

Verified Numerical Computations and Related Applications



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Summary

The author has been engaged in the study of numerical computations with result verification starting from 1990. As a result, the following results have been obtained:

1. We have proposed a concept of error-free transformations for calculating not only approximate values of numerical evaluations of certain arithmetic expressions consisting of additions, subtractions and multiplications, but also exact error of such numerical evaluations. Using this concept, we have established the way of getting numerical solutions for various problems in numerical linear algebra with required accuracy. Especially, we have established the verified numerical methods for the following problems:
 - a. Finite dimensional linear equations including extremely ill-conditioned problems.
 - b. Matrix eigenvalue problems.
2. We have proposed various verified numerical methods for various problems including
 - a. Calculation of ill-conditioned definite integrals.
 - b. Boundary value problems for nonlinear differential equations based on invention of methods for eigenvalue evaluation of associated linearized problems.

In this talk, we will review some of these results and will mention possible applications for cryptography.

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