Investigation of the Efficacy of Using the Typst Typesetting System for Academic Writing

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Doctor of Philosophy

Thesis

Faculty of Engineering and Computing

May 2026

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Abstract

This thesis explores a lot of different areas. It is very exciting. So wow!

Acknowledgments

I would like to thank everyone for their support.

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Chapter 1

Introduction to Typst

Typst is a modern typesetting system that has gained popularity for its simplicity and flexibility. This thesis investigates the efficacy of using Typst for academic writing, comparing it with traditional systems like LaTeX. The study focuses on user experience, document quality, and the learning curve associated with Typst. Through a series of experiments and user surveys, we aim to provide insights into the advantages and limitations of Typst in an academic context (Shor, 1997).

The findings suggest that Typst offers a user-friendly interface and rapid document creation, making it a viable alternative for academic writing. However, certain advanced features found in LaTeX may be lacking in Typst, which could impact its adoption among researchers and academics.

$$\mathrm{I} = \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \quad \mathrm{X} = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix} \quad \mathrm{Y} = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix} \quad \mathrm{Z} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

$$\alpha \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} |1\rangle$$

1.1 Probability of Error with Shor Code

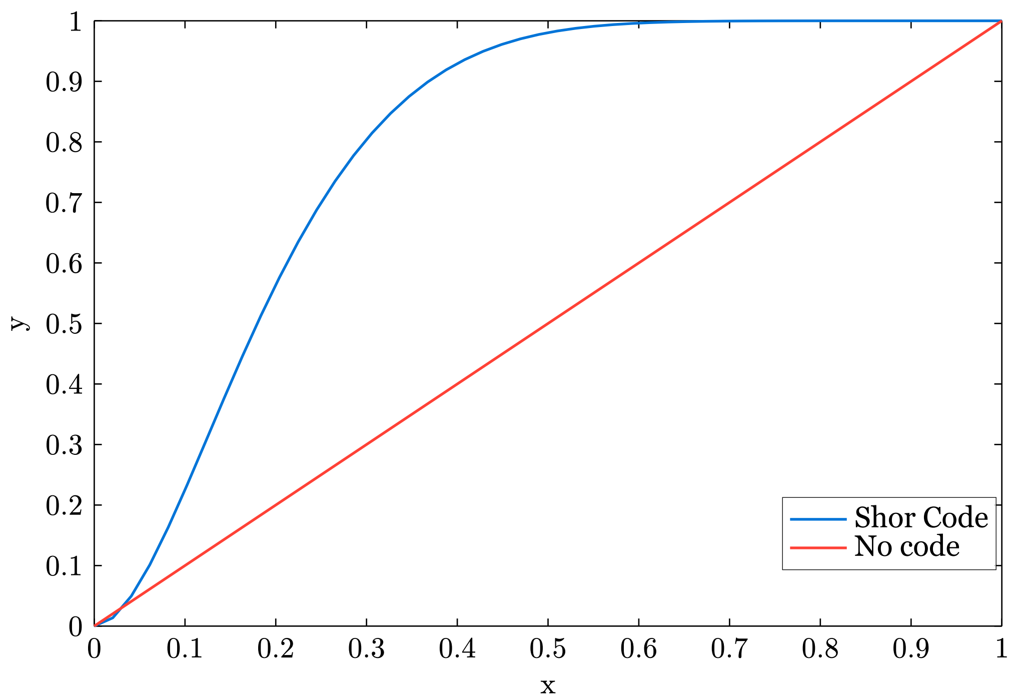

Figure 1: $\mathrm{P(error)} = 1 - \mathrm{P}(< 2) = 1 - (1-p)^9 + 9p(1-p)^8$

1.1.1 Circuits

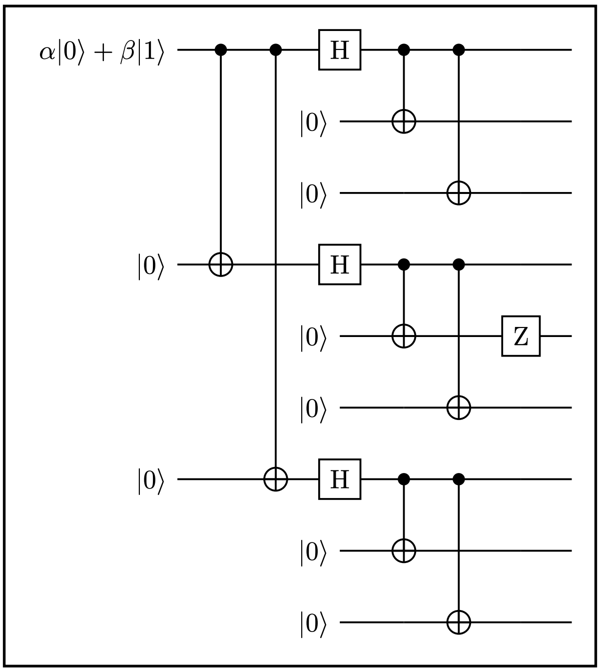

Figure 2: Phase flip error.

This circuit is indistinguishable to the following one, based on the identity above. Note that $Z|0\rangle = |0\rangle$.

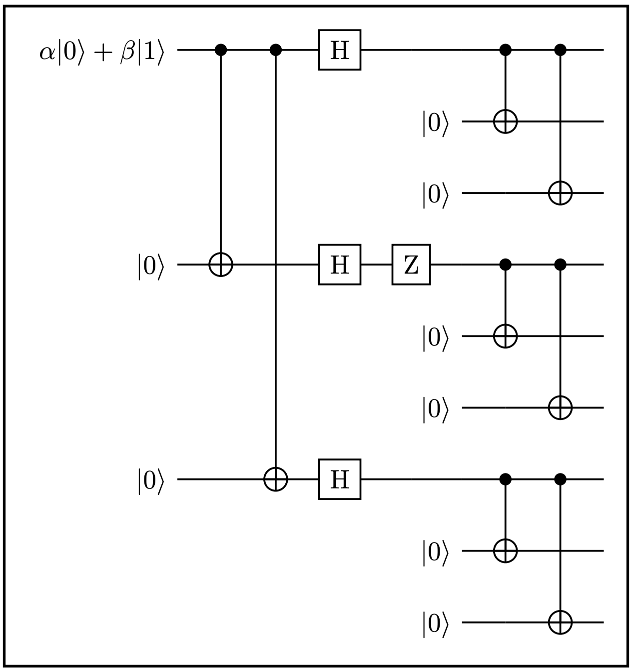

Figure 3: Phase flip error equivalence.

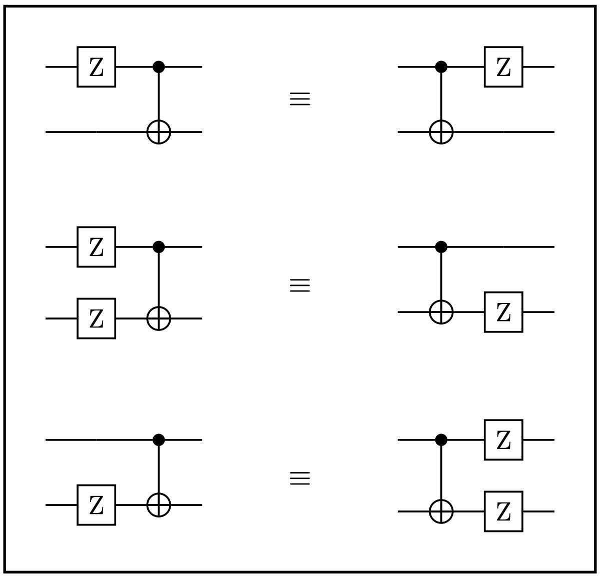

Figure 4: Relationship between Z and CX gates.

Chapter 2

Literature

The literature review (Javadi-Abhari et al., 2024) is a critical component of any academic work, providing a comprehensive overview of existing research and theories related to the topic at hand. This section aims to synthesize relevant literature, identify gaps in current knowledge, and establish the theoretical framework for the study.

2.1 Oh I like It

This section will discuss the advantages of using Typst for academic writing, including its user-friendly interface, rapid document creation, and flexibility. It will also compare Typst with traditional typesetting systems like LaTeX, highlighting the strengths and weaknesses of each.

Chapter 3

Foundations of Quantum Information Theory

3.1 Comparing Definitions of a Qubit

The term qubit, short for quantum bit, was coined by American physicist Benjamin Schumacher in 1995 (Schumacher, 1995). A qubit is the basic unit of quantum information. Different sources define the term with varying emphasis depending on their field (physics, computing, engineering).

