MULTILEVEL AND RANDOMIZED ALGORITHMS

LONG CHEN

Course Information.
- Instructor: Long Chen
- Room: The Third Lecture Building 205
- Lecture time: Th 8:00 - 9:50 am (Odd week), M, Th 8:00 - 9:50 am (Even week)
- Office and hours: 1287, Tu 9:00 am - 11:00 am or by appointment.
- Email: chenlong@math.uci.edu
- Course webpage http://www.math.uci.edu/~chenlong/MathPKU.html

Course Description. We shall present several fast algorithms in numerical computation. In the first half of this course, we shall discuss algorithms based on the multilevel structure which reduces the complexity from $O(N^2)$ or $O(N^3)$ to $O(N \log N)$ or $O(N)$ for a problem of size N. Selected algorithms are:
- Quick sort.
- FFT (Fast Fourier Transform).
- FMM (Fast Multipole Method).
- Multi-Grid (MG) Method.
- Krylov Subspace Method.

In the second half, we shall discuss randomized numerical linear algebra which is a very active subject now, with ideas from and impacts on various fields, including analysis of big data sets, probability and statistics, numerical analysis, and computational complexity. Selected topics are:
- Johnson-Lindenstrauss transform
- Low rank matrix approximation
- Least squares approximation
- Matrix Concentration and Sparsification

Text Book. Lecture Notes will be provided via the course webpage.

Prerequisite. Linear algebra, Numerical analysis, Probability, MATLAB

Grading.
- Homework: 20%;
- Project: 30%;
- Midterm: 20%;
- Final exam: 30%.

Date: September 17, 2015.