

load current, and (b) loss component of APF; to preserve the average capacitor voltage to a constant value. Peak value of the current (I_{max}) so found, will be multiplied by the unit sine vectors in phase with the individual source voltages to obtain the reference compensating currents. These expected reference currents (I_{sa}^* , I_{sb}^* , I_{sc}^*) and detected actual currents (I_{sa} , I_{sb} , I_{sc}) are equated at a hysteresis band, which delivers the error signal for the modulation technique. This error signal chooses the operation of the converter switches. In this current control circuit configuration the source/supply currents I_{sabc} are made to follow the sinusoidal reference current I_{abc} , within a fixed hysteresis band. The width of hysteresis window regulates the source current pattern, its harmonic spectrum and the switching frequency of the devices. The DC link capacitor voltage is always preserved constant during the operation of the converter. In this scheme, each phase of the converter is measured independently. To increase the current of a particular phase, the lower switch of the converter related with that particular phase is turned on while to decrease the current the upper switch of the corresponding converter phase is turned on.

4. Simulation Results

The simulation of the project was carried out in Matlab 8.1 and the project uses the simpower system library of SIMULINK, the total harmonic distortion and fft analysis was performed using power gui tool provided in sim power systems, the results are as shown:

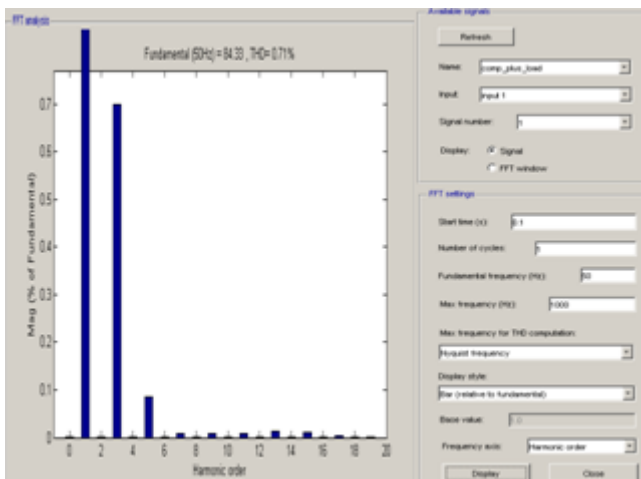


Figure 6: Result of THDi for the SIMULINK model



Figure 7: Graph of source current and THD without apf

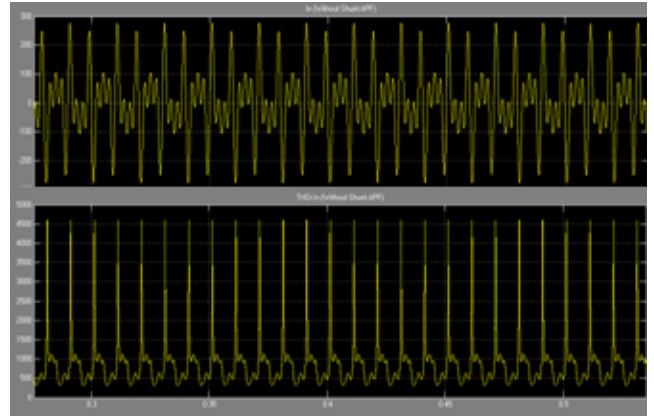


Figure 8: Graph of neutral current and THD without apf

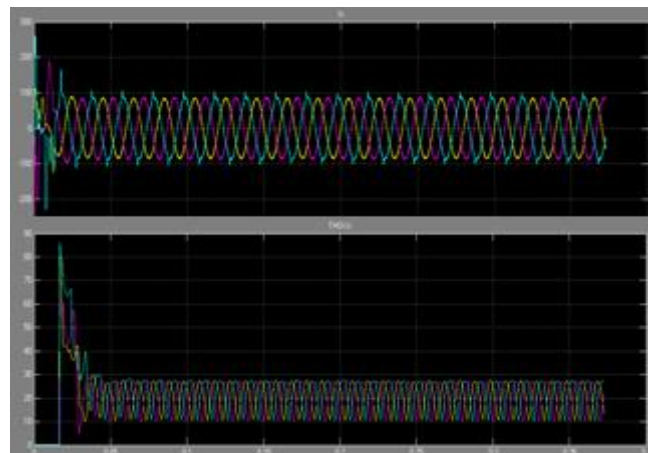


Figure 9: Graph of source current and THD in presence of apf

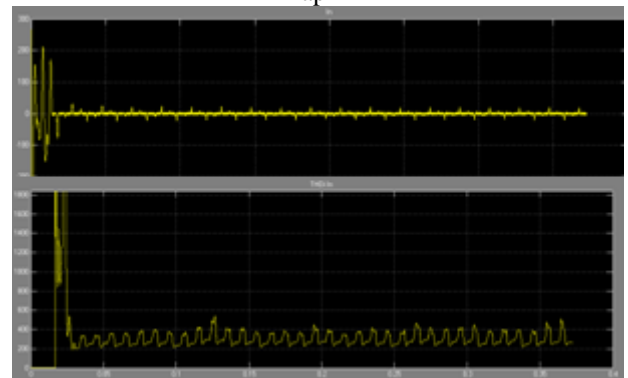


Figure 10: Graph of neutral current and THD in presence of apf

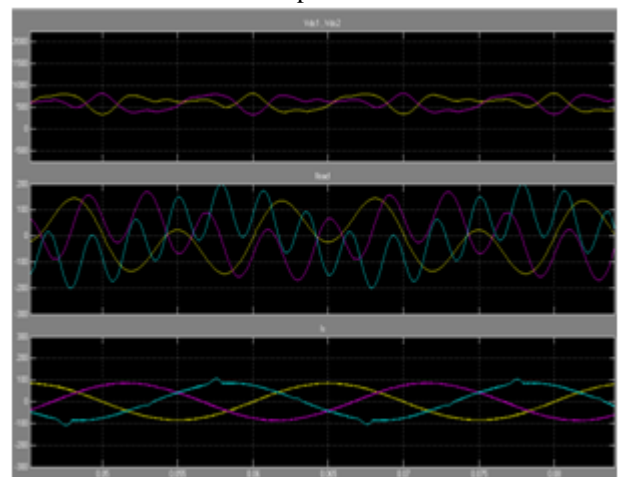


Figure 11: Graph showing PI controller operation

4.2 Comparison of Different Methodologies Adopted for Harmonic Reduction

Parameters	1 st	2 nd	3 rd	4 th	Our Work
