Filters as Solution of Harmonic Reduction

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Abstract—The function of resonant circuits in reducing harmonic currents is described. Types of filters are explained in brief and Q- factor is defined. Effect of Harmonics and advantages of filters is also mentioned.

I. INTRODUCTION

The resonant circuits are designed to shunt or block harmonic currents. Resonant circuits reduce the harmonic currents at the source and thus reduce harmonic voltage distortion. Unsuspected resonances are produced when these filters interact with the system or with other filters. The type, rating of filter group must be decided before using. When the filter forms the capacitive section of an SVC, it is essential for it to be capacitive at fundamental frequency so it will produce the reactive power required.

II. QUALITY FACTOR

The selectivity or tuning response of simple single resonant frequency filter circuit.

\[ Q = \frac{\omega}{\text{LR}} \]

A high Q factor gives good selectivity (narrow frequency response). The filter tuned circuit drifts in its tuned frequency due to changes in temperature. Change in system frequency and low Q factor.

Active filters are employed so as to filters is constant in tune automatically varying the reactor by means of control system to keep the inductor and capacitor voltages equal.

III. TYPES OF FILTERS

1. Passive filters
2. Active filters
3. Hybrid filters

Passive filters

It is an LC circuit such as to filter each harmonic. It is installed in parallel to non-linear load. This bypass circuit absorbs the Harmonics. Several parallel filters are connected to load if harmonics elimination is required. Applications of the parallel filters are required where non-linear loads are present such as variable speed drives, UPS, Rectifiers, etc. It also improves power factor correction; reduce voltage distortion & current distortion.
Active filters -
This filter is installed in series to non-linear load. This filter eliminates current distortion due to overload. Applications of the parallel filters are required where non-linear loads are present such as variable speed drives, UPS, Rectifiers, etc.

Hybrid filters -
Active & Passive filters combine to form Hybrid filters. It compensates wide range of power & performance levels. Applications of the parallel filters are required where non-linear loads are present such as variable speed drives, UPS, Rectifiers, etc.

Passive filters are made up of components such as resistors, inductors and capacitors which are passive in nature. The inductors and capacitors work oppositely. These filters do not have any amplifying elements such as transistors, op-amps, etc. These do not have any signal gain. Output level is always less than input level.

Active filters are made up of active components such as amplifiers implemented in analog circuits. It is used to improve the cost and performance of the filter. The active notch filter employs both negative and positive feedback around op-amp which improves the high degree of performance.

Harmonic currents produced by non-linear loads are compensated by Active filters. Hence this filter extracts the harmonic currents.

Advantages of Active filters over Passive filters
In active filters op-amp provides a gain, so the input signal is not attenuated. Also this filter is easier to tune and adjust. The performance of the equipment is improved and reduces the cost of energy by filtering unwanted harmonics.

Effects of Harmonics -
1. The serial & parallel resonance causes the amplification of harmonics in the system.
2. Reduction in performance in generation, transport and energy usage system.
3. Harmonics reduce the age of insulation of grid.

REFERENCES
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