

Quantum Algorithm for Finding Roots of n^{th} Degree Polynomials

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Quantum algorithm is an algorithm for solving mathematical problems using quantum systems encoded as information, which is found to outperform classical algorithms. The objective of this study is to develop a quantum algorithm for finding the roots of n^{th} degree polynomials where n is any positive integer. In classical algorithm, the resources required for solving this problem increase drastically when n increases and it would be impossible to practically solve the problem when n is large. It was found that any polynomial can be rearranged into a corresponding companion matrix, whose eigenvalues are roots of the polynomial. This leads to a possibility to perform a quantum algorithm where the number of computational resources increases as a polynomial of n . In this study, we construct a quantum circuit representing the companion matrix and use eigenvalue estimation technique to find roots of polynomial. The complexity of this quantum algorithm is also compared with a classical algorithm for solving the same problem.

Summary

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