MAX-PLANCK-INSTITUT
FÜR DYNAMIK KOMPLEXER
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CSC Seminar

SPEAKER

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TITLE

Adaptively restarted block Krylov subspace methods with low-synchronization skeletons

ABSTRACT

With the recent realization of exascale performance by Oak Ridge National Laboratory's Frontier supercomputer, reducing communication in kernels like QR factorization has become even more imperative. Low-synchronization Gram-Schmidt methods, first introduced in [K. Świrydowicz, J. Langou, S. Ananthan, U. Yang, and S. Thomas, *Low Synchronization Gram-Schmidt and Generalized Minimum Residual Algorithms*, *Numer. Lin. Alg. Appl.*, Vol. 28(2), e2343, 2020)], have been shown to improve the scalability of the Arnoldi method in high-performance distributed computing. Block versions of low-synchronization Gram-Schmidt show further potential for speeding up algorithms, as column-batching allows for maximizing cache usage with matrix-matrix operations. In this work, low-synchronization block Gram-Schmidt variants from [E. Carson, K. Lund, M. Rozložník, and S. Thomas, *Block Gram-Schmidt algorithms and their stability properties, Lin. Alg. Appl.*, 638, pp. 150--195, 2022] are transformed into block Arnoldi variants for use in block full orthogonalization methods (BFOM) and block generalized minimal residual methods (BGMRES). An adaptive restarting heuristic is developed to handle instabilities that arise with the increasing condition number of the Krylov basis. The performance, accuracy, and stability of these methods are assessed via a flexible benchmarking tool written in MATLAB. The modularity of the tool additionally permits generalized block inner products, like the global inner product.

Tuesday, October 4, 2022 at 2 pm

seminar room Prigogine