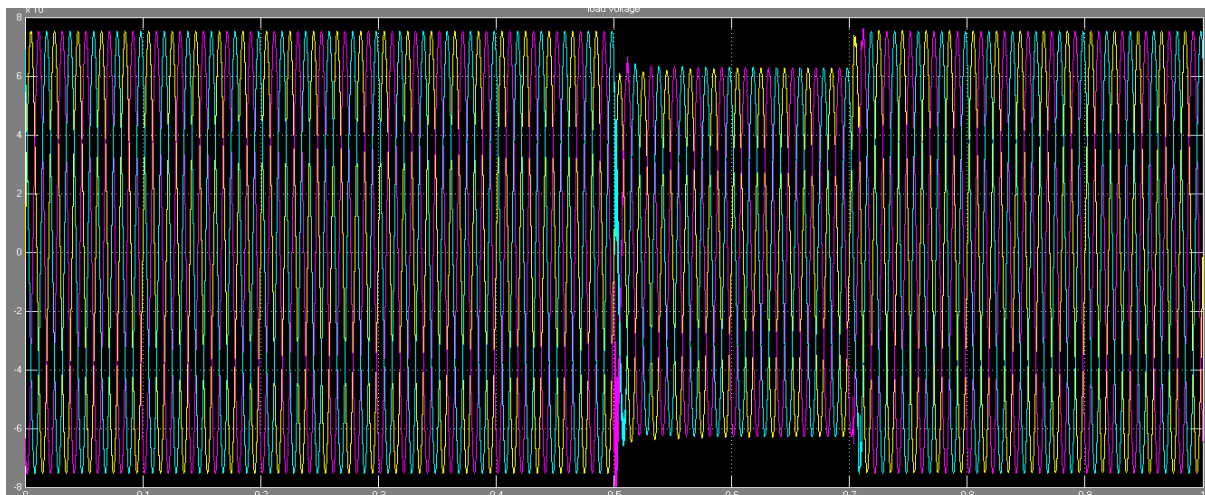


Fig.5 (a) Three phase voltage sag waveform analysis without Distributed power flow controller

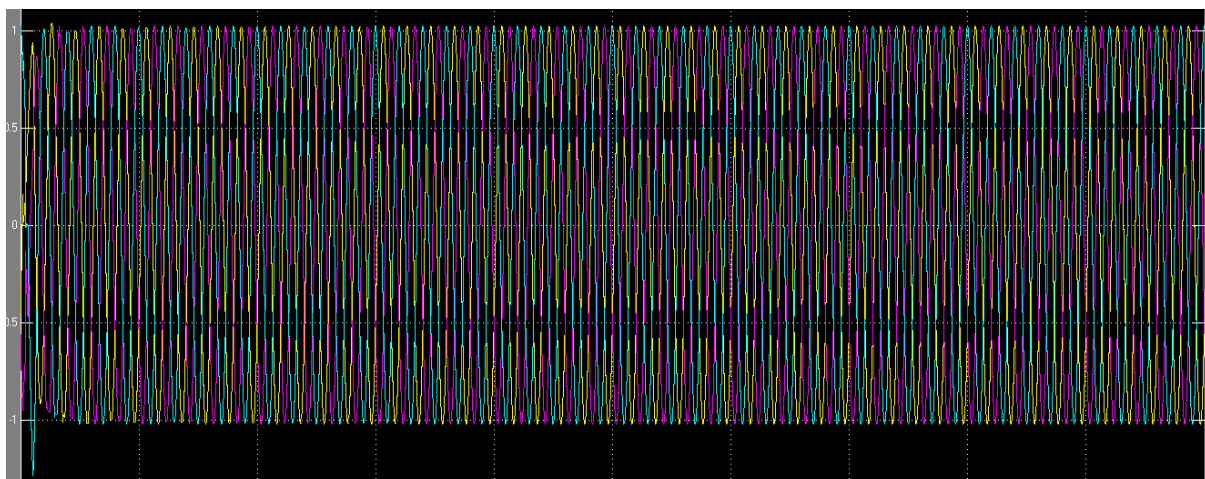


Fig.5 (b) Modification of three-phase load voltage sag by Distributed power flow controller

The three-phase load current swell without DPFC and with DPFC are shown in Fig.4(c) and Fig.4 (d).

