

# Power quality improvement for passive shunt filter by using MAT-lab

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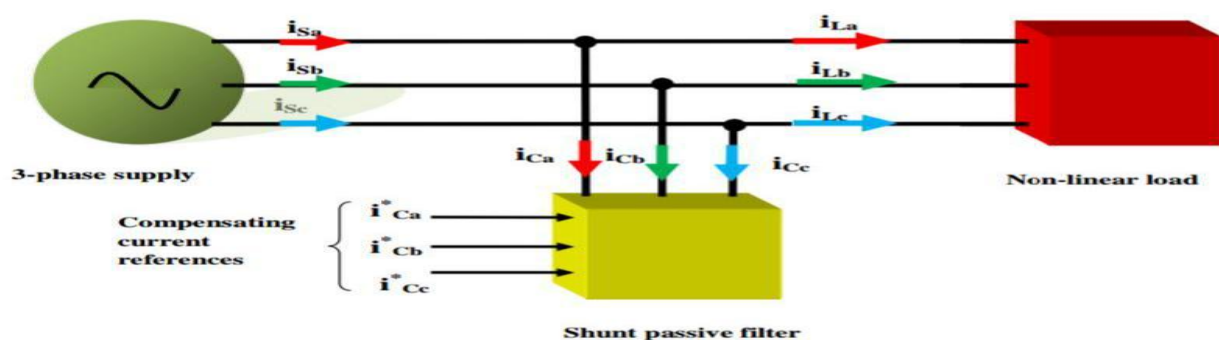
**Abstract:** Power system harmonics are a menace to electric power systems with disastrous consequences. The line current harmonics cause increase in losses, instability, and also voltage distortion. With the proliferation of the power electronics converters and increased use of magnetic, power lines have become highly polluted. Both passive and active filters have been used near harmonic producing loads or at the point of common coupling to block current harmonics. Shunt filters still dominate the harmonic compensation at medium/high voltage level, whereas active filters have been proclaimed for low/medium voltage ratings. With diverse applications involving reactive power together with harmonic compensation, passive filters are found suitable. Passive filtering has been preferred for harmonic compensation in distribution systems due to low cost simplicity, reliability, and control less operation.[1,2].

## I. INTRODUCTION

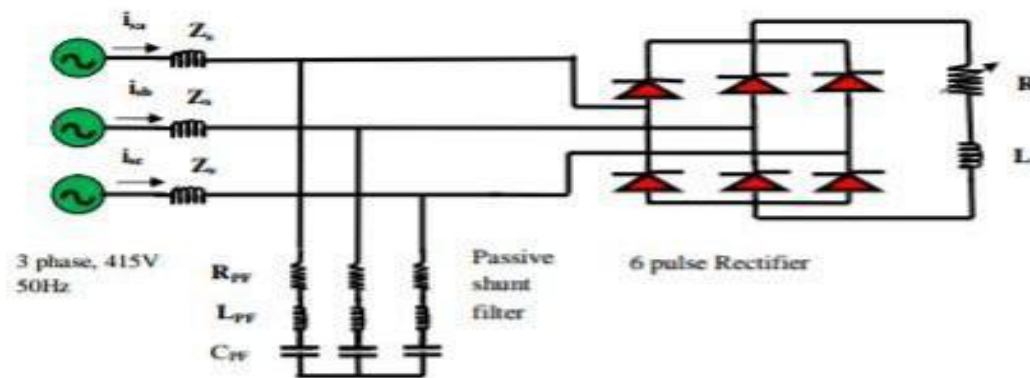
Nonlinear loads such as saturated coils and transformers are the main cause of producing harmonics in power system. Power electronic creates most of the due to its non linear characteristics pollution issues. Most of the pollution issues are created due to the nonlinear characteristics and fast switching of Power electronics. Classically, shunt passive filters, mainly consist of tuned LC filters and or high passive filters are used to reduce the harmonics and power capacitors are used to improve the power factor. But they have the limitations of fixed compensation, large size and can also exile resonance conditions. In this work both shunt passive filter is used for power quality improvement. Transformers, motors, cables, interrupters and capacitors are the some equipment which is affected by harmonics converters mainly produces notches and they basically affect the electronic control devices. There are two routes to the reduction of power quality problems. The first way is known as load conditioning, which assures that the equipment is made less sensitive and effective to power disturbances. The second technique is, to install line-conditioning systems that counteract or suppress the power system disturbances .In distribution systems passive filters have been used to limit of harmonic currents. The necessary modeling and simulations are carried out in MAT-lab environment using SIMULINK and power system block set toolbox.[3,2].

