

Numerical Linear Algebra - Sheet 11

to be handed in until January 24, 2024, 11am.

Problem 1. Use your implementation of Problem 2(a) on Sheet 9 and augment it such that you can compute the eigenvalues of the projected matrix \mathbf{H}_m in each step. For the computation of the eigenvalues you could, for example, use your implementation of the QR iteration (Problem 4 on Sheet 5). Test your implementation with \mathbf{L}_2 as in Problem 2(b) on Sheet 9 and observe the convergence of extremal eigenvalues λ_{\min} and λ_{\max} .

The following problems review some topics of this lecture. They are a good preparation for the oral exam and they will also help with better understanding the programming problem and project. Please summarize your thoughts on those using bullet points.

Problem 2. Recapitulate the concept of an orthogonal projection and an oblique projection. What are use cases of both and why are they important for numerical linear algebra?

Problem 3. What methods presented in the lecture can be used for computing or estimating the eigenvalues of a matrix \mathbf{A} ? Sort by properties of the methods, as well as by conditions on \mathbf{A} .

Problem 4. How can the QR factorization of a given matrix be computed? Discuss downsides and benefits of the different methods.