

On the relation between conjugate gradient and quasi-Newton algorithms

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ABSTRACT

In the paper the new formulation of the Broyden restricted convex class of updates involving oblique projections found recently by Stachurski is further exploited. First the new proof of the inheritance of the directions conjugacy is presented when the methods are applied to the strictly convex quadratic problems and the exact directional minimization is used. This analysis leads to another formulation of the quasi-Newton updates. Their construction requires only some amount of differences of unknowns, values of the scalar products with the corresponding differences of the goal function derivatives and the last difference of the derivatives itself. Appropriate selection of the coefficients in the studied class of methods generates the same directions as in the recently popular memory gradient methods. The methods considered may represent a good alternative to the limited – memory BFGS method with an advantage that it doesn't require the precise formulation of the approximation of the inverse of the hessian matrix. Some preliminary computational benchmarking results will be reported.

We view the derived formulation of the quasi-Newton updates as an answer to the question raised by Andrei concerning the relation between conjugate gradients and quasi-Newton methods.