## II. METHODOLOGY

In modern electrical distribution systems there has been a sudden increase of harmonics because of single phase and three phase non-linear loads. These non-linear loads are cause of harmonics. Passive power filters have been used to overcome these problems. In this paper passive shunt filter is used for total harmonic distortion. Mat-lab simulation is used for presenting it. Basically the cause of harmonic is nonlinear load. For removing it passive shunt filter is used. Results are discussed in the present work with the help of Mat-lab. Results of passive filter are also discussed.[3]



Six pulse AC-DC converter with R-L load and passive shunt filter



### III. PASSIVE FILTER

The power system is growing fast and electric utility is expected to supply fine quality of electric power with high efficiency and reliability. Efficiency and reliability can be improved with the help of additional power electronic controllers, but these devices introduce large distortions in current and voltage. These power quality issues became more serious in the past decade, with the proliferation of the solid state devices in rectifiers, variable speed drives, UPS, computers, printers, electronic equipments, etc. in the industrial, commercial and residential sectors. The voltage and current distortions generated by these equipments spread throughout the power system, causing malfunction of power system components, which are designed for operation under pure sinusoidal conditions. The shunt passive filter is made up of passive elements resistance, inductance and capacitance. When the inductive and capacitive reactance of the passive filter become equal at a particular harmonic frequency, shunt passive filter acts as low impedance path for that harmonic component.[5,6]. The selection of these element ratings depends on

1. Reactive power to be injected
2. Harmonics to be mitigated
3. Quality factor of the tuned filter circuit
4. Tolerance in supply frequency permitted

### IV. CLASSIFICATION OF PASSIVE FILTER

The classification of Passive filter is done on the type of harmonic generation component source present in the system

- 1: PASSIVE SERIES FILTER
- 2: PASSIVE SHUNT FILTER
- 3: PASSIVE HYBRID FILTER

#### PASSIVE SHUNT FILTER

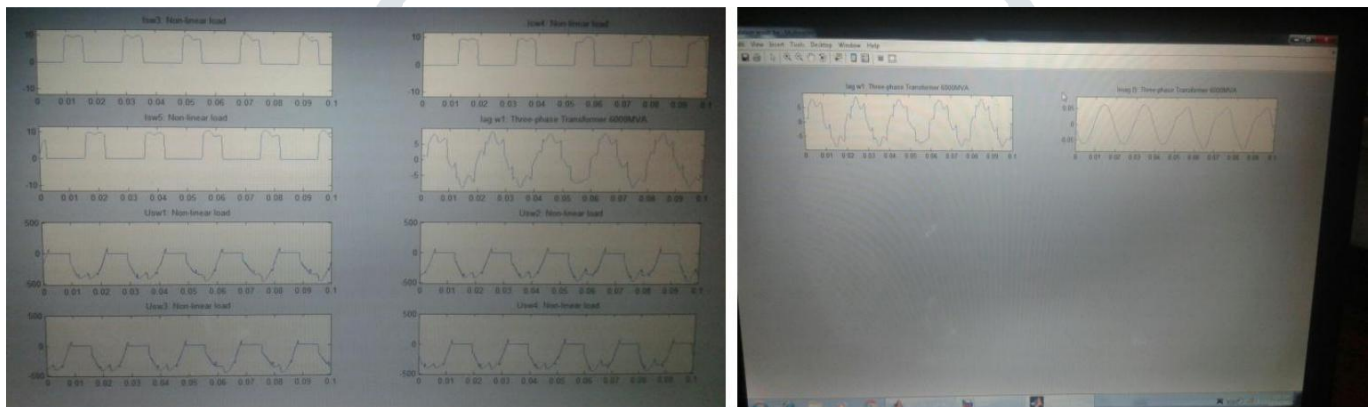
A very classical type of passive filter is shown in the figure where filter is connected in the parallel with distribution System through power common coupling point having non-linear load characteristics. It is the most common method for the cancellation of harmonic current in the distribution system. Passive harmonic filter are basically designed on principle of either single tuned or band pass filter technology. As the name suggests shunt type filter are connected in system parallel with load. Passive filter offer a very low impedance in the network at the tuned frequency to divert all the related current & at given tuned frequency. Because of passive filter always have tendency of offering some reactive power in the circuit so the design of passive shunt filter take place for the two purpose one is the filtering purpose & another one is to provide reactive compensation purpose of correcting power factor in the circuit at desired level. The advantage with the passive shunt type filter is that it only carry fraction of current so the whole system AC power losses are reduced compare to series type filter. The six pulse converter system connected with shunt passive type filter which are simply employed ever connection in distribution system have R-L load in system.[5,6]

## V.PARAMETERS

Components	Specification
AC Source	$V_s=415\text{v}$ , $f=50\text{Hz}$
Non-linear Load Universal bridge	$R_L=40\Omega$ $L_L=50\text{e-}3\text{H}$
Passive Filter	$L_{PF}=16\text{e-}3$ , $R_{PF}=0.83$ , $C_{PF}=25\text{e-}6$

## VI.RESULTS:

The simulation results are obtained through MATLAB in SIMULINK by taking system parameter as given below. The harmonics are eliminated completely



## VII. CONCLUSION:

The effect of multiple harmonic sources can be investigated by applying the superposition principle. The synchronous voltage control harmonic generation modeled by positive-, negative-, and zero-sequence harmonic sources. The system represented by linear models at each harmonic frequency. The precise evaluation of harmonic distortion must have accurate load modeling.

## VIII. FUTURE SCOPE OF THE WORK

- ❖ This configuration can be tested in hardware.
- ❖ Multi-pulse rectifier can be added to the load as 12 pulse or 36 pulse ac-dc rectifier with R-L load.
- ❖ Induction motor can also be the load instead of R-L load.
- ❖ Active filter can be introduced it for better performances.

**IX. REFERENCES:**

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