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On Direct Matrix Factored Inversion via Broyden's Updates

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Abstract : A direct method based on the good Broyden's updates for evaluating the inverse of a nonsingular square matrix of full rank and solving related system of linear algebraic equations is studied. For a matrix A of order n whose LU-decomposition is A = LU, the multiplication count is O (n3). This includes the evaluation of the LU-decompositions of the inverse, the lower triangular decomposition of A as well as a “reduced matrix inverse”. If an explicit value of the inverse is not needed the order reduces to O (n3/2) to compute to compute inv(U) and the reduced inverse. For a symmetric matrix only O (n3/3) operations are required to compute inv(L) and the reduced inverse. An example is presented to demonstrate the capability of using the reduced matrix inverse in treating ill-conditioned systems. Besides the simplicity of Broyden's update, the method provides a mean to exploit the possible sparsity in the matrix and to derive a suitable preconditioner.

Keywords : Broyden's updates, matrix inverse, inverse factorization, solution of linear algebraic equations, ill-conditioned matrices, preconditioning
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