

Additive manufacturing of reflectors based on desired light distributions

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A spatial adapted light distribution offers great advantages in many light applications. To illuminate complex architectures or exhibits in museums, a limitation or homogenization of the light distribution results in restrictions for illumination design. Besides a reduction of energy consumption, which can be achieved by illuminating only relevant areas and by adapting the luminous intensity, light pollution can be reduced especially in urban areas. Computer aided engineering tools allow the designing of necessary optical elements for these applications. Considering the great effort to manufacture Tailored Light components in only small quantities, additive manufacturing processes can offer suitable solutions.

The main objective within this PhD program is the development of regulations and guidelines to design optical reflectors for desired light distributions, considering the constraints of additive manufacturing processes. With optical simulation tools and CAD-Systems the designing of reflectors can be accomplished. The Institute offers professional measurement equipment to characterize the resulting light distributions. Designed reflectors can be manufactured with a selective laser melting (SLM) machine, the figure shows as example a reflector for an automotive headlight. The first step in the project is the identification of relevant machine parameters and the documentation of their influence on the manufacturing process. Various aluminum alloys will be analyzed regarding their characteristics in the additive manufacturing process. Here the PhD Student can benefit from the experience of the Laser Zentrum Hannover. Research results will be published in a conference contribution.

Secondly the surface and reflection properties of the aluminum reflectors will be analyzed. The analyzation of necessary finishing processes allows conclusions for the initial geometric dimensions, used in the CAD-System. With a combined consideration of the identified machine parameters, material properties and finishing processes, one can determine requirements for the reflector design. An open access publishing will make the results accessible.

The third part of the project covers the idea of desired light distributions. Complex geometries in reflector design are necessary, which can be realized with additive manufacturing. In this part of the project the ideal geometry for a specific illumination task will be combined with the determined requirements of additive reflector manufacturing and result in regulations and guidelines. The PhD thesis documents and discusses the developed guidelines for additive manufactured reflectors for various purposes.



Figure 21: Additive manufactured reflector of an automotive headlight



This is a PhD-project of Tailored Light. Tailored Light is a coordinated PhD-programme of the Hanover Centre for Optical Technologies from the Leibniz Universität Hannover together with the Hochschule Hannover, the Laser Zentrum Hannover, the HAWK Hildesheim/ Holzwinden/ Göttingen, the TU Braunschweig and the TU Clausthal.

Students interested in this or another project of Tailored Light can apply for fellowships. Have a look at www.tailored-light.uni-hannover.de for details.

