

SENIOR RESEARCH PROJECT

Title: How to identify nonphysical numerical eigenvalues of the Maxwell operator

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Description: Computing eigenvalue of the Maxwell operator accurately and reliably is one of the fundamental problems in computational electromagnetism. Not all numerical schemes can produce satisfactory numerical spectrum for this operator. Such examples include the continuous piecewise linear finite element discretization, which is known to generate non-physical Maxwell eigenvalues. One practically important issue is how to identify these spurious values.

Outcome: Knowledge from the following courses would be used in this project: Numerical Computing, Multivariable Calculus, Linear Algebra and (Partial) Differential Equations. One would begin with a simple finite element code to compute numerical eigenvalues of the Maxwell operator on some two dimensional domain. Then the focus would be on choosing proper indicators to tell an approximating eigenvalue is physical or not. Some possible indicator would be certain combination of the derivatives of the approximating eigenfunction.

Prior experience of working with finite element methods is not expected. But one does need to learn to write a finite element code in order to start this project.