# HOW DIRECT METHODS MAKE ITERATIVE METHODS WORK

**Iain S. Duff**
*Rutherford Appleton Laboratory and CERFACS*
*England*
*e-mail: I.S.Duff@rl.ac.uk*

## Abstract

Even the strongest advocates and developers of iterative methods recognize their limitations when solving difficult problems, that is problems that are poorly conditioned and/or very unstructured. It is now universally accepted that preconditioning must be used in such instances.

Clearly the best preconditioning would be a direct factorization, but even the most ardent promoters of direct methods recognize that memory considerations in particular limit the size and complexity of system that can be factorized. It may, however, be feasible to use a direct factorization on a "nearby" problem or on a subproblem.

We examine the use of a symmetric indefinite solver in constrained optimization problems that is used in the first way, and the use of a direct solver within domain decomposition techniques in the second.