SuperLU

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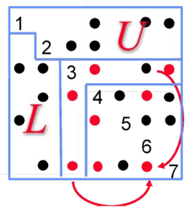
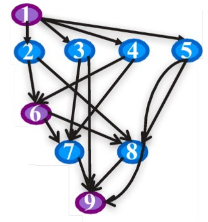
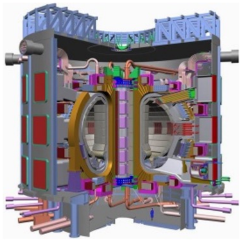
Supernodal Sparse LU Direct Solver. Flexible, user-friendly interfaces. Examples show various use scenarios. Testing code for unit-test. BSD license.

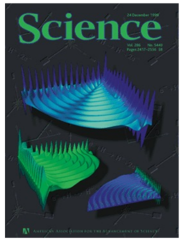
- **Capabilities**
  - Serial (thread-safe), shared-memory (SuperLU_MT, OpenMP or Pthreads), distributed-memory (SuperLU_DIST, hybrid MPI+ OpenM + CUDA/HIP). Written in C, with Fortran interface
  - Sparse LU decomposition (can be nonsymmetric sparsity pattern), triangular solution with multiple right-hand sides
  - Incomplete LU (ILUTP) preconditioner in serial SuperLU
  - Sparsity-preserving ordering: minimum degree or graph partitioning applied to A^TA or A^T+A
  - User-controllable pivoting: partial pivoting, threshold pivoting, static pivoting
  - Condition number estimation, iterative refinement, componentwise error bounds
- **Exascale systems GPU-readiness**
  - Available: Nvidia GPU (CUDA), AMD GPU (HIP), Intel GPU (SYCL)
- **Parallel Scalability**
  - Factorization strong scales to 32,000 CPU cores (IPDPS'18, JPDC'19)
    - additional 10x speedup with GPUs
  - Triangular solve strong scales to 4000 CPU cores (SIAM CSC'18, SIAM PP'20, SC'23)
    - 3D algorithm strong scales to 256 GPUs
- **Open-source software**
  - Used in a vast range of applications, can be used through hypre, PETSc, SUNDIALS, Trilinos, etc.
  - available on github

xSDK E4S









ITER tokamak quantum mechanics

Widely used in commercial software, including AMD (circuit simulation), Boeing (aircraft design), Chevron, ExxonMobile (geology), Cray's LibSci, FEMLAB, HP's MathLib, IMSL, NAG, SciPy, OptimaNumerics, Walt Disney Animation.

FASTMATH ECP

https://portal.nersc.gov/project/sparse/superlu/