Parallel Computing in Quadratic Programming

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We describe the research activity of the *Unità Operativa* in Naples, coordinated by Prof. G. Toraldo (*Metodi numerici per alcuni problemi di ottimizzazione non lineare*), and the *Unità Operativa* in Naples, coordinated by Prof. A. Murli (*Software matematico per architetture avanzate*) concerning the development of parallel software for numerical optimization.

We present some design and computational experiences on the solution of convex bound constrained quadratic programming problems on high performance machines. We want to compare active set strategies with interior point strategies, in order to develop efficient software. In particular, efficient parallelization strategies and computational results [1, 3] will be presented for the projected gradient method [6] and the potential reduction algorithm [4] which are considered very competitive and well representative of the two classes of algorithms that we want to compare.

We consider the case in which the matrix A is dense and a direct solver is used in the inner iterations. The main differences between the two algorithms stands in the linear algebra operations that must be performed at each iteration; the potential reduction requires the solution of a linear system of order n while the projected gradient requires a factorization updating process that can not be performed by using standard linear algebra libraries like LAPACK. Moreover, it has been observed that the number of iterates in interior point algorithms does not depend on the number of variables; in contrast, the number of iterations for an active set strategy strongly depends on the number of variables.

Our numerical results seem to suggest that on sequential machines, although not easy to be implemented, active set strategies can be competitive with interior point algorithms. Moving on parallel machines, however, things are very different, and the Potential Reduction algorithm is the most effective to be implemented.

In this talk we will also, briefly, outline the development of block and simultaneous versions of a *Row-Action* algorithm for solving large sparse convex programming problems on parallel machines [2].

References

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