ELEMENT-BASED PRECONDITIONERS FOR PROBLEMS IN GEOMECHANICS

C.E. Augarde, A. Ramage*, J. Staudacher

Department of Mathematics, University of Strathclyde
26 Richmond Street, Glasgow G1 1XH, UK
e-mail: A.Ramage@strath.ac.uk
web page: http://maths.strath.ac.uk/∼caas63

ABSTRACT

At the heart of a nonlinear finite element analysis for geotechnical engineering problems, in common with many other areas of structural engineering and elastostatics, lies the solution of algebraic nonlinear equilibrium equations. These equations are usually solved with well-established incremental or iterative solution techniques (such as the modified Euler or Newton-Raphson methods), reducing the problem to a sequence of linear systems involving the structure stiffness matrix and load vector which must be solved for the nodal displacements. Because of the size and sparsity of the matrices which occur in practice, solution of these systems consumes most of the computing resources required (in terms of both CPU time and memory) for a finite element analysis. Iterative solvers and preconditioners therefore play important roles. In this talk we review the use of a range of established element-based preconditioning methods for linear elastic and elasto-plastic problems and compare their performance with a new element-based method which appears to offer a significant improvement in performance.