学 位 論 文 の 要 旨

A Novel Method of Diagonal-Inner Outer Factorization

（対角インナー・アウター分解の新設計法）

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Diagonal inner-outer factorization is a mathematical technique that has garnered significant attention due to its applications in various computational mathematics fields. The study began by establishing the importance of factorization methods in mathematics, particularly focusing on the utility and applications of diagonal inner-outer factorization. This method is critical in simplifying matrix equations and optimizing computational algorithms. The research aimed to propose a novel approach to diagonal inner-outer factorization by focusing on a diagonal function as the inner component, addressing existing limitations in computational efficiency and adaptability.

A comprehensive literature review was conducted to understand the evolution and current state of diagonal inner-outer factorization. Early developments in matrix factorization were examined, starting from foundational techniques like LU decomposition to more advanced concepts. The review highlighted significant contributions by researchers such as Strang (2018), Varga (1998), and Xia (2012), who introduced innovative methodologies that improved the efficiency and adaptability of factorization methods. The literature review also included a critical analysis of existing methods, underscoring the need for novel approaches that could enhance computational efficiency and accuracy.

The research methodology centered around developing and testing a new diagonal inner-outer factorization method. This involved designing algorithms that utilized a diagonal function as the inner matrix component. The methodology was crafted to test the efficacy of this approach in terms of computational efficiency and accuracy. Simulations and mathematical modeling were used to compare the proposed method with traditional factorization techniques, assessing improvements in computational time and resource utilization.

The results demonstrated that the diagonal function-based approach to inner-outer factorization significantly improved computational efficiency. Comparisons with conventional methods showed a marked reduction in computational time and resources, particularly for matrices with specific structural characteristics. The findings indicated that focusing on the diagonal structure of the inner component could lead to more precise and efficient matrix factorization.

The discussion section delved into the implications of these findings, comparing the new method with existing factorization techniques. It was evident that the proposed approach addressed some of the key limitations of traditional methods, such as computational inefficiency and lack of adaptability. The study also discussed the potential applications of this method in various fields, including engineering, data processing, and scientific computing, highlighting its practical relevance.

The thesis concluded with a summary of the research contributions, emphasizing the significance of introducing a diagonal function in the inner-outer factorization process. The research opened up new possibilities for efficient and accurate matrix factorization, contributing both to theoretical knowledge and practical methodologies in computational mathematics. Future research directions were suggested, including extending the application of the method to more complex matrices, integrating it with machine learning algorithms, and optimizing its computational aspects.