

RWTH AACHEN UNIVERSITY
Chair of Computer Science 2
Software Modeling and Verification

Master Thesis

**Compilation of Quantum Programs with Control Flow
Primitives in Superposition**

Sascha Thiemann
Matr.-No.: 406187
Study Program: Computer Science M.Sc.
July 8, 2024

Supervisors: apl. Prof. Dr. Thomas Noll
Chair for Software Modeling and Verification
RWTH Aachen University

Contents

1	Introduction	1
2	Background	1
2.1	Quantum Computing	1
2.2	Quantum Control Flow	1
2.3	QASM	1
2.4	ANTLR (or parsing in general)	1
3	Concept	1
4	Implementation	i
5	Conclusion and Future Work	i
	References	i

1 Introduction

- Introduction with random citation to not cause error [ACR*10]

2 Background

... Background

2.1 Quantum Computing

- Introduction into quantum computing

2.2 Quantum Control Flow

- Introduction into quantum control flow
- Branching
- Iteration
- Limitations

2.3 QASM

- Give overview of QASM language and concepts

2.4 ANTLR (or parsing in general)

- Give overview of ANTLR and parsing in general

3 Concept

4 Implementation

- Describe the implementation of LUIE
- What are the main components
- How do they interact
- Important structures/classes

5 Conclusion and Future Work

- Conclusion to thesis
- Future work
 - how could language be extended

Bibliography

- [ACR*10] A. Ambainis, A. M. Childs, B. W. Reichardt, R. Špalek, and S. Zhang. Any and-or formula of size n can be evaluated in time $\tilde{O}(n^{1/2})$ on a quantum computer. *SIAM Journal on Computing*, 39(6):2513–2530, 2010.