Analysis and Differential Geometry Seminar

Designing lenses with help from geometry and optimal transport

Vladimir Oliker
Emory University

Abstract: Mirror and lens devices converting an incident plane wave of a given cross section and intensity distribution into an output plane wave irradiating at a given target set with prescribed intensity are required in many applications. Most of the known designs are restricted to rotationally symmetric mirrors/lenses. In this talk I will discuss designs with freeform lenses, that is, without a priori assumption of rotational symmetry. Assuming the geometrical optics approximation, it can be shown that the functions describing such freeform lenses satisfy Monge-Ampère type partial differential equations. Because of strong nonlinearities analysis of these PDE's is difficult. Fortunately, many such problems can also be formulated geometrically and lead to problems in calculus of variations in which instead of solving the nonlinear PDE's one needs to find extrema of some Fermat-like functionals. Furthermore, discrete versions of such problems can be formulated and are useful for numerics. In this talk I will describe some of these results in the case of the lens design problem.
This is work "in progress", so the presentation may be technical and require more than one seminar.

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