DIGITAL NEURON INTEGRATED CIRCUIT DESIGN FOR FEEDFOWARD NEURAL NETWORK USING SILTERRA 0.13MICROMETER TECHNOLOGY

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ABSTRACT

Artificial Neural Networks (ANNs) is an interconnected group of neurons that uses a mathematical model for information processing often done using computational method. The neural network faces timing issues because it consists of many gates due to the repetition of neurons. This thesis presents the design and comparison of the neuron architecture between tree and ring structure in terms of functionality, usage of resources, total thermal power dissipation and timing analysis. Then, we perform the analysis of feedfoward neural network that consists of several. The objective of the project is to design a neuron on digital platform using hardware description language for their functionality and analysis purpose. The best structure will be implemented as integrated circuit. Neuron layout is designed using custom approach based on schematic from post synthesis done in Quartus II. IC design is designed using Cadence Design Systems Virtuoso targeted for Silterra 0.13 micrometer technology. Since both structures have tradeoffs in their advantages, we decide on the layout ring structure as it more reliable compared to tree in terms of delay. The number of resources usage for tree structure is 423 while the ring structure is 425. The delays of tree and ring structure are 29.047ns and 27.340ns respectively. The performance of neural network is dependent on the performance of neuron. The ring structure of neuron and neural network IC layout has a size of 680μmeter x 2493μ meter and 3211μ x 2351μ meter respectively.

Keywords-component; feedfoward; neuron; neural networks;

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

A neural network is an artificial representation of the human brains that used learning process as their principle. In other words, it mimics certain processing capabilities of the human brain. Neural computing is an information processing paradigm, inspired by biological system, composed of a large number of highly interconnected processing elements (neurons) working in unison to solve the specific problems. In engineering, it is a computational model that learns by training on past experience using an algorithm which modifies the interconnection weights as directed by a learning objective for a particular application. It consists of repetition of adder and multiplier units with hyperbolic activation functions [1].