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3. Title page
4. Table of content
5. Student’s declaration about individual work and usage of electronic data
6. Summary of the thesis work in English and in a second language
7. Introduction: explanation of the task, design objectives, motivations behind the task, short description of the organization of the thesis
8. Detailed explanation and analysis of the task description
9. Preliminaries (results available in the literature, similar designs and constructions), comparisons and conclusions
10. Detailed description of the design process, evaluation of available options, motivations and justifications of design decisions
11. critical assessment of the engineering product designed, further development options
12. Acknowledgements (if applicable)
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Budapest University of Technology and Economics

Faculty of Electrical Engineering and Informatics

Department of Control Engineering and Information Technology

Areeba Tabassum Shoaib

MAXIMIZING POWER CONSUMPTION OF MIMO NETWORK USING A NOVEL QUANTUM GENETIC ALGORITHM

SUPERVISOR

Dr. El Gaily Sara

BUDAPEST, 2023

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Full text of thesis works classified upon the decision of the Dean will be published after a period of three years.

Budapest, 8 March 2023

...…………………………………………….

Areeba Tabassum Shoaib

Summary

Quantum computing is one of the most promising approaches to addressing the problems of computational complexity, data storage, and power consumption because of its extremely fast performance. Applying the principles of quantum computing to the development of optimization algorithms is a rapidly growing field of study.

With its ability to provide game-changing improvements in area throughput and energy efficiency, the massive multiple-input multiple-output (MIMO) system offers significant potential for 5th generation (5G) wireless communication systems. The number of antennas used by the base station is increased in massive MIMO. This has several advantages, including an array gain that may be utilized to expand coverage, favorable propagation that makes user separation easier, and channel hardening that makes the system more robust and stable. Yet, the computational complexity of the embedded optimization techniques in MIMO systems remains a problem. Several techniques, such as the Nash equilibrium-based effective water-filling algorithm (WFA), have been developed in an effort to enhance the power allocation system for MIMO.

This thesis focuses on the question of how the power consumption of MIMO systems can be maximized by using a novel Quantum Genetic Algorithm.

In this research , we implemented a quantum optimization technique known as the Quantum Extreme Value Searching Algorithm (QEVSA) to Develop a new Unconstrained Quantum Genetic Algorithm (UQGA).

Sommaire

The text of a ½-1 page long summary goes here in a second language, different of English (German, French, Portuguese, Russian, Finnish, Korean, Chinese, Japanese, Hungarian, etc,). This summary is the translation of the summary in English and has to be also uploaded to the Thesis Portal separately.

# Introduction

This chapter presents a couple of examples of the usual formatting requirements of different items you may need to include into your thesis.

## Quantum Computing Overview

In classical computing, the smallest unit of information is referred to as a "bit" and can be represented by one of two states, "0" or "1"; these states are also known as classical states. The classical processor carries out a variety of transformations on classical states, i.e., information processing using classical gates. Comparable to classical computing, Quantum computing employs specific quantum elements that do not exist in traditional computation. It is important to note that there are four primary postulates that describe quantum computer, and they are as follows:

### Postulates of Quantum Computing

**First postulate (State-space)**

A qubit is the fundamental quantum systems unit in the quantum universe that can simultaneously contemplate both classical states, referred as superposition. Below is an illustration of a qubit:

(

where a and b are complex coefficients, and |0 > and |1 > are the so-called computational basis states , such that,

Two classical states can coexist in one qubit. The outcome of a coin flip can be thought of as an example of a qubit. If we toss a coin (and assume it's fair), we've got an equal chance of getting a head or a tail with a probability of 0.5 for either outcome.

It is important to stress that is a superposition of two states, and the precise formula of (1.1) can be stated as follows:

**Second postulate (Evolution)**

How a quantum state changes over time is described by the second postulate. For those unfamiliar, the quantum gate is just a unitary operator used in quantum computing.

A unitary operator satisfies the following formula:

Moreover, the unit norm of the quantum state is conserved by a unitary transformation. The relation between and is shown as in Figure 1.1, where between is an input quantum state and is the output quantum state after performing the unitary transform U.

Logic gates in digital circuits function similarly to quantum gates in quantum circuits. The manipulation and alteration of qubits is their primary goal. Contrary to logic gates, quantum gates support the idea of reversibility, which allows us to easily convert an input quantum state into an output quantum state and vice versa.

We list some well-known quantum gates here that work with just one qubit,

**Hadamard-gate**

All quantum algorithms rely heavily on this operator during their startup phase. It is well known that when the Hadamard gate is dominated by classical states, uniform probability distributions of all computational basis states are generated.

### Images

Use the **Image** style to insert images.

All images must have captions. It is advised to add captions by right clicking on the image and selecting the *Insert Caption …* command. The resulting caption will have automatically **Caption** style and you are required to specify the caption details in a dialog window.



1.1. figure: Caption example

### Program codes

Use the **Prg code** syle to insert programming code as bellow.

using System;

namespace MyApp

{

class Program

{

static void Main( string[] args )

{

Console.WriteLine( "Hello world! Kachi Kapsida" );

}

}

}

### References

Items in the reference list are formatted using the **Reference item** style so that the titles are emphasized by the **Reference source** style.

You may place citations of references in the text using the *Insert / Cross-reference* command (an example looks like this: [1]). These citations are updated automatically if a new reference is added or their order is changed.

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* Update cross-references: select all the text first (Ctrl+A) and then press F9 to let the Word to update all cross-references. A check for “Error!..” at the places of references should be carried out.
* Specify document properties: you need to specify all necessary meta-data for the document such as the author, title, keywords, etc. The Document property panel appears if the File / Info / Document panel command is selected and these properties can be set there.
* Check the PDF: the best test of the document is to go through the PDF file generated from the Word version attentively.

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Annex