3.1.1 Core Definition

A qubit is a two-level quantum system, whose state is described by a unit vector in the complex Hilbert space $\mathbb{C}^2$. It can be in a superposition of basis states:

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle \quad \text{with } \alpha, \beta \in \mathbb{C},$$
$$|\alpha|^2 + |\beta|^2 = 1$$

3.1.2 Nielsen & Chuang (Nielsen & Chuang, 2010)

A qubit is a two-state quantum-mechanical system, such as the spin of an electron or the polarization of a photon. Mathematically, a pure qubit state can be represented as a normalized vector in a two-dimensional complex vector space.

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle$$

$$|\alpha|^2 + |\beta|^2 = 1$$

3.1.3 John Preskill (Preskill, 2024)

A qubit is a quantum system whose state space is the two-dimensional complex Hilbert space:

$$\mathbb{H}_2 = \mathbb{C}^2$$

- Strong emphasis on Hilbert spaces, unitary operations, and quantum circuits.
- Discusses density matrices, entanglement, and tensor product structure.

3.1.4 Oxford Dictionary of Physics (Rennie, 2015)

A unit of quantum information equivalent to the quantum state of a two-level system, which can be in a superposition of the basis states.

The Oxford Dictionary of Physics provides a more accessible definition for general audiences. It focuses on the concepts of superposition and measurement.

3.1.5 IBM Qiskit Textbook (Javadi-Abhari et al., 2024)

A qubit is a quantum version of the classical bit and is the basic unit of quantum information. Unlike a bit, which can be either 0 or 1, a qubit can be in a superposition of both.

Qiskit has a practical focus on physical implementations. It introduces the Bloch sphere parametrization:

$$|\psi\rangle = \cos\left(\frac{\theta}{2}\right)|0\rangle + e^{i\varphi}\sin\left(\frac{\theta}{2}\right)|1\rangle$$

3.1.6 Wikipedia (contributors, 2025)

In quantum computing, a qubit is the basic unit of quantum information – the quantum version of the classical binary bit.

Wikipedia includes both mathematical and physical realization aspects in its definition. It also covers the use of qubits in entanglement, quantum circuits, and decoherence.

3.1.7 MIT OpenCourseWare (OpenCourseWare, 2024)

A qubit is a two-level quantum system whose state is a linear combination of orthonormal basis vectors $|0\rangle$ and $|1\rangle$, forming a unit vector in $\mathbb{C}^2$.

MIT OpenCourseWare teaches from the quantum algorithm perspective and makes strong use of Dirac notation, gates, and measurement postulates.

3.2 Mathematical Summary

State space:

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle \qquad \alpha, \beta \in \mathbb{C}, |\alpha|^2 + |\beta|^2 = 1$$

Bloch sphere representation:

$$|\psi\rangle = \cos\left(\frac{\theta}{2}\right)|0\rangle + e^{i\varphi}\sin\left(\frac{\theta}{2}\right)|1\rangle$$

where:

$$\theta \in [0, \pi], \varphi \in [0, 2\pi)$$

3.3 Physical Realizations

A qubit can be physically realized in various systems, each with its own advantages and challenges. Some common physical realizations include:

- Spin-half particles (e.g. electron spin)
- Photon polarization
- Superconducting circuits
- Trapped ions
- Quantum dots

Bibliography

contributors, W. (2025,). *Qubit*.

Javadi-Abhari, A., Treinish, M., Krsulich, K., Wood, C. J., Lishman, J., Gacon, J., Martiel, S., Nation, P. D., Bishop, L. S., Cross, A. W., Johnson, B. R., & Gambetta, J. M. (2024,). *Quantum computing with Qiskit*. https://doi.org/10.48550/arXiv.2405.08810

Nielsen, M. A., & Chuang, I. L. (2010). *Quantum Computation and Quantum Information: 10th Anniversary Edition*. Cambridge University Press.

OpenCourseWare, M. (2024,). *Quantum Complexity Theory*.

Preskill, J. (2024,). *Lecture Notes for Physics 229: Quantum Computation*.

Rennie, R. (2015). *A Dictionary of Physics*. Oxford University Press. https://books.google.ie/books?id=l_MkBwAAQBAJ

Schumacher, B. (1995). Quantum coding. *Phys. Rev. A*, *51*(4), 2738–2747. https://doi.org/10.1103/PhysRevA.51.2738

Shor, P. W. (1997,). *Fault-tolerant quantum computation*. https://arxiv.org/abs/quant-ph/9605011