

IMPLEMENTATION OF SINUSOIDAL PULSE WIDTH MODULATION BASED ON CORDIC ALGORITHM USING SILTERRA 0.18 μ m CMOS TECHNOLOGY

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ABSTRACT

This thesis presents the implementation of Sinusoidal Pulse Width Modulation (SPWM) using Silterra 0.18 μ m technology and it is based on CORDIC algorithm. The SPWM technique is used to control switches such as Insulated Gate Bipolar Transistor (IGBT) in major AC appliances. Synopsys tool is used to synthesize the Verilog Hardware Description language (HDL) model of the SPWM to its ASIC form. The use of Coordinate Rotation Digital Computer (CORDIC) in the source code make it provides an area-efficient architecture for effective design at Silterra 0.18 μ m CMOS technology.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Pulse Width Modulation (PWM) is normally used as a controller in power conversion and motion control. There are various kinds of modulating modes available such as sinusoidal PWM, space vector PWM, current tracking PWM, harmony elimination PWM and others [1]. The most widely used in industrial applications are the sinusoidal PWM and space vector PWM [2]. The SPWM is used to control the insulated gate bipolar transistor (IGBT) which is a three-terminal power semiconductor device with high efficiency and fast switching. They are normally used in applications such as electric cars, air-conditioners and stereo systems that switch rapidly [5]. SPWM produces several pulses per half cycle. The pulses near the edge of the 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 the portion of the cycle [3]. The conventional SPWM uses lookup table method in generating sine wave signal but it is not effective in area-architecture hardware implementation due to excessive memories needed if better resolution is used.

CORDIC is another method in generating trigonometric functions such as sine, cosine, sinh and cosh. It is an acronym for **CO**ordinate **R**otation **D**igital **C**omputer. Since the objective of this project is to generate SPWM signal and the reference signal to be compared with the triangular wave in SPWM is sinusoidal signal, hence, only sine function is considered. Thus, the architecture for CORDIC algorithm and its hardware is only based on the sine function.