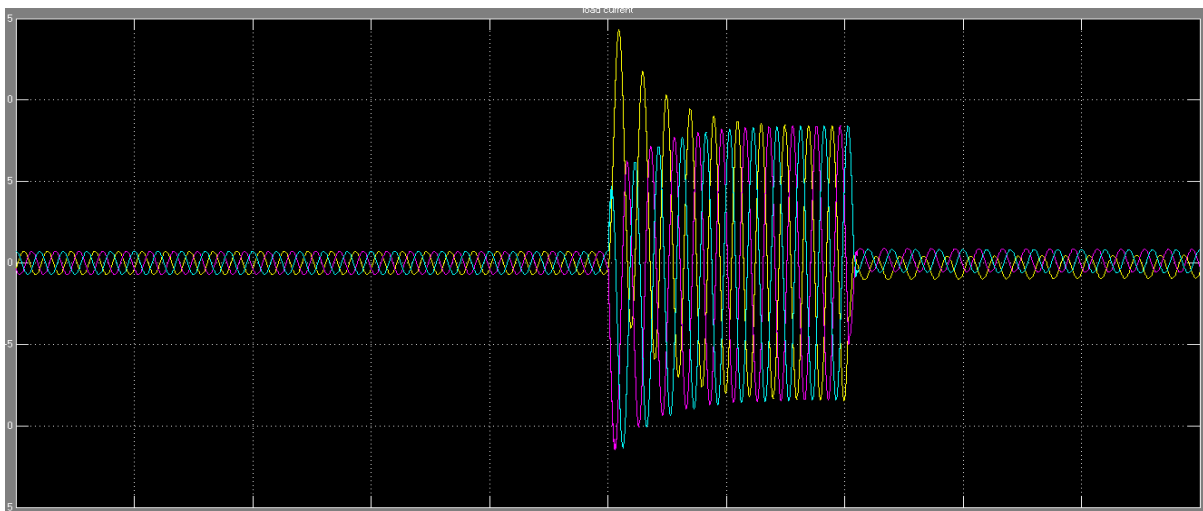


Fig.5(c) Three-phase load current swell waveform analysis without Distributed power flow controller

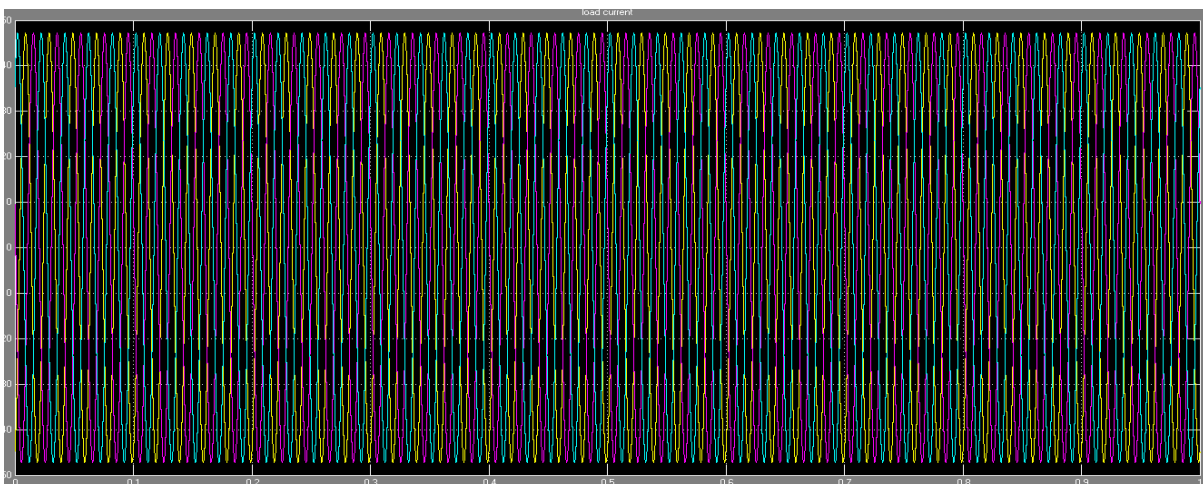


Fig.5 (d) Modification of three-phase load current swell using Distributed power flow controller

