HARMONIC ANALYSIS OF NONLINEAR LOADS USING FILTER

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MOHD FAHMI BIN ABDUL HALIM
Faculty of Electrical Engineering
Unoversiti Teknologi Mara
40450 Shah Alam, Malaysia
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ABSTRACT

Power quality is the degree to which both the utilization and delivery of electrical power affect the performance of electrical equipment. Harmonics power quality issues have been taken into consideration. Harmonics is a term that describes sinusoidal waveforms that operate at a frequency that is a multiple of the fundamental 50Hz frequency in Malaysia. Harmonic in power systems shortens the equipment's life expectancy and effect in the electrical distribution system. The most significant effects of high frequency harmonic current such as inductive heating of transformers, generators, motors, relays and coils.

This paper presents the modeling of nonlinear electrical loads used in domestic and small scale industrial distribution systems to estimate the harmonic distortion. In this paper, personal computer and fluorescent lamp are developed as simulation models for nonlinear loads. Analysis of current harmonics is performed for these loads individually by simulation software using MATLAB-SIMULINK. Total Harmonics Distortion (THD) is used as the harmonic index to study the effect of these nonlinear loads at the utility. In order to eliminate these harmful harmonics and improve system reliability, passive filter located at the line supply of these models. Simulations are carried out with and without the filters to analyse the harmonics on the nonlinear loads. The current waveforms, frequency spectrum and dominant harmonics in each model are recorded.

Harmonic analysis for personal computer shows that the current waveform had distorted and come out with current THD is 82.28%. There are three dominant harmoniscs. The current has 39.53% of 3rd harmonic, 3.96% of 5th harmonic and 5.43% of 7th harmonic obtained from simulation. After implement the filter the current has 0.95% of 3rd

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CHAPTER 1

INTRODUCTION

1.0 BACKGROUND

Service reliability and quality of power have become growing concerns for many facility managers, especially with the increasing sensitivity of electronic equipment and automated controls. There are several types of power quality problem such as surges and spikes, sags, harmonics distortion and momentary disruptions [1]. Harmonics is one of the power quality concerns generated by widely dispersed nonlinear loads.

Harmonics in power distribution system are current or voltage that are integer multiples of fundamental frequency. For example if the fundamental frequency 50Hz, then the 2nd harmonics is 100Hz, the 3rd is 150Hz, etc. A pure voltage or current sine wave has no distortion and no harmonics but nonsinusoidal wave has distortion and harmonics. To quantify the distortion, the term total harmonics distortion (THD) is used. The THD value is the effective value of all the harmonics current added together, compared with the value of the fundamental current [2]. Wave form distortion can be analyzed using Fourier analysis as a periodical oscillation at different frequency.

The generators that produce the electric power generate a very close approximation to a sinusoidal signal. However, there are loads and devices on the