SAPF implementation method	pq theory with PI controller	SRF theory	pq theory	pq theory with MRC	pq theory with PI controller
Supply system	Single phase	Not specified	Single phase	3-phase3-wire	3-phase 4-wire
Load used	Non linear (6 IGBT bridge)	Not specified	Single phase00d iode rectifier	Not specified	Three phase bridge
THDi	1.10%	1.01%	1.85%	Not specified	0.71%
Tools used	PSCAD	Simulink	Simulink	Simulink	Simulink

5. Conclusion

In this paper an Active filter based on the instantaneous active and reactive power component p-q method is studied. Current harmonics consist of positive and negative sequence including the fundamental current of negative sequence can be compensated. Therefore, it acts as a harmonic and unbalance current compensator. The analysis of IRP p-q theory for non-sinusoidal conditions such as distorted supply voltage and harmonic-generating loads also provides us with an evaluation of performance of the p-q theory. For an instance, it shows that the values of instantaneous powers in a 3pN system with a balanced harmonic generating load (HGL) supplied by a sinusoidal and symmetrical voltage does not change with the harmonic order. In other words, the values of instantaneous powers do not change when a 5th order current harmonic generating load is replaced by a 7th order current HGL. The total harmonic reduction for current at the point of common coupling turns out to be 0.7% which is way below the specification provided by IEEE 519 standard which specifies a nominal total harmonic distortion to be under 5% , in this way the efforts put in to work are aptly rewarding and the results were in compliance with industrial standard.

6. Future Work

Experimental analysis can be done on Shunt Active Power Filter based on instantaneous active and reactive power component (p-q) method by developing prototype model in the laboratory to verify the simulation result based on (p-q) method with PI controller. It is important to develop this system in laboratory because the field test of the theory promises to give exciting results , although every care has been taken to model the simulation as close as as possible to the real world but the testimony of the project will remain incomplete without the field testing of the model.

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