HSL PARALLEL DIRECT SOLVERS FOR LARGE SPARSE LINEAR SYSTEMS

Jennifer A. Scott
Computational Science and Engineering Department,
Atlas Centre, Rutherford Appleton Laboratory,
Chilton, Didcot,
Oxon OX11 0QX, England.
e-mail: j.scott@rl.ac.uk

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Abstract

Many applications in science and engineering give rise to large sparse linear systems of equations that need to be solved as efficiently as possible. As problem sizes increase, it is necessary to consider exploiting multiprocessors to solve these systems. We report on the design and development of new parallel direct solvers for the numerical solution of the large sparse linear systems. These codes are available through the mathematical software library HSL [1] (formerly the Harwell Subroutine Library). We have developed parallel frontal solvers both for finite element problems and for highly unsymmetric linear systems such as those that arise in chemical process engineering. These solvers exploit the serial frontal code `MA42`. Most recently, Duff and Scott have developed a general parallel unsymmetric solver that has at its heart the well-known software package `MA48`.

In each case, the problem is first subdivided into a (small) number of loosely connected subproblems. A direct solver is then applied in parallel to each of the subproblems. Once all possible eliminations for the subproblems have been performed, there remains an *interface* problem, which we also solve using a direct method.

In this talk, we discuss how our software is designed to achieve the goals of portability, ease of use, efficiency, and flexibility, and illustrate the performance using a range of large-scale problems arising from real applications.

References

[1] HSL. A collection of Fortran codes for large scale scientific computation. Full details from www.cse.clrc.ac.uk/Activity/HSL

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