Electronic Transactions on Numerical Analysis.
Volume 3, pp. 160-176, December 1995.

ISSN 1068-9613.

ETNA
Kent State University
etna@mcs.kent.edu

A PARALLEL GMRES VERSION FOR GENERAL SPARSE MATRICES *

JOCELYNE ERHEL †

Abstract. This paper describes the implementation of a parallel variant of GMRES on Paragon. This variant builds an orthonormal Krylov basis in two steps: it first computes a Newton basis then orthogonalises it. The first step requires matrix-vector products with a general sparse unsymmetric matrix and the second step is a QR factorisation of a rectangular matrix with few long vectors. The algorithm has been implemented for a distributed memory parallel computer. The distributed sparse matrix-vector product avoids global communications thanks to the initial setup of the communication pattern. The QR factorisation is distributed by using Givens rotations which require only local communications. Results on an Intel Paragon show the efficiency and the scalability of our algorithm.

Key words. GMRES, parallelism, sparse matrix, Newton basis.

AMS subject classifications. 65F10, 65F25, 65F50.

*Received Oct 2, 1995. Accepted for publication November 22, 1995. Communicated by L. Reichel.

†INRIA-IRISA , Campus de Beaulieu, 35042 Rennes, France. erhel@irisa.fr