

**UNIVERSITI TEKNOLOGI MARA
CAWANGAN PULAU PINANG**

**DESIGN AND IMPLEMENTATION OF
CORDIC ALGORITHM WITH
SINUSOIDAL PULSE WIDTH
MODULATION SWITCHING STRATEGY**

NUR SOFEA ELEENA BINTI MADZZAINI

Faculty of Electrical Engineering

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ABSTRACT

Sinusoidal pulse width modulation (SPWM) is frequently used in motor control and inverter application. Sinusoidal wave in sinusoidal pulse width modulation (SPWM) is used to generate pulse width modulation (PWM) signal. Usually, one sinusoidal wave is used for one inverter. In this design, SPWM is used for multilevel inverter application in photovoltaic (PV) system. Generally, sinusoidal wave is generated using typical technique (unipolar sinusoidal pulse width modulation (SPWM) technique). For this technique, data is stored in Look Up Table (LUT). The size of required memory bits to store data in the LUT increases as the bit resolution of the generated digital sinusoidal wave increases. To overcome the large memory space, area and power consumption, CORDIC Algorithm is used to generate the sinusoidal wave. The SPWM controller will be designed using HDL Verilog codes and will be tested using MODELSIM for digital functionality. The SPWM controller will be implemented in VLSI ASIC flow. Coordinate Rotation, Digital Computer (CORDIC), known as Volders Algorithm based on its inventor, is an algorithm that is applied to perform trigonometric related computations. CORDIC is very popular for its potential of efficiency and low cost implementation of a large category of applications since it only requires shifter and adder. In addition, CORDIC algorithm has a low usage of memory space compared to Look Up table (LUT) technique. This design presents the uses of sinusoidal pulse width modulation (SPWM) as a switching control for multilevel inverter by using CORDIC algorithm. By the end of this project, it can be seen that the simulation is the same as the simulation of the previous project that have ever been done.

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CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF STUDY

SPWM in multilevel inverter is based on classic two level sinusoidal pulse width modulation with triangular carrier and sinusoidal reference wave form. The values (levels) of an output voltage generated by inverter are determined by the number of levels of one's inverter. For instance, two values of an output voltage are generated by a two level inverter that correspond to the negative terminal of the capacitor, while three levels of an output voltage is generated by three-level inverter. Number of level (n) in the inverter increase as the value of output voltage increase. Each multilevel inverter, which starts from the three-level inverter, could produce a cascade effect where the higher number of levels in the inverter, the output voltages produced have more steps in creating staircase wave form, thus reducing the total harmonic distortion. Still, a high number of levels could cause voltage imbalance problems and increases the control complexity. The switches often alternate between two states in order to manage the power flow in the converter and they happened fast enough where the inductors and capacitors at the input and output nodes of the converter average or filter the switched signal. Attenuation of power strength resulted from the switched component and the wanted DC or low frequency AC component is maintained. This process where the modulation of the width pulses generates wanted average value, is called Pulse Width Modulation (PWM) [7]. Sinusoidal pulse width modulation is often used in motor control and inverter application. Sinusoidal wave in SPWM is used to generate pulse width modulation (PWM) signal. SPWM is a type of "carrier based" pulse width modulation. Carrier based PWM uses pre-defined modulation signals to determine output voltages. In sinusoidal PWM, the modulation signal is sinusoidal, with the peak of the modulating signal always less than the peak of the carrier signal. Usually, three