Shape calculus in optics

S. Sargheini, A. Paganini, R. Hiptmair, Ch. Hafner
Laboratory of Electromagnetic Fields and Microwave Electronics, ETH Zürich, Zürich CH-8092, Switzerland.
Seminar of Applied Mathematics, ETH Zürich, Zürich CH-8092, Switzerland.

Nano optics is the study of the interaction of light with sub-wavelength structures. There are different fabrication methods in this field, but all these methods introduce some perturbations to the initially designed structure. We need to know how sensitive our structure is with respect to these variations.
On the other hand, different kinds of imaging methods, like SNOM, can be used to visualize the fabricated structure. To use the measured data, a post processing procedure, or inverse problem solving, is necessary.
Both these inverse problem and sensitivity analysis can be reformulated in terms of a shape optimization problem. We have solved the shape optimization problem for a PEC scatterer by evaluating shape gradients and adjoint PDE.