AMLS Solver

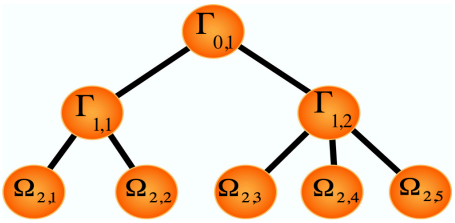
The AMLS solver builds a reduced-order model to approximate eigenmodes in a frequency interval [*0, f_{max}*] with one factorization of the stiffness matrix. This method approximates a large number of eigenpairs for a finite element model with millions of degrees of freedom at a fraction of the cost used by the Lanczos algorithm. Frequency response analysis is often the targeted application for this reduced-order model.

Implementation

The VKI implementation of AMLS is an *algebraic* variant of the Automated Multi-Level Substructuring [1, 2].

Built on top of our latest sparse multifrontal linear solver, our implementation uses the *algebraic* elimination tree from the multifrontal linear solver. Supernodes in the elimination tree are *aggregated* to generate a hierarchy of components. The original pencil (**K, M**) is then transformed into a reduced pencil in terms of *component* eigenvectors. Solving the reduced eigenproblem provides approximations to the global eigenpairs.

Algebraic Elimination Tree



The VKI implementation makes extensive use of LAPACK and BLAS-3 routines, is fully parallelized using C++ threads, and can run in-core and out-of-core simulations.

References

1. J. Bennighof, “An adaptive multi-level substructuring method for efficient modeling of complex structures”, 33. AIAA/ASME/Structural Dynamics and Materials Conference, pp. 1631–1639, Dallas, TX, 1992
2. J. Bennighof and R. Lehoucq, “An automated multi-level substructuring method for eigenspace computation in linear elastodynamics”, SIAM J. Scient. Comp. 25, 6, pp. 2084–2106, 2004