

18.336J/6.335J project proposals (Feb 28 version) :: Spring 2012

1. Solution of the heat equation via potential theory and Ewald summation (Greengard, Strain)
2. The Fast Gauss transform for convolution with a Gaussian
3. Poisson solvers in porous media for geophysical flows and reservoir simulations.
4. Domain decomposition, Schwarz preconditioners for Laplace or Helmholtz problems.
5. Layer potentials, first vs. second kind integral BIE, and the FMM.
6. Application of FMM to molecular dynamics
7. Extension of FMM to the vector case, Biot-Savart law
8. Kernel-independent FMM (Biros, Ying)
9. Calculus of h-matrices: fast direct inversion of elliptic problems
10. A comparative study of different rank-revealing QR algorithms
11. Preconditioners for saddle-point problems, e.g., Stokes and Navier-Stokes.
12. Kronecker-product-based and tensor-based preconditioners (Khoromskii)
13. Sweeping preconditioners for the Helmholtz equation (Engquist, Ying)
14. Dutt-Rokhlin unequid spaced FFT, and applications in CAT scans, or MRI imaging, or SAR imaging.
15. Ulander butterfly and application in radar backprojection or seismic migration.

You are of course very welcome to suggest other topics.