ECE 7011: Computational Electromagnetics

Course Description

Advanced topics in numerical methods for solving Maxwell equations, including finite element methods, integral equation methods, and their hybridization.

Prior Course Number: 813 & 814
Transcript Abbreviation: Computational EMs
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Even Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 5510 (715) or 6010.
Exclusions: Not open to students with credit for 813 or 814.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Course Goals

Learn advanced topics in 3D vector finite element methods for solving Maxwell equations
Learn advanced topics in fast method, such as FFT-based methods, fast multipole methods, and rank-deficiency based methods, for solving surface integral equation methods
Introduced to various mechanisms of coupling finite elements to integral equation methods for solving unbounded electromagnetic problems

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
FEMs: Vector finite elements, low frequency instability, ABCs, PML, preconditioners, MOREs, TDFEM	18.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
IEs: Low frequency instability for EFIE, Calderon preconditioners, internal resonance and CFIE, IE-FFTs, Rank-deficient fast methods, FMM, VSIEs	18.0							
Hybrid finite elements and boundary elements methods: conventional FE-BI, DDM-FE-BEM, preconditioners	6.0							

Representative Assignments

Homeworks
Individual Computer Projects
Final Team Project

Grades

Aspect	Percent
Homeworks	40%
Individual Computer Projects	30%
Final Team Project	30%

Representative Textbooks and Other Course Materials

Title	Author
Papers, class lecture notes and slides	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
*	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.
***	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
**	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
**	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Changed course abbreviation, prereqs, exclusions, goals and topics to conform to university format. 3/29/12

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