

# SuperLU



**Supernodal Sparse LU Direct Solver.** Unique user-friendly interfaces. Flexible software design. Used in a variety of applications. Freely available.

## Capabilities

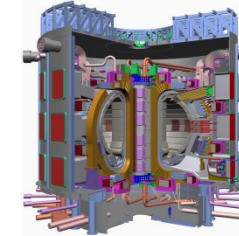
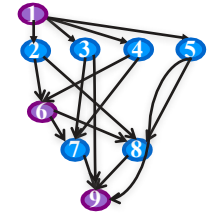
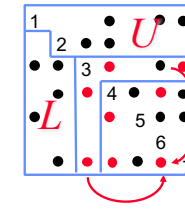
- Serial (thread-safe), shared-memory (SuperLU\_MT, OpenMP or Pthreads), distributed-memory (SuperLU\_DIST, hybrid MPI+ OpenM + CUDA).
  - Implemented in C, with Fortran interface
- Sparse LU decomposition, triangular solution with multiple right-hand sides
- Incomplete LU (ILU) preconditioner in serial SuperLU
- Sparsity-preserving ordering:
  - Minimum degree ordering applied to  $A^T A$  or  $A^T + A$
  - Nested dissection ordering applied to  $A^T A$  or  $A^T + A$  [(Par)METIS, (PT)-Scotch]
- User-controllable pivoting: partial pivoting, threshold pivoting, static pivoting
- Condition number estimation, iterative refinement.
- Componentwise error bounds

## Performance

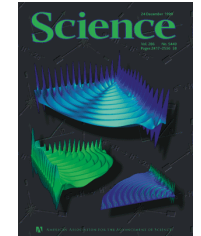
- Factorization strong scales to 24,000 cores (IPDPS'18)
- Triangular solve strong scales to 4000 cores (CSC'18)

## Open source software

- Used worldwide in a vast range of applications, can be used through PETSc and Trilinos, available on github



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.



<http://crd-legacy.lbl.gov/~xiaoye/SuperLU>