# ACTIVE FILTER DESIGN TO REDUCE THE HARMONICS LEVEL GENERATED BY NON LINEAR LOAD

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# ABSTRACT

Nonlinear load is one of the common sources of harmonic. The harmonic content that exceeds the IEEE 519 limits will harmful the overall system connected to the nonlinear load. Active filter is one of the alternative approaches to reduce the harmonics content. Therefore, proper active filter (AF) design is required to reduce the harmonics content produced by non linear load. For that purpose this thesis presents the development of single phase active filter simulation model using digital simulation software. The model is simulated with rectifier and semi-converter located at the load side. Without installing the active filter, these loads caused the total harmonic distortion (THD) goes high. However, with the aids of active filter simulation model, the results show some reduction in harmonic level.

Active filters are used to reduce harmonics generated by non-linear loads, such as, for example, rectifiers of the electrical drive. Distortion of sinusoidal voltage and current waveforms caused by harmonics is one of the major power quality concerns. Nonlinear load such as traditional diode / thyristor rectifiers with capacitive and inductive load generate harmonic and reactive current, which lead to poor power factor, low energy efficiency and harmful disturbance to the other appliances. The harmonic pollution can be reflected by harmonic current components, which bring about more serious problem than harmonic voltage components in some cases [1].

Inspired with the important of harmonic studies, this thesis has focuses the study on designing the single phase active filter simulation model. The model which adopted series type of active filter is developed using PSCAD/EMTDC program.

Two types of load which are rectifier and semi-converter are applied in the simulation. The utilization of the active filter simulation model should reduce the harmonic level at the load side. Hence, to verify the design of the model, the harmonic level (THD) of the circuit is measured before and after installing the active filter simulation model

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# CHAPTER 1

# INTRODUCTION

## 1.1 INTRODUCTION OF HARMONIC

Distortion of sinusoidal voltage and current waveforms caused by harmonics is one of the major power quality concerns in electric power industry. Harmonic is a distorted waveform, a component of the wave with frequencies that are multiple of the fundamental harmonic distortion distorted wave shapes contain components with frequencies that are multiples of the fundamental frequency. These higher frequency components are known as harmonics.

Harmonic – related problems can occur throughout commercial, industrial and institutional facilities. The harmonics' problems can be described as follows:

- Operation of over current devices without a measurable overloads or short-circuits condition.
- Random component failure in electronic devices, such as printers and personal computers.
- Operating problems with electronic devices untraceable to any identifiable component problems.
- Interaction between multiple VFDs so that one or more drives do not follow their control set-points.
- Interactions between uninterruptible power supplies (UPS) and the emergency generator supplying power to them during extended utility power outrages.
- System power factor reduction, with associated distribution system capacity loss and power-factor penalties applied by the serving electrical utility.

Most harmonics-related problems have one of two basic origins: current –wave distortion or voltage –wave distortion. A third factor, harmonic phase shift, results from a combination of the first two and is not as crucial.