

Title: Inverse and Optimal Design Problems in Diffractive Optics

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Abstract:

The recent explosion of applications of diffractive optics has driven the need for mathematical models and numerical algorithms. Computational models provide a relatively inexpensive 'virtual prototype' of diffractive structures as opposed to costly, time-consuming physical prototyping. They also provide the exciting possibility of obtaining completely new designs -- an example of the optimal design problem. In this talk, recent progress in our mathematical modeling and design efforts will be reported. Various forms of Maxwell's equations for extremely general media and materials will be examined by a variational approach. Issues on uniqueness, stability, and reconstruction for the inverse and design problems will be addressed. Techniques based on sharp eigenvalue bounds of the vector Laplacian and homogenization will be highlighted. The speaker will also describe ongoing research and significant open problems.