Algorithms of Generalized Inverse and their stabilization

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Abstract

An inverse of a matrix which is not necessarily square or is square nevertheless singular is applied to solve ill-conditioned problems such as large sized matrix computations. Such the inverse is referred to as a generalized inverse. The generalized inverse have many applications in engineering problems, such as data analysis, electrical networks, character recognitions, and so on. The most frequently used one is a Moore-Penrose type inverse. Several algorithms to compute generalized inverse have been proposed.

We designed computer (software) system for obtaining the Moore-Penrose type generalized inverse from a viewpoint of an algorithm stabilization proposed by Shirayanagi and Sweedler. The system can compute generalized inverse of a matrix which permits the use of limited precision computation in a convergent fashion. We already computed the generalized inverse by stabilized Greville's algorithm on a computer algebra system, Risa/Asir. In this paper, the similar system is designed by floating-point computation in C. Results by high precision floating computations are compared with them by Risa/Asir. They show an advantage especially in computation time. This does not mean that Greville's algorithm may be directly computed with limited precision computation in a convergent fashion, but rather the algorithm is amenable to the stabilization techniques to the algorithm.

Results obtained by the system are highly reliable and also show some advantages for results obtained by similar systems especially in computation time.

Further, other algorithms for the generalized inverse such as Glassey's method and others are also stabilized in our system. Through some examples, we show the effectiveness of the stabilization techniques.