Block Computations for Interval Arithmetic and Verified Numerical Computations for Linear Systems

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Abstract

This talk is concerned with verified numerical computations for linear systems. Numerical computations are very fast but sometimes produce inaccurate results due to accumulation of rounding errors. The verified numerical computations produce an approximate result and its rigorous error bound by using only floating-point arithmetic [1]. Interval arithmetic is one of powerful methods for the verified numerical computations. There are special methods for the verification for linear systems [2].

Many methods for the verification based on BLAS (Basic Linear Algebra Subprograms) and LAPACK (Linear Algebra PACKage) libraries which are highly optimized by engineers in the field of high performance computing. We propose grouped block computations based on BLAS for interval matrix multiplication and the verification for the linear systems. Here, the grouped block method is a sort of super block family of algorithms [3]. Such block computations efficiently reduce error bounds for matrix multiplication and bounds for the residual of LU decomposition and triangular systems. In addition, we will show that the performance of computations with the grouped block computations is comparable to that of the original routines in BLAS and LAPACK.

References

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