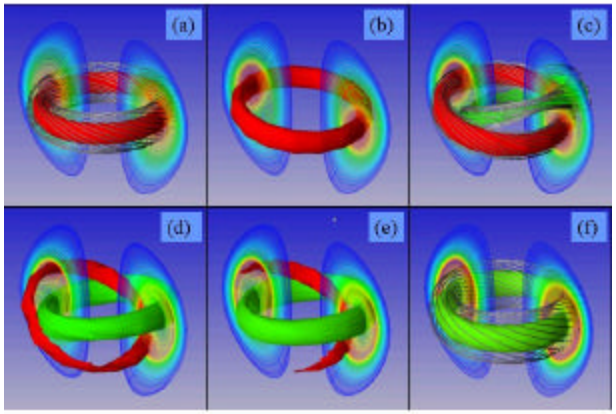
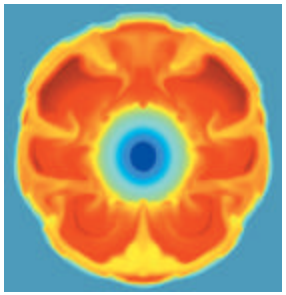
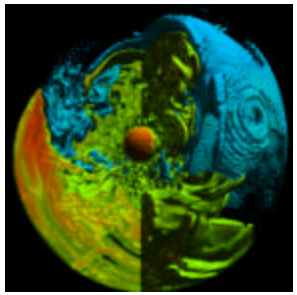
TOPS is motivated by the many DOE mission-critical systems governed by PDEs that need to be solved with sufficiently high resolution to do predictive simulation, like fusion...



Tokamak sawtooth instability image c/o CEMM SciDAC

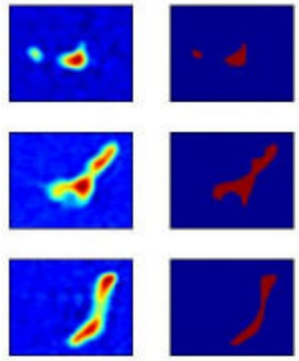
and astrophysics...



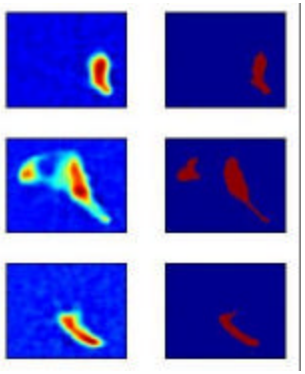


Stellar evolution image c/o TSI SciDAC

For the Center for Extended Magnetohydrodynamic Modeling (CEMM), TOPS's scalable linear solvers power an operator-split time integration of tokamak dynamics. For the Terascale Supernovae Initiative (TSI), TOPS is replacing 1D operator-split solvers with 3D nonlinearly implicit.

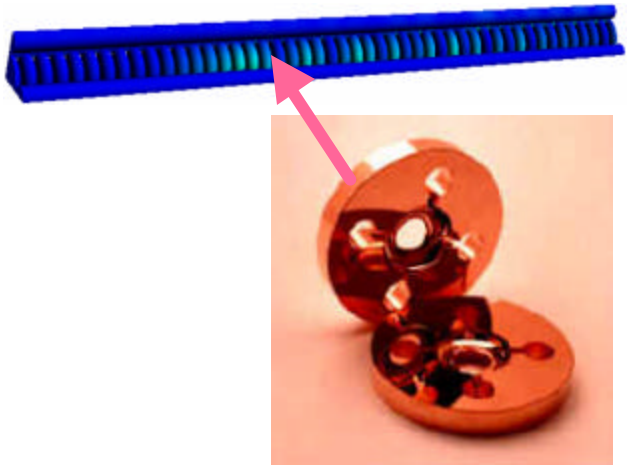


Together with PDE integration, TOPS provides sensitivity analysis, design, control, parameter identification, and data assimilation for systems governed by PDEs.

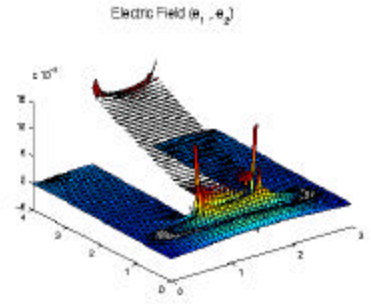


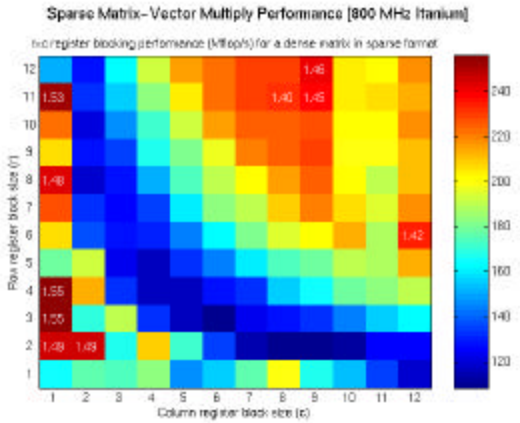
For the 21st Century Accelerator Science & Technology project (AST), TOPS eigensolvers enable full system analysis of EM modes.

Accelerator chamber images c/o AST SciDAC



TOPS aims to deliver the power of multilevel solvers to applications outside of mainstream multigrid, including strongly anisotropic, inhomogeneous, and first-order systems. Pictured is the E-field from a Maxwell Eqs simulation performed with the FOSLS multigrid technique.





TOPS emphasizes high performance implementations in addition to highly convergent algorithms. Blocking a sparse matrix-vector multiply provides up to 55% improvement over the unblocked (1x1) case on a single processor.