

18.335 Problem Set 5

Due Wednesday, 29 October 2008.

Problem 1:

Trefethen, problem 33.2.

Problem 2:

- (a) Trefethen, 36.3. Plot the error in this eigenvalue as a function of how many Ax matrix-vector multiplies you perform (use a semilog or log-log scale as appropriate).
- (b) Same problem, but use restarted Lanczos: after every 10 iterations of Lanczos, restart with the best Ritz vector from those 10 iterations. Again, plot the error vs. matrix-vector multiply count.

Problem 3:

- (a) Trefethen, problem 38.6.

Reminder: final project proposals

A half-page final-project proposal is due on October 31, outlining the goal and scope of your proposed paper. Problems motivated by your research are perfectly fine, although you shouldn't simply recycle something you've already done. The only restriction is that, since PDEs are covered in 18.336 and other courses, I don't want projects where the primary focus is how to discretize the PDE (e.g. no projects on discontinuous Galerkin methods or stable time-stepping, please). It is fine to take a discretized PDE as *input*, however, and then work on solvers, preconditioning, optimization, etcetera. Methods for ODEs are also fair game (especially recent developments that go beyond classic Runge-Kutta). One source of ideas might be to thumb through a copy of *Numerical Recipes* or a similar book and find a topic that interests you. Then go read some recent review papers on that topic (overview books like *Numerical Recipes* are not always trustworthy guides to a specific field).