SciDAC-4 Institute on Applied and Computational Mathematics

FASTMath: Frameworks, Algorithms and Scalable Technologies for Mathematics

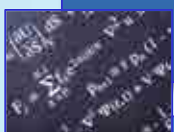
FASTMath Goals

Develop advanced, robust numerical techniques for DOE science problems

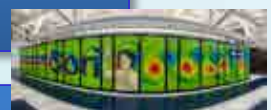
- Eight focused topical areas based on application needs
- High level synergistic techniques

Deploy high-performance software on DOE supercomputers

- Algorithmic and implementation scalability
- Performance portability
- Interoperability of libraries

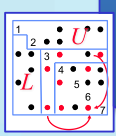


FASTMath Objective: Reduce the barriers facing computational scientists



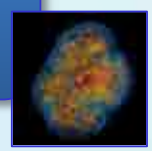
Demonstrate basic research technologies from applied mathematics

- Build from existing connections with basic research
- Focus on research results that are most likely to meet application needs

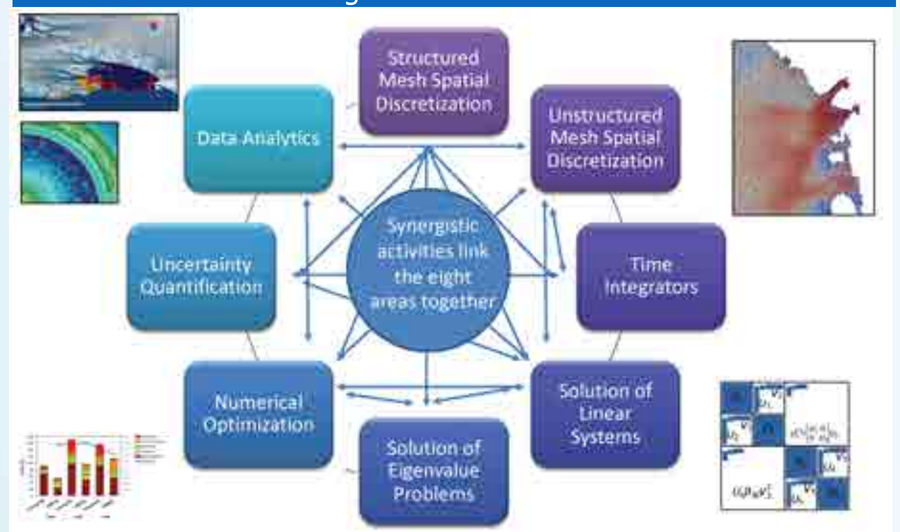


Engage and support the computational science community

- Publications and presentations in highly visible venues
- Team tutorials
- Workforce pipeline and training
- Web presence



Eight Technical Areas



100s of Person-years of Experience building Math Software

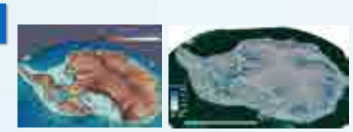
SuperLU, AMReX, SUNDIALS, mfem, UQTk, symPACK, PUMI, Trilinos, DAKOTA, hypre, PETSc, Albany, ZOLTAN, kokkos kernels

Actively Engaging in 22 SciDAC-4 Partnership Projects

FES (Tang): Adaptive mesh control in accurate RF simulations of complex antennas within the tokamak geometry

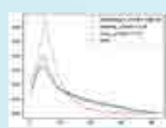
NP (TEAMS, Hix): MAESTROeX models supernovae progenitors and other low Mach number astrophysical phenomena using AMReX

NP (NUCLEI, Carlson): Accelerating nuclear configuration interaction calculations through a preconditioned block iterative eigensolver

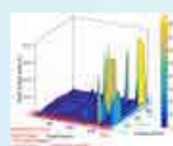


BER (ProSPecT, Price/Ng): Solvers, mesh adaptivity and graph algorithms supporting Antarctic ice sheet simulations in MALI (left) and BISICLES (right)

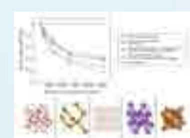
BER (ProSPecT, Price/Ng): Maximum *a posteriori* point (MAP) of the posterior distribution of the Basal friction field between the ice-sheet and land mass in Greenland



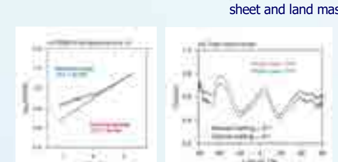
HEP (Kowalkowski): Determining sensitivity of simulation model fit to observation data used in optimization and to the definition of the objective function



NE (Andersson): Active parameter down-selection for the FECD cluster dynamics code enabled by global sensitivity analysis



BES: Two-level Chebyshev filtering based complementary subspace projection algorithm enables electronic structure calculation of both insulating and metallic systems with tens of thousands of atoms on DOE leadership machines without full subspace diagonalization



BER (Wan): Integration methods with better convergence rates in atmospheric models show changes in cloud cover and long-term climate that are larger than the inherent uncertainty

More Information: https://fastmath-scidac.org or contact Esmond G. Ng (EGNg@lbl.gov)

Argonne National Laboratory | Berkeley Lab | Lawrence Livermore National Laboratory | Sandia National Laboratories | Oak Ridge | CU | MIT Massachusetts Institute of Technology | Rensselaer | SMU | USC University of Southern California