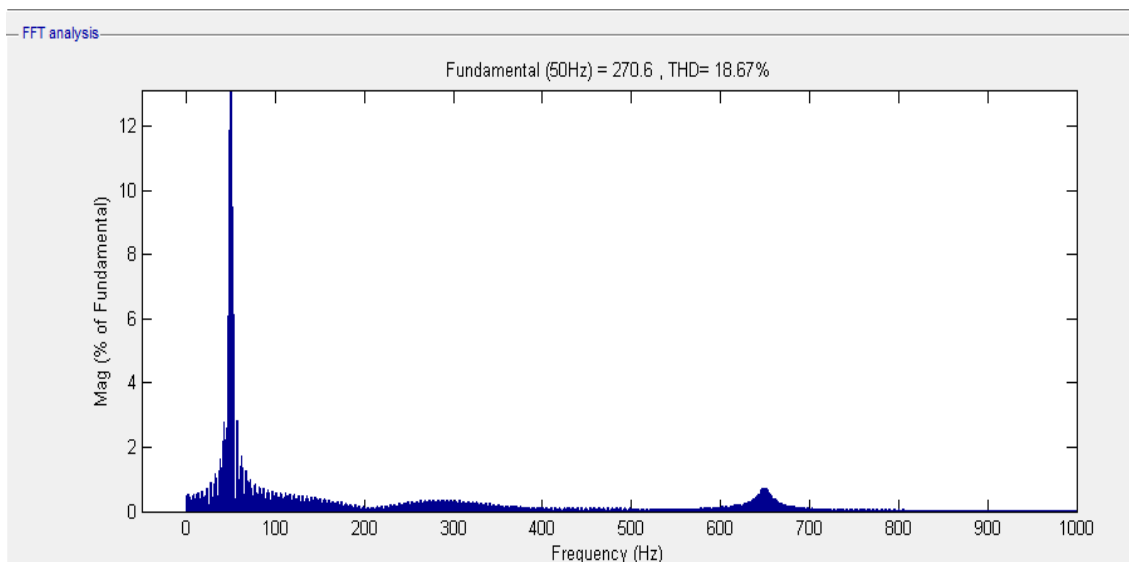


Fig.5 (e) Total harmonic distortion (THD) analysis of load voltage without Distributed power flow controller

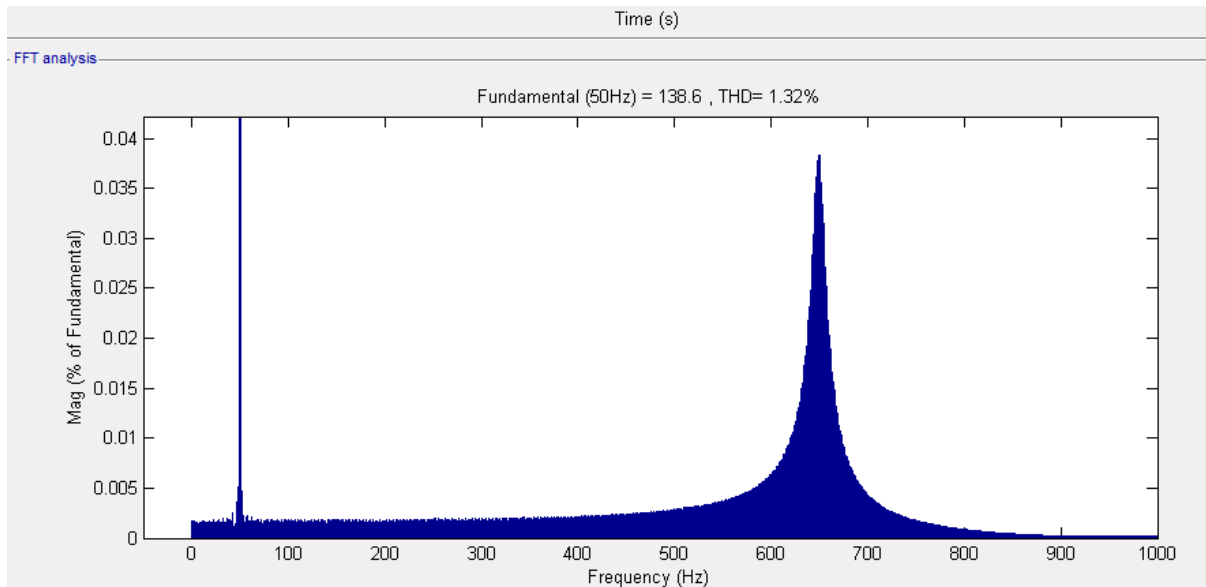


Fig.5 (f) Total Harmonic distortion (THD) analysis of load voltage with Distributed power flow controller

7. CONCLUSION

In this paper has been spoken to various thought known as DPFC. The joint dc link connect among the shunt and series converters arrangement converters, which is utilized for exchanging active power inside UPFC, has been evacuated. The power has been exchanged through the transmission line at the third harmonic frequencies. What's more, three converters is supplanted by utilizing the numerous single stage converters. The trustworthiness of the DPFC is imperatively enhanced due to the end of the three arrangement converters. Accordingly, DPFC gives a reasonable demonstration in power quality change and power flow control.

APPENDIX

TABLE I. Simulation Parameters

Parameters	Standards
Source	3 phase , 25kv , 50 Hz
X/R	3
Transmission line	
Resistance	0.012 p u/km ,
Inductance / Capacitance reactance	0.933e-3 p u/km , 12.74e-9pu/km
Length of transmission line	100km
Shunt converter 3-phase	
DC link capacitor	2000 μF
Coupling transformer (shunt)	
Nominal power and frequency	250MVA , 50Hz
Three phase fault	
Type	ABC-G
Ground resistance	0.01ohm

8. REFERENCES

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