

ON THE EFFICIENT UPDATE OF RECTANGULAR LU-FACTORIZATIONS SUBJECT TO LOW RANK MODIFICATIONS*

PETER STANGE[†], ANDREAS GRIEWANK[‡], AND MATTHIAS BOLLHÖFER[†]

Abstract. In this paper we introduce a new method for the computation of KKT matrices that arise from solving constrained, nonlinear optimization problems. This method requires updating of null-space factorizations after a low rank modification. The update procedure has the advantage that it is significantly cheaper than a re-factorization of the system at each new iterate. This paper focuses on the cheap update of a rectangular LU-decomposition after a rank-1 modification. Two different procedures for updating the LU-factorization are presented in detail and compared regarding their costs of computation and their stability. Moreover we will introduce an extension of these algorithms which further improves the computation time. This turns out to be an excellent alternative to algorithms based on orthogonal transformations.

Key words. KKT-system, LU-factorization, low-rank modification, quasi-Newton method

AMS subject classifications. 15A23, 65F05, 65F30, 65K05, 90C53

*Received February 7, 2006. Accepted for publication September 4, 2006. Recommended by Y. Saad. This work was supported by the DFG-research center MATHEON “Mathematics for key technologies” in Berlin.

[†]Institute for Mathematics, Technische Universität Berlin, Germany. (p.stange@tu-bs.de).

[‡]Institute for Mathematics, Humboldt-Universität zu Berlin, Germany (griewank@mathematik.hu-berlin.de, bolle@tu-bs.de).