Transmonqubit model

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Date: 10.07.2020

***Abstract*—**

I. Introduction

QANTUM Computing is the real shit at the moment. Nothing else like quantem computing bla bal therefore a realization is nessersarry and theser are the quibits a quantum state system.

For this quantum state the Hamiltonian can be described.

The time evolution of a system can be described as :

$$i\hbar\frac{\partial}{\partial t}|\psi\rangle = H|\psi\rangle$$

describe briefly the problem you are modeling and simulating (write in complete sentences)

$$H_{\text{Model}} = H_{\text{Transmon}} + H_{\text{Drive}}$$

$$\hat{H}_{\text{Transmon}} = \omega\hat{a}^\dagger\hat{a} + \frac{\alpha}{2}\hat{a}^\dagger\hat{a}\left(\hat{a}^\dagger\hat{a} - I\right)$$

$$\hat{H}_{\text{Drive}} = Pulse(t)\left(\hat{a}^\dagger + \hat{a}\right)$$

$$\hbar\omega\left(\hat{a}^\dagger\hat{a} + \frac{1}{2}\right) = \hbar\omega\left(\hat{n} + \frac{1}{2}\right)$$

$$\hat{a}\,|n\rangle := \sqrt{n}\;|n-1\rangle \tag{1}$$
$$\hat{a}^\dagger\,|n\rangle := \sqrt{n+1}\;|n+1\rangle \tag{2}$$

$$\hat{a}^\dagger\hat{a}\,|n\rangle := \sqrt{n}\;|n-1\rangle \tag{3}$$
$$\hat{a}\,|n\rangle := \sqrt{n}\;|n-1\rangle \tag{4}$$
$$\hat{a}^\dagger\,|n\rangle := \sqrt{n+1}\;|n+1\rangle \tag{5}$$

$$\mathbf{c}(t) = e^{-i\mathbf{H}t/\hbar}\mathbf{c}_0 = \mathbf{U}(t)\mathbf{c}_0$$

$$\mathbf{c}_0 = \begin{pmatrix}1\\0\end{pmatrix}$$

$$\mathbf{H} = \begin{pmatrix}1 & 0\\0 & E_2\end{pmatrix}$$

$$\mathbf{U}(t) = e^{-i\mathbf{H}t/\hbar} = \begin{pmatrix}e^{-iE_1t/\hbar} & 0\\0 & e^{-iE_2t/\hbar}\end{pmatrix}$$

$$\hat{H} = \hbar\omega\left(\hat{a}^\dagger\hat{a} + \frac{1}{2}\right) = \hbar\omega\left(\hat{n} + \frac{1}{2}\right)$$

II. Simulation model and method

Use the second order product formula approach to solve the time-dependent Schroedinger equation

The model Hamiltonian has two parts: The first part describes the qubit The second part describes a time-dependent control drive

describe briefly the problem you are modeling, as well as the simulation method.

$P_i(t) = |c_i(t)|^2$

III. Simulation results

show figures (with figure captions) depicting the results Give a brief description of the results

Do not forget to answer specified questions.

answer the posed questions

IV. Discussion

summarize your findings

APPENDIX

$$\sin x = \frac{\mathrm{e}^{\mathrm{i}x} - \mathrm{e}^{-\mathrm{i}x}}{2\mathrm{i}}, \quad \cos x = \frac{\mathrm{e}^{\mathrm{i}x} + \mathrm{e}^{-\mathrm{i}x}}{2}$$

https://www.fz-juelich.de/SharedDocs/Downloads/PGI/EN/SpringSchool/Lecture-Notes-Book-Form/Skriptbuch-2013.pdf?__blob=publicationFile

REFERENCES

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