Dissertation Defense

Some Mathematical Problems in Design of Free-Form Mirrors and Lenses

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Abstract: In this dissertation, we investigate several optics-related problems. The problems discussed in Chapters 1, 2, and 3 are concerned with the determination of surfaces reshaping collimated beams of light to obtain a priori given intensities on prescribed target sets. In optics, such transformations are performed by lenses and/or mirrors whose shapes need to be determined in order to satisfy the application requirements. These are inverse problems, which in analytical formulations lead to nonlinear partial differential equations of Monge-Ampère type. In Chapter 4, we present several different designs of radiant energy concentrators. Our goal in these designs is to obtain a device that can capture solar rays with maximal efficiency.

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