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winter semester 2021/2022

Please send your solutions (including a MATLAB®implementation if applicable) by **Dec 05, 11:59 PM (Magdeburg students), Dec 6, 11:59 PM (Chemnitz students)** to przybilla@mpi-magdeburg.mpg.de (Magdeburg students) or jan.blechta@math.tu-chemnitz.de (Chemnitz students) with subject `NLA-HW07`. Late submissions are only possible if requested by email before the due date for a valid reason.

Numerical Linear Algebra – homework #07

Problem 1 (Loosing the orthogonality during Arnoldi)

Implement a MATLAB-Code, that runs the Arnoldi method. Compute for every of the following matrices 100 Arnoldi steps. Then compute the inner products $q_1^* q_j$ for $j = 2, \ldots, 100$. Observe that the orthogonality gets less accurate with increasing j. Compute $\|I_j - Q_j^* Q_j\|$ for $j = 100$ as well. This expression is in theory equal to zero, what do you observe?

a) For the first test, use the matrix `west0479`, that is given in MATLAB. This is a non-symmetric, sparse matrix of dimension 479.

```
>> load west0479
>> A = west0479;
>> spy(A)
```

b) Now, do the tests with a discrete Laplace operator of Dimension 324. This matrix is sparse and symmetric.

```
>> A = delsq(numgrid('S',20));
```

Problem 2 (Konvergence of Arnoldi)

Run 40 steps of the Arnoldi-Process for the matrix `west0479`. To make the convergence of the Arnoldi-process visible, plot the eigenvalues of `eig(A)` and the approximated eigenvalues after 10, 20, 30, and 40 steps. What do you observe?