UNIVERSITÀ DEGLI STUDI DI MILANO

FACOLTÀ DI SCIENZE E TECNOLOGIE

Master degree in Physics

Title

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Contents

Summary

Chapter 1

Quantum computing

Chapter 2

Qibo

Chapter 3

Results

Tutti i risultati che sono presentati nel seguito sono stati ottenuti utilizzando il software di `Qibolab`per l'interazione con gli strumenti del laboratorio e `Qibocal`per il controllo delle operazioni sui qubit. L'hardware è un chip ... di QunatumWare. Durante il lavoro condotto per questo progetto di tesi entrambe le librereria, sia Qibocal che Qibolab undergo update and release, for this reason the first part of this work was realized using `Qibocal`v0.1 and `Qibolab`v0.1 while the second part of the work, dato che puntava anche allo sviluppo di routine ch epotessero essere utili per la calibrazione dei qubit è stato realizzato direttamente con `Qibocal`v0.2 e `Qibolab`v0.2.

3.1 RB fidelity optimization

3.1.1 Randomized Benchmarking

A strong limitation to the realization of quantum computing technologies is the loss of coherence that happens as a consequence of the application of many sequential quantum gates to to the quibts. Indeed, a grate challenge faced by quantum computing eexperiments is to physicallly realize gates with low errors whenerver and wherevere applied, currently ... inserire qual è un valore ACCETTABILE. A possible approach to *gate error charachterization* is the process tomography which allows the experimenter to establish the behaviour of a quantum gates. The main drawback of this approach is that process tomography can be very time consumig since its time complexity scales exponentially with the number of qubits involved [1]

Randomized benchmarking (RB) is technique used to characterize the performance of quantum gates measuring their avarage error rates. RB was firstly introduced in 2005 [2], the key idea

Randomized Benchmarking

For the results we present in the following the technique used slightly differs from the one described in section 3.1.1,

Randomized Benchmarking on `qua`

3.1.2 Optimization methods

`Optuna` [3]

Scipy methods [4]

- SQLP ?

- Nelder-Mead → approfondimento

CMA - genetics algorithm [5]

3.2   RX90 calibration

3.3   Flux pulse correction

3.3.1   Cryoscope

[6]

Chapter 4

Conclusions

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