DECOMPOSITION OF QUANTUM GATE INTO MULTIPLICATION OF GATES TAKEN FROM A GIVEN SET

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Abstract. Decompose a quantum operation into a finite set of gates is extremely important in quantum information because it allows you to reproduce the operation in your laboratory even if you don't have that special gate. Here, we use linear algebra for find the decomposition of such matrices given a finite set and the starting matrix. the approach is for 4x4 matrices with 2x2 or 4x4 gates but can be generalized.

1. Introduction

Quantum computation is very useful for finding a solution to problems that on classical computer are nowadays intractable and there are many researchers trying to make quantum computation works on their small laboratories. Therefore is very important to reproduce any gate even if you don't have it. there are many articles about the decomposition of quantum gates, but here we want to find a sequence of matrices from a given set for finding the solution, knowing that the matrix is composed by multiplying that matrices. This article is composed into ... sections, section number 2 gives , section number 3 explain how is made the algorithm and section number 4 gives some information about future work based on this article.

2. base results

2.1. **Subsection.** Subsection text.

2.1.1. *Subsubsection.* Subsubsection text.

Paragraph. Paragraph text.

Subparagraph. Subparagraph text.

Select a part of the text then click on the button Emphasize (H!), or Bold (Fs), or Italic (Kt), or Slanted (Kt) to typeset *Emphasize*, **Bold**, *Italics*, *Slanted* texts.

You can also typeset Roman, Sans Serif, Small Caps, and `Typewriter` texts.

You can also apply the special, mathematics only commands $\mathbb{BLACKBOARD\ BOLD}$, $\mathcal{CALLIGRAPHIC}$, and $\mathfrak{fraktur}$. Note that blackboard bold and calligraphic are correct only when applied to uppercase letters A through Z.

You can apply the size tags – Format menu, Font size submenu – tiny, scriptsize, footnotesize, small, normalsize, large, Large, LARGE, huge and Huge.

You can use the `\begin{quote} etc. \end{quote}` environment for typesetting short quotations. Select the text then click on Insert, Quotations, Short Quotations:

Date: May 11, 2015.

> The buck stops here. *Harry Truman*
>
> Ask not what your country can do for you; ask what you can do for your country. *John F Kennedy*
>
> I am not a crook. *Richard Nixon*
>
> I did not have sexual relations with that woman, Miss Lewinsky. *Bill Clinton*

The Quotation environment is used for quotations of more than one paragraph. Following is the beginning of *The Jungle Books* by Rudyard Kipling. (You should select the text first then click on Insert, Quotations, Quotation):

> It was seven o'clock of a very warm evening in the Seeonee Hills when Father Wolf woke up from his day's rest, scratched himself, yawned and spread out his paws one after the other to get rid of sleepy feeling in their tips. Mother Wolf lay with her big gray nose dropped across her four tumbling, squealing cubs, and the moon shone into the mouth of the cave where they all lived. "*Augrh*" said Father Wolf, "it is time to hunt again." And he was going to spring down hill when a little shadow with a bushy tail crossed the threshold and whined: "Good luck go with you, O Chief of the Wolves; and good luck and strong white teeth go with the noble children, that they may never forget the hungry in this world."
>
> It was the jackal—Tabaqui the Dish-licker—and the wolves of India despise Tabaqui because he runs about making mischief, and telling tales, and eating rags and pieces of leather from the village rubbish-heaps. But they are afraid of him too, because Tabaqui, more than any one else in the jungle, is apt to go mad, and then he forgets that he was afraid of anyone, and runs through the forest biting everything in his way.

Use the Verbatim environment if you want LaTeX to preserve spacing, perhaps when including a fragment from a program such as:

```
#include <iostream>          // < > is used for standard libraries.
void main(void)              // ''main'' method always called first.
{
 cout << ''This is a message.'';
                             // Send to output stream.
}
```

(After selecting the text click on Insert, Code Environments, Code.)

2.2. **Mathematics and Text.** It holds [**?**] the following

Theorem 1. *(The Currant minimax principle.) Let T be completely continuous selfadjoint operator in a Hilbert space H. Let n be an arbitrary integer and let $u_1, \ldots, u_{n-1}$ be an arbitrary system of $n-1$ linearly independent elements of H. Denote*

$$\max_{\substack{v \in H, v \neq 0 \\ (v,u_1)=0,\ldots,(v,u_n)=0}} \frac{(Tv,v)}{(v,v)} = m(u_1, \ldots, u_{n-1}) \tag{2.1}$$

Then the n-th eigenvalue of T is equal to the minimum of these maxima, when minimizing over all linearly independent systems $u_1, \dots u_{n-1}$ in H,

$$\mu_n = \min_{u_1,\dots,u_{n-1}\in H} m(u_1, \dots, u_{n-1}) \tag{2.2}$$

The above equations are automatically numbered as equation (**??**) and (**??**).

2.3. **List Environments.** You can create numbered, bulleted, and description lists (Use the Itemization or Enumeration buttons, or click on the Insert menu then chose an item from the Enumeration submenu):

(1) List item 1
(2) List item 2
    (a) A list item under a list item.
        However, the typeset style for this level is different.
    (b) Just another list item under a list item.
        (i) Third level list item under a list item.
            (A) Fourth and final level of list items allowed.

- Bullet item 1
- Bullet item 2
  - Second level bullet item.
    - Third level bullet item.
      - Fourth (and final) level bullet item.

Description List: Each description list item has a term followed by the description of that term. Double click the term box to enter the term, or to change it.

Bunyip: Mythical beast of Australian Aboriginal legends.

2.4. **Theorem-like Environments.** The following theorem-like environments (in alphabetical order) are available in this style.

Acknowledgement 1. *This is an acknowledgement*

Algorithm 1. *This is an algorithm*

Axiom 1. *This is an axiom*

Case 1. *This is a case*

Claim 1. *This is a claim*

Conclusion 1. *This is a conclusion*

Condition 1. *This is a condition*

Conjecture 1. *This is a conjecture*

Corollary 1. *This is a corollary*

Criterion 1. *This is a criterion*

Definition 1. *This is a definition*

Example 1. *This is an example*

Exercise 1. *This is an exercise*

Lemma 1. *This is a lemma*

Proof. This is the proof of the lemma. □

Notation 1. *This is notation*

Problem 1. *This is a problem*

Proposition 1. *This is a proposition*

Remark 1. *This is a remark*

Solution 1. *This is a solution*

Summary 1. *This is a summary*

Theorem 2. *This is a theorem*

Proof of the Main Theorem. This is the proof. □

This text is a sample for a short bibliography. You can cite a book by making use of the command `\cite{KarelRektorys}`: [**?**]. Papers can be cited similarly: [**?**]. If you want multiple citations to appear in a single set of square brackets you must type all of the citation keys inside a single citation, separating each with a comma. Here is an example: [**?**, **?**, **?**].

References

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[4] Carlson D. E.: *On Günther's stress functions for couple stresses*, Quart. Appl. Math., **25**, (1967), 139-146.

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