

Programming-Exam Numerical Linear Algebra

Winter 2024/25

Assignment

Implement the transformation of a Hermitian matrix to real tridiagonal form and the QR-iteration with shifts and deflation for tridiagonal matrices. Document the decisions you made in the implementation.

Verify your program with meaningful tests and document their results.

Formalities

The program(s), documentation, and results should be submitted electronically through Moodle in a single PDF or a PDF plus one file with code by Feb 2nd, 2025. You are welcome and encouraged to discuss your work with your peers, but every student must submit their own, unique work.

As part of the exam, you will be asked to give a short oral presentation of your work and you should be able to answer questions about your code. Oral presentations will be scheduled for the week of Feb 3rd, or later upon request. Please sign up online on Moodle.

Please submit at the oral test a signed declaration: "I/We have prepared the assignment myself/ourselves and I/we have only used the sources declared in the submission".

Guidelines

1. The program must run with several example matrices without crashing and you must be able to change parameters like the matrix size
2. The program must be subdivided into functions of well-defined purpose
3. Your code should be well structured and readable
4. You must be able to describe how you verify the correctness of your program
5. The target dimension for matrices should be at least 20
6. Follow all suggestions from the notes on how to save memory and operations
7. Avoid complex numbers whenever possible
8. The QR iteration must be able to identify multiple eigenvalues
9. Use appropriate shift strategies and document
10. Document your deflation strategy
11. Bonus if you compute not only eigenvalues but also eigenvectors

Grading criteria

You pass (at least grade 4,0), if your program successfully computes the eigenvalues of a Hermitian matrix given to you.

Your grade will be excellent (1,0) if you follow all of the guidelines and your documentation shows that you can transfer the knowledge of the lecture meaningfully to writing code and tests as well as discussing your the relation between theoretical and experimental results.