

Recent developments in multifrontal codes

Iain S Duff

CCLRC Rutherford Appleton Laboratory
and
CERFACS

For over twenty-five years, the multifrontal method has been one of the main approaches utilized by direct methods for the factorization of sparse matrices. We reflect on the early work in this area and sketch some of the milestones in the development of multifrontal codes.

We then discuss two recent developments.

We first describe some experiments in using MA57, an HSL multifrontal code for symmetric indefinite systems, to detect the rank of highly deficient rectangular systems. The application of interest was in limit analysis problems from Geotechnical Engineering and was conducted jointly with Scott Sloan and Andrei Lyamin from the University of Newcastle, NSW. We discuss algorithmic changes that were needed in MA57 and compare our strategy with using a modified version of the HSL code MA48 directly on the rectangular system.

We have also developed a multifrontal code for skew symmetric systems using a modified version of the pivoting strategy developed by Duff, Gilbert, and Pralet that works on a reduced matrix. It is interesting that the skew solver is much simpler than its counterpart for symmetric indefinite systems. We show results from a prototype code and discuss the uses of such a solver.