OPTIMAL METHOD OF REDUCING HARMONIC CONTENT FOR SINUSOIDAL PULSE WIDTH MODULATION (SPWM)

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Bachelor of Engineering (Hons.) Electrical

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ABSTRACT

This project is focusing on optimizing harmonic content in Sinusoidal Pulse Width Modulation (SPWM) design. The results show that by varying number of bits, modulation index and switching frequency, the harmonic content to Total Harmonic Distortion (THD) can be analyzed and optimal method to reduce the harmonic content of THD can be found.

This SPWM is designed using VHDL and implemented on ALTERA (DE2-70 board). The results, the SPWM waveforms and its Fast Fourier Transform (FFT) waveform, are measured using Digital Oscilloscope.

The Total Harmonic Distortion (THD) is calculated from measured waveform. From the analysis, for 10 bit, mod index one and at frequency of 20 kHz, Total Harmonic Distortion for the SPWM design is optimized.

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CHAPTER 1

INTRODUCTION

1.0   BACKGROUND OF THE PROJECT

Sinusoidal pulse width modulation is a method of pulse width modulation used in inverters. Pulse width modulation produced when the width of the pulse can be adjusted as a means of regulating the output voltage [1]. The pulses near the edges of the half cycle are always narrower than the pulses near the center of the half cycle such that the pulse widths are proportional to the corresponding amplitude of a sine wave at that portion of the cycle. To change the effective output voltage, the widths of all pulses are increased or decreased while maintaining the sinusoidal proportionality.

The harmonics in Sinusoidal Pulse width Modulation occurs during the inverter produces a square voltage waveform. And then using Fourier analysis, periodic waveforms are represented as the sum of an infinite series of sine waves. The sine wave that has same frequency as the original waveform is called as fundamental component and the other sine wave known as harmonics component [2].

Pulse width is normally used as a controller in power conversion and motion control. It also widely used for converting DC power to AC power in low power wind plants and also used in power electronics to digitize the power, that a sequence of alternating voltage pulse can be generated by the on and off of the inverter power transistor. [3], [4]. A control technique for the PWM converter is based on the input current control, in which the current commands are provided from the detect power-source voltages [5]. There are various kinds of modulation modes available such as sinusoidal PWM, current tracking PWM, space vector PWM and harmonic elimination [6].