

# STRUMPACK

## Structured Matrix Package



Hierarchical solvers for dense rank-structured matrices and fast algebraic sparse solver and robust and scalable preconditioners.



### Dense Matrix Solvers using Hierarchical Approximations

- Hierarchical partitioning, low-rank approximations
- Hierarchically Semi-Separable (HSS), Hierarchically Off-Diagonal Low-Rank (HODLR), Hierarchically Off-Diagonal Butterfly (HODBF), Block Low-Rank (BLR), Butterfly
- C++ Interface to ButterflyPACK (Fortran)
- Applications: BEM, Cauchy, Toeplitz, kernel & covariance matrices, ...
- Asymptotic complexity much lower than LAPACK/ScaLAPACK routines

### Sparse Direct Solver

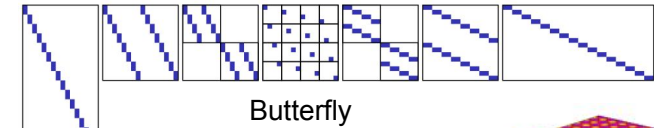
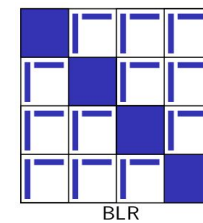
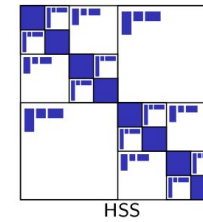
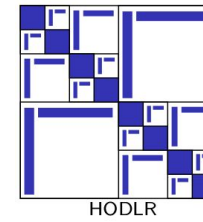
- Algebraic sparse direct solver
- GPU: CUDA, HIP/ROCm, DPC++ (in progress)
- Orderings: (Par)METIS, (PT)Scotch, RCM

### Preconditioners

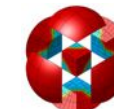
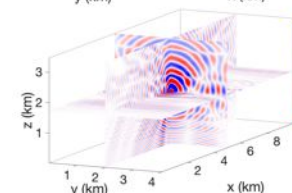
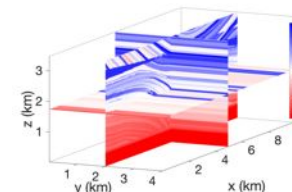
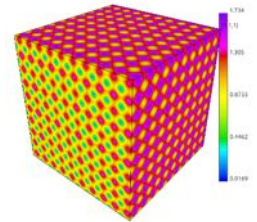
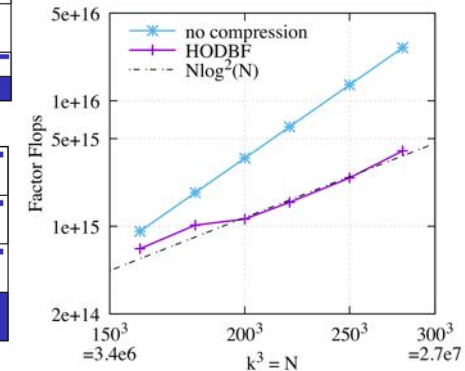
- Approximate sparse factorization, using hierarchical matrix approximations
- Scalable and robust, aimed at PDE discretizations, indefinite systems, ...
- Iterative solvers: GMRES, BiCGStab, iterative refinement

### Software

- BSD license
- Interfaces from PETSc, MFEM, Trilinos, available in Spack



Near linear scaling for high-frequency wave equations



[github.com/pghysels/STRUMPACK](https://github.com/pghysels/STRUMPACK)