MSE 4989: Introduction to Research
FEM Modeling of Piezoelectric Nanogenerators Based on Core-Shell Nanowire Architectures

Spring 2018

Course Description
Development and applications of finite-element method (FEM) based computational methods for modeling the behavior of functional materials and nano/microstructures with coupled physical properties at mesoscale. Specific functionalities involve combinations of elastic, optical, dielectric and electronic properties, processed in tensorial form respecting crystallographic symmetries and anisotropy. Parameterization of mesoscale free-energy expressions using literature searches, fitting of experimental results, or data-mining/machine-learning studies. Utilization of the Ferret module within the Multiphysics Object Oriented Simulation Environment (MOOSE) under Linux-like OS on a laptop or HPC cluster for FEM calculations. Interaction with collaborating experimental groups, interpretation and analysis of experimental results. Writing of technical reports and papers; presentation of the obtained results.

Instructor
Prof. Serge Nakhmanson
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Office hours: 2:00pm-3:00pm, Tuesday or by appointment

Student Mentors
Lukasz Kuna, lukasz.kuna@uconn.edu
Role of student mentors: training, tasking, and monitoring of the participating students, providing timely guidance and evaluation of the students, and feedback to the instructor.

Lab Safety Compliance
The enrolled students need pass the standard Institute of Materials Science (IMS) lab safety training and test.

Course Goals and Organization
The course is organized in a research project-oriented format, with one project per student.

- The choice of research projects centers around simulations of the properties of nanostructured functional materials for various applications with FEM.
- Each project with a specific title will be completed on a semester base with a possibility of continuation of the project to the next semester after appropriate progress review.
- Each participating student will work under the supervision of an assigned student mentor.
- At least 3 hours per week time commitment is needed for each credit or unit to be earned by the enrolled student.
- A final project report from each student is due by 11:59pm, Friday of the final exam week of the semester.
- Optional monthly reports are encouraged to help with instructor evaluation of the student performance throughout the semester.

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Grading Policy

- 1 final project report: 70%; Instructor/mentor meetings attendance: 30%.
- Late submissions: 20% grade loss per 24-hour delay.

Final Project Report Format

- By arrangement with the course instructor, the final report could be done as a poster or a paper (or both) presenting the results of the research conducted in the course of the project.
- Paper or poster formatting and production software requirements (MS Word and Powerpoint, or LaTeX) are by arrangement with the course instructor.