SF3580

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1 Task 2

1.1 (a)

Insert figure

1.2 (b)

Insert figure

1.3 (c)

Insert figure

The Rayleigh quotient only uses the symmetric part of A in

$$r(\mathbf{x}) = \mathbf{x}^H A \mathbf{x}$$

assuming $\mathbf{x}$ is normalized. The matrix A is no longer symmetric, i.e. $A \neq A^H$, but any square matrix can be decomposed into a symmetric part A_s and a nonsymmetric part A_{ns} by

$$A = \underbrace{\frac{1}{2}\left(A + A^H\right)}_{=A_s} + \underbrace{\frac{1}{2}\left(A - A^H\right)}_{=A_{ns}}.$$

Thus

$$r(\mathbf{x}) = \mathbf{x}^H A_s \mathbf{x} + \mathbf{x}^H A_{ns} \mathbf{x} = \mathbf{x}^H A_s \mathbf{x}$$

since

$$\mathbf{x}^H A_{ns} \mathbf{x} = \mathbf{x}^H A \mathbf{x} - \mathbf{x}^H A^H \mathbf{x} = 0.$$

For a nonsymmetric matrix all avaliable information is not used.

2 Task 3

The performance of different versions of Gram-Schmidt orthogonalizations is investigated when combined with the Arnoldi method. We consider the matrix A constructed by

`Random.seed!(0) A=matrixdepot("wathen",nn,nn)` (1)

and m number of iterations in the Arnoldi method

m	SGS time	SGS orth	MGS time	MGS orth	DGS time	DGS orth	TGS time	TGS orth
5	188 ms	4.82×10^{-13}						
10	496 ms	2.15×10^{-12}						
20	1.10 s	1.04×10^{-11}						
50	4.05 s	1.06×10^{-10}						
100		4×10^{-11}						

2.1 (a)

2.2 (b)

3 Task 4

We investigate a primitiv version of the Arnoldi method. Let

4 Task 6

test

5 Task 8

test