ECE 929D: Advanced Computational Methods in Electromagnetics
Spring 2015;

Instructor: Prof. Shanker Balasubramaniam
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Office Hours: By appointment.
Recommended Text: None; most of the course will be taught using papers that will be available on the class website.
Class Policies

1. **Homework** Approximately 7-8 homework assignments will be given. Most of these will involve programming and possibly, proofs.
2. **Projects**: There will be 3 projects during the course of the semester + 1 presentation. The last project will be presented to the class the week before the final.
3. **Grade Distribution**
   - Homework: 30%
   - Projects: 60%
   - Presentation: 10%

Course Outline:

1. Introduction
   (a) Complexity
   (b) $\mathcal{O}(N)$ methods
   (c) Fast Fourier transforms
   (d) Polynomial systems
   (e) Different matrix structures
   (f) Mapping of Fast Fourier Transforms to Toeplitz Matrices
2. Development of FFT-like schemes
   (a) Fast matrix vector multiplication
   (b) CGFFT
   (c) Adaptive integral methods (on a uniform grid)
   (d) Adaptive integral methods (on a non-uniform grid)
3. Rank deficient methods (SVD and IES^3)
4. Fast multipole methods
   (a) FMM for the Laplace Equation
   (b) Variations of this technique for other kernels (low frequency, time domain, Gauss, etc)
   (c) 2-D FMM for the Helmholtz equation
   (d) 3-D FMM for the Helmholtz equation
   (e) Plane wave time domain scheme for the wave equation