

ASE n396 FINITE ELEMENT METHODS FOR MAXWELL EQUATIONS
Summer 05, # 75870 , MWFTh 1:00-2:30p, WRW 413

Suggested reading:

1. L. Demkowicz, “Computing with hp Elements” , in preparation, an electronic version of the book will be distributed to the class.
2. C.R. Paul and S.A. Nasar, “Introduction to Electromagnetic Fields”, McGraw-Hill, 1987.
3. P. Monk, “Finite Element Methods for Maxwell’s Equations”, Oxford University Press, 2003.
4. M. Cessenat, “Mathematical Methods in Electromagnetism”, World Scientific, Singapore, 1996.
5. R.F. Harrington, “Time-Harmonic Electromagnetic Fields”, McGraw-Hill, 1961.

The class covers fundamentals on theory and computations for conforming Finite Element Methods for Maxwell equations. A tentative list of topics is as follows.

1. Maxwell equations in time and frequency domains (2 lectures)
2. Variational formulation in bounded domains, Helmholtz decomposition, the div-curl problem (3)
3. Edge ($H(\text{curl})$ -conforming) finite elements, exact sequence (3)
4. Coding edge elements in 2D (5)
5. Theory of mixed finite elements (2)
6. Convergence analysis for Maxwell equations, why is it so difficult ? (3)
7. Frontiers: techniques for solving exterior problems: PML, infinite element (4)
8. Frontiers: adaptive methods (3)
9. Frontiers: spaces $H(\text{curl}, \Omega)$, $H(\text{div}, \Omega)$, $H^{-1/2}(\text{curl}, \Gamma)$, $H^{-1/2}(\text{div}, \Gamma)$, Hodge decomposition (3)
10. Frontiers: Boundary Integral formulations, coupling Finite and Boundary elements (2)

The class will be conducted in a seminar style.

I intend to cover the first six topics myself, with the “Frontiers” topics corresponding to journal articles presented by students. No exams (including final) will be given. Instead, problems with varying difficulty, ranging from ”hard theory”, through practice exercises, assignments involving numerical experiments, and

Final score range	grade
100 and above	A+
80 - 100	A
60 - 80	B
40 - 60	C
20 - 40	D
00 - 20	F

presentations of the papers, will be assigned in the class on a continuous basis. Each problem/assignment will be worth a number of points (10-50). The final grade will be determined by the number of collected points.

Discussion session; one hour, once a week, to be determined.

Instructor: Dr. Leszek Demkowicz, ACES 6.326, Office hours: immediately after the class.