Applied Electromagnetism: Magnet and RF-Cavity Design

> Jeremiah Holzbauer - FNAL Mauricio Lopes - FNAL

Objectives

This course will focus on the theory and design of the two main components of accelerators: magnets and RF cavities. The class will be structured to give a good understanding of the underlying electromagnetics as well as the practical demands of component design.

While this class is not intended to be a software tutorial, modeling software will be used extensively to give students hands-on experience with the process of designing these accelerator components.

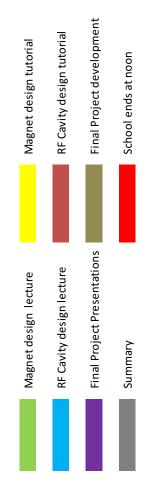
Class Structure 1

- 20 Lectures (~1.5h each)
- ~ 12 hours of tutorials
- 12+ hours for the project development
- ~ 6 hours for the final project presentations

Class Structure 2

- Homework (40%)
- Project (60 %)
- The project will be done in pairs.
- The teams should be decided by the end of this week!
- Drawing lots on Friday of this week
- Each team will develop two projects: a Magnet and a Cavity related project.
- Afternoons of the second week dedicated to the projects development.
- No HW during the second week.
- Final presentation will be on Thursday of the next week.

Schedule



	First week						
	Monday	Tuesday	Wednesday	Thursday	Friday		
9:00-10:30	Introduction	Cavities and Figures of Merit	Stored Energy	Couplers and Cavity Testing	FEM		
10:45-12:15	Introduction to RF	Perturbations	Design Examples	Magnetic Measurements	Tutorial (FEMM)		
12:15-13:30	Lunch						
13:30-15:00	Conformal Map	RF Components	Tutorial	Tutorial (OPERA3D)	Simulation Procedure		
15:15-16:45	Waveguides and Cavities	Magnet Excitation			Tutorial		

	Second week						
	Monday	Tuesday	Wednesday	Thursday	Friday		
9:00-10:30	Practical Concerns	SC magnets	Advanced Simulations	Presentations	Summary		
10:45-12:15	Magnet Fabrication	Advanced Design	Unusual designs				
12:15-13:30		School end					
13:30-15:00	Droject	Project	Project	Presentations			
15:15-16:45	Project	Project	Project	Presentations			

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Course Material

- J. Tanabe "Iron Dominated Electromagnets: Design, Fabrication, Assembly and Measurements" - World Scientific Pub Co Inc – 2005 – ISBN: 981256327X <u>http://www.slac.stanford.edu/cgi-wrap/getdoc/slac-r-754.pdf</u>
- Class notes

General School Information

- USPAS Office is in the Tannehill Room (open 8:30 am to 5 pm)
- Classes start at 9 a.m.
- Dinner will be in the "Capitol D" ballroom from 6 pm to 7 pm
- Study will be held in the "Capitol D" ballroom immediately following dinner (open from 7 pm to midnight)
- This classroom will be open until midnight

Instructors Jeremiah Holzbauer

- Undergraduate at the University of Wisconsin Madison
 - Applied Mathematics, Nuclear Engineering, Physics
- Graduate Work at Michigan State University
 - Superconducting RF
 - Low-Beta cavity design for the Facility for Rare Isotope Beams (FRIB)
 - Multi-harmonic buncher/RFQ design for FRIB and ReA3
- Post-doctoral Work at Argonne National Laboratory
 - Advanced Photon Source Upgrade, short pulse x-ray production
 - SRF deflecting-mode cavity research and development with heavily damped
 - Lower/Higher-Order Mode damper design
 - Cryomodule Design
- Associate Scientist at Fermi National Accelerator Laboratory
 - Dressed 1.3 GHz R&D for LCLS-II
 - Mechanical Tuner R&D for LCLS-II and PIP-II
 - Active Resonance Control for Microphonics Compensation

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Instructors Mauricio Lopes

- Undergraduate at the University of Sao Paulo Brazil
 - Physics
- Graduate Work at University of Sao Paulo Brazil
 - Transport Line Magnets Design
 - Main Microtron Design
- Physicist/Magnet Designer for the Spanish Light Source (ALBA), Barcelona, Spain
 - SR Magnets
 - Booster Magnets
 - Transfer Line Magnets
- Post-doctoral Work at Fermilab
 - IR Quadrupoles for ILC
 - Helical Solenoids for the Muon Collider
- Associate Scientist at Fermilab
 - Mu2e Transport Solenoids
 - Elliptical Combined Function Magnets for the Muon Collider SR
- Scientist I
 - Mu2e Transport Solenoid Leader

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