product option

LUSAS
Finite Element Analysis

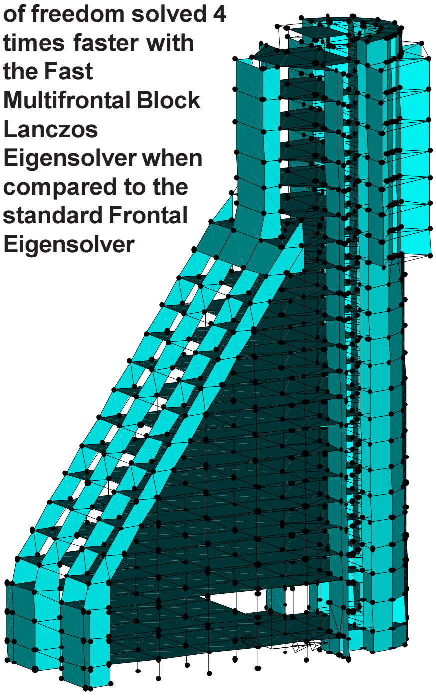
Fast Multifrontal Solvers

Additional solvers are available as a product option for use with Version 13.2 and above of any LUSAS product. The Fast Multifrontal Direct Solver can provide solutions several times faster than the standard Frontal Direct Solver for certain analysis problems. The Fast Multifrontal Block Lanczos Eigensolver can, similarly, return results several times faster than the standard Frontal Eigensolvers for certain problems. The complex eigensolver provides efficient solutions for large-scale damped natural frequency problems.

Fast Multifrontal Direct Solver

The Fast Multifrontal Direct Solver is an implementation of the multifrontal method of Gaussian Elimination, and uses the modern sparse matrix technology of assembling a global stiffness matrix where only the non-zero entries are stored. The solver can be used for almost all types of analysis, and has extensive pivoting options to ensure numerical stability, especially for symmetric problems. It is particularly fast at solving large 3D solid models.

Disk space requirements are typically 75% less than that of the standard frontal direct solver. An advanced out-of-memory facility means that problems which exceed the memory capabilities of the machine can still be solved. A data check facility is provided and a re-solution facility, as with the standard Frontal Direct solver, enables you to rerun linear analyses with different loadcases without having to eliminate the stiffness matrix. Various checks are made to see if the solution vector has been corrupted by round-off error, and warnings are issued accordingly. An estimate of the condition number of the matrix is also computed, so that the relative error in the solution (with respect to machine precision) can be predicted. The solver also recognises negative and near-zero pivots, and will give diagnostic warning messages in each case relating to a particular node and variable in the model.



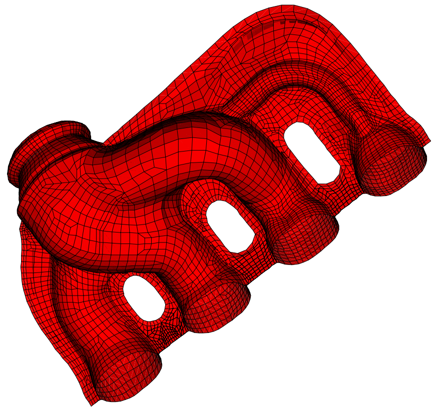
Beam and shell model of a building with 6984 degrees of freedom solved 4 times faster with the Fast Multifrontal Block Lanczos Eigensolver when compared to the standard Frontal Eigensolver

> *"Upgrading to the LUSAS Fast Solver gave us an estimated 5 to 10 times speed-up of our solution times."*
>
> *Mike Gower, National Physical Laboratory, UK*

Fast Multifrontal Block Lanczos EigenSolver

The Fast Multifrontal Block Lanczos Eigensolver solves natural frequency, vibration and buckling problems with real, symmetric matrices. It is very fast, extremely robust, and ensures that convergence is almost always achieved.

It is based on the same underlying technology as the Fast Multifrontal Direct Solver and has the same pivoting options, error diagnostics and out-of-memory facilities. You can specify the lowest, highest or a range of eigenvalues to be returned, along with the normalised eigenvectors and error norms which are currently given with the standard Frontal Eigensolvers.



Thin shell model of an exhaust manifold with 52020 degrees of freedom solved 15 times faster with the Fast Multifrontal Direct Solver when compared to the standard Frontal Direct Solver

Complex Eigensolver

The complex eigensolver is non-symmetric eigen solver based on an implicitly restarted Arnoldi method. It provides solutions to damped natural frequency problems for both solid and fluid mechanics. It can solve large scale problems with real, non-symmetric input matrices (in particular, those involving non-proportional damping), and gives solutions that consist of complex numbers, where appropriate.

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