IMPLEMENTING ROOT RAISED COSINE (RRC) FILTER

FOR WCDMA

Thesis submitted to the Faculty of Electrical Engineering, Universiti Teknologi MARA in fulfillment of the requirement for the Degree of Bachelor of Engineering

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NOVEMBER 2009

ACKNOWLEDGEMENT

In the name of Allah, the most Beneficent and Merciful, with the deepest gratefulness to Allah who has given me this full of strength in order to complete this final year project.

First and foremost, I would like to express my gratitude to my project supervisor Mrs. Norhazlin Khairudin for hers guidelines, supervision and assistance. Not to be forgotten to my co-supervisor Mr. Abdul Hadi Abdul Razak who was helping me understanding the project since the beginning. I would also like to thank Miss Harnani bte Hassan for her helpful suggestion and guidelines.

Herein, I would like to emphasize this thankfulness to my family members especially my parents Nik Hassan Bin Nik Soh and for their advices, prayer, encouragement and continuous moral supports for the completion of my study in UiTM.

Last but not least, I would like to dedicate this thankfulness to all my friends, lecturers, staff and supporting staffs that has been helping me a lot during finishing this project in various ways.

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ABSTRACT

The aim of this project is to implementing Root Raised Cosine (RRC) filter for WCDMA on Field Programmable Logic Array (FPGA) using VHDL programming language. The RRC filter is used for both transmitter and receiver of 3G-WCDMA wireless communication but the area of interest is only on the transmitter side. The main objective of this filter is to reduced the inter-symbol interference (ISI), but it also can limit the bandwidth required for transmission and reduced Co-Channel interference. This digital filter is designed and simulated by generating filter coefficient using Matlab 7.0. The designed filter is then verified in Matlab 7.0 to check its functionality that is to reduce the inter-symbol interference by placing the design filter in WCDMA Transmitter system SIMULINK. This experiment is conducted to check the functionality of the RRC Filter and to measured the channel bandwidth; 5MHZ for the WCDMA system. Finally, the RRC filter is generated into VHDL coding based on application Xilinx and being verified in ModelSim SE 6.3f before synthesized using Xilinx ISE Simulator. All the results were compared for verification.

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CHAPTER 1

INTRODUCTION

The thesis describes about the implementing of Root Raised Cosine (RRC) digital filter for WCDMA on Field Programmable Logic Array (FPGA) using VHDL programming language. WCDMA technology has emerged as the most widely adopted third generation (3G) air interface. The major issue for this high-tech application is the rising cost that including the hardware cost, battery life and power consumption. Root raised Cosine (RRC) pulse shaping filters are one of hardware requirement for 3G wireless communication. The implementation of RRC filters using FPGA can yield significant hardware saving and greater clock rate. The RRC filter is used for both transmitter and receiver of 3G-WCDMA wireless communication but the area of interest is only on the transmitter side.

1.1 WHY IMPLEMENTING DIGITAL FILTER

The digital filters are widely used in various applications like digital video broadcast, digital video effects and digital wireless communication. Basically, digital filtering includes the process of smoothing, predicting, differentiating, integrating, separation of signal, and removal of noise from a signal. In other words, a filter selects, suppresses, or modifies certain frequency components of the signal, either to reduce noise or to shape the spectrum. The fundamental tool of digital filtering is the frequency approach, which based on the use of sines and cosines rather than on the use of polynomial [1].

In analog system, filter components comprise of resistors, inductors and operational amplifier. In comparison, digital filter is build with adders, multipliers and delays. The main advantages of digital filter over the analog filter techniques are due to accuracy, stability, higher signal to noise ratio and decreasing cost of hardware and software implementation [1].