Review of: "Design of Quantum Gates Using Quantum Scattering Theory"

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The scattering matrix (or S-matrix) is a unitary matrix that allows one to define the transition probability amplitude of a scattering process[1][2].

In the article entitled “Design of quantum gates using quantum scattering theory,” the authors Harish Parthasarathy and Monika Aggarwal propose a method, based on the Dyson expansion[3], for the calculation of the S-matrix, with the aim of adopting the latter to "approximate a given unitary gate in infinite-dimensional Hilbert space.”

Specifically, in section 2 of the manuscript, the authors, after presenting the Lippmann-Schwinger equation[4][5][6], derive the S-matrix element between two free particle states.

In section 3, they determine the matrix R = S-I, with S the scattering matrix, and introduce the optimization problem.

In section 4, assuming a time-varying potential, controlled by incorporating parameters, they redefine the S-matrix, which, in section 5, is obtained from the Hudson-Parthasarathy equation[7].

Overall, the article is clear and understandable. However, in the manuscript, some definitions that could be useful for a better understanding of the text are omitted, such as the definition of the TPCP map.

Moreover, I point out some corrections to be made.

On page 1, the [K.B. Sinha] reference is not reported in the bibliography.

On page 4, correct the formula of Ω_+ and substitute both the term "submanfold" with "submanifold" and "Lippman" with "Lippmann."

On page 5, some typos and some signs are wrong. Does not $|\Phi_\beta>$ define a free state?

On pages 8 and 9, some typing errors.

In the end, I note that in the article, sometimes the term "time-varying" is used and sometimes the term "time varying."

I conclude by thanking the authors, with the hope that this review can be helpful.

References

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