Project 2

For the course FYS3150

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Contents

1 Abstract

2 Introduction

All programs are found at our GitHub-repository.

3 Method

3.1 Exercise a)

In this exercise we are going to prove that $\vec{w}_i = U\vec{v}_i$ is an orthogonal or unitary transformation that preserves the dot product and orthogonality. We start by multiplying $\vec{w}_j^T$ with $\vec{w}_i$ to take the vector product, also called the dot product. If the vector product of these vectors is equal to δ_{ij}, given by $\vec{v}_j^T\vec{v}_i = \delta_{ij}$ in the exercise, then the dot product and orthogonality is preserved. In this exercise we assume that $U^TU = I$, where I is the identity matrix, because this defines a unitary matrix U which we compute with in this exercise.

The vector product is calculated as followed:

$$\begin{aligned}
\vec{w}_j^T\vec{w}_i &= (U\vec{v})^T U\vec{v}_i \\
&= \vec{v}_j^T U^T U\vec{v}_i \\
&= \vec{v}_j^T\vec{v}_i \\
&= \delta_{ij}
\end{aligned}$$

The vector product of $\vec{w}_j^T$ and $\vec{w}_i$ is δ_{ij}, which proves that the dot product and orthogonality is preserved for the transformation.

3.2 Exercise b)

3.2.1 Calculations

Det under som ikke er mulig å lese blir kommentert ut:
Ferdig kommentert ut.

3.2.2 The programming

3.3 Exercise c)

3.3.1 Calculations

3.3.2 The programming

3.4 Exercise d)

3.4.1 Calculations

3.4.2 The programming

3.5 Exercise e)

3.5.1 Calculations

3.5.2 The programming

4 Results and discussion

Our results are as shown in the Appendix. We also have `.txt`-files for all the raw data generated by the projects up on GitHub.

4.1 Exercise a)

4.2 Exercise b)

4.3 Exercise c)

4.4 Exercise d)

4.5 Exercise e)

5 Conclusion and perspective

6 Appendix

7 References

Link to the PDF for Project 2.

Our GitHub-repository.

Link to lecture slides in FYS3150 - Computational Physics.