Seminar Numerical Linear Algebra

Winter Semester 2023/24

Prof. Dr. Jörg Liesen

(September 4, 2023)

The seminar Numerical Linear Algebra in the Winter Semester 2023/24 is about topics that are closely related to the lecture *Advanced Topics in Numerical Linear Algebra* in the Summer Semester 2023. It is highly recommended that participants are familiar with the topics of that lecture. A smaller selection of topics related to the lecture *Matrix Theory* in the Summer Semester 2023 is also available.

Every participant of the seminar is expected to give a talk about one of the selected articles, and to submit a written report. The talks will be held in blocks towards the end of the lecture period. Details will be announced in the first meeting of the seminar in the week of October 16, 2023 (exact date, time, and room TBD).

Registration for the seminar:

- Send an email to `liesen@math.tu-berlin.de` **until October 10, 2023**.
- This email should contain a selection of at least 4 preferred articles from the list below. (Articles will be assigned based on these preferences.) Also specify if you are interested in writing a B.Sc. or M.Sc. thesis on a seminar topic.

Selection of articles:

1. Krylov subspace methods with short recurrences and closely related topics
   (a) C. F. Jagels and L. Reichel, *A fast minimal residual algorithm for shifted unitary matrices*, Numer. Lin. Alg. Appl., 1 (1994), pp. 555-570
   (b) T. A. Manteuffel and J. S. Otto, *On the roots of the orthogonal polynomials and residual polynomials associated with a conjugate gradient method*, Numer. Linear Alg. Appl., 1 (1994), pp. 449-475
   (c) T. Barth and T. Manteuffel, *Multiple recursion conjugate gradient algorithms part I: Sufficient conditions*, SIAM J. Matrix Anal. Appl., 21 (2000), p. 768-796
   (d) M. Huhtanen and R. M. Larsen, *Exclusion and inclusion regions for the eigenvalues of a normal matrix*, SIAM J. Matrix Anal. Appl., 23 (2002), pp. 1070-1091

(e) M. Huhtanen, *A Hermitian Lanczos method for normal matrices*, SIAM J. Matrix Anal. Appl., 23 (2002), pp. 1092-1108

(f) M. Huhtanen, *Orthogonal polyanalytic polynomials and normal matrices*, Math. Comp., 72 (2002), pp. 355-373

(g) M. Eiermann and O. G. Ernst, *A restarted Krylov subspace method for the evaluation of matrix functions*, SIAM J. Numer. Anal., 44 (2006), pp. 2481-2504

(h) H. Fassbender and K. D. Ikramov, K. D., *SYMMLQ-like procedure for $Ax = b$ where A is a special normal matrix*, Calcolo, 43 (2006), pp. 17-37

(i) C. Jagels and L. Reichel, *The extended Krylov subspace method and orthogonal Laurent polynomials*, Linear Alg. Appl., 431 (2009), pp. 441-458

(j) C. Jagels and L. Reichel, *The structure of matrices in rational Gauss quadrature*, Math. Comp., 82 (2013), pp. 2025-2060

(k) M. Berljafa and S. Güttel, *Generalized rational Krylov decompositions with an application to rational approximation*, SIAM J. Matrix Anal. Appl., 36 (2015), pp. 894-916

(l) M. Huhtanen and O. Nevanlinna, *Polynomials and lemniscate of indefiniteness*, Numer. Math., 133 (2016), pp. 233-253

(m) S. Güttel and M. Schweitzer, *Randomized sketching for Krylov approximations of large-scale matrix functions*, SIAM J. Matr. Anal. Appl., 44 (2023), pp. 1073-1096

(n) N. Van Buggenhout, *On generating Sobolev orthogonal polynomials*, arXiv:2302.10691 (2023)

2. Matrix Theory

(a) H. Shapiro, *Simultaneous block triangularization and block diagonalization of sets of matrices*, Linear Alg. Appl., 25 (1979), pp. 129-137

(b) A. Paz, *An application of the Cayley-Hamilton theorem to matrix polynomials in several variables*, Lin. Multilin. Algebra, 15 (1984), pp. 161-170

(c) A. E. Gutermann, O. V. Markova, and V. Mehrmann, *Lengths of quasi-commutative pairs of matrices*, Linear Alg. Appl., 498 (2016), pp. 450-470

(d) D. Lahat, C. Jutten, and H. Shapiro, *Schur's Lemma for coupled reducibility and coupled normality*, SIAM J. Matr. Anal. Appl., 40 (2019), pp. 998-1021