ETH
Eidgenössische Technische Hochschule Zürich
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Development of an RF resonator for a double junction ion trap

Semester Project

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Abstract

This paper shows complete process of modeling, designing and testing an RF helical resonator suitable for supporting a double-junction ion trap in a cryogenic environment.

Contents

Chapter 1

Introduction

Quantum computing is an exciting and rapidly evolving field of a modern science. One of the popular implementations of a quantum computer is based on an ability to control and measure systems of trapped ions.

1.1 Why do we need resonators?

RF traps require quite high voltage. In order to sustain low temperatures need for an adequate functioning of an ion trap cables used inside of a cryostat must have low heat conductivity. Such materials also have low electrical conductivity, which inevitably leads to generation of a more thermal power than a cooling system can potentially dissipate while preserving 4K temperature. Thus a solution would be to use an amplifier (resonator) close to the high voltage target.

1.2 Context of a project

Microfabricated ion traps provide a scalable realization for quantum computations, potentially reusing existing electronics machinery and allowing for a mass fabrication.

1.3 Kinds of resonators

There are multiple types of resonators typically used. This includes helical and RLC resonators.

Chapter 2

Theory

2.1 Helical resonator models

2.2 Comparing Macalpine's vs Hensinger's

Chapter 3

Design

Chapter 4

Validation

Chapter 5

External circuits & additional features

Appendix A

Dummy Appendix

You can defer lengthy calculations that would otherwise only interrupt the flow of your thesis to an appendix.

Bibliography

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