Summary

Title of dissertation: “Fine structures of light generation with Spatial Light Modulators”

In recent years the attention devoted to fine structures of light is growing. Together with searching for new optical fields, the same effort is put in the beam shaping techniques. The efficient technique should offer enough versatility, to be successfully used in various optical systems and be able to shape the light into almost any desired output. Therefore, the goal of this dissertation is to prove that: Spatial Light Modulators (SLMs) are capable of creating a wide range of high quality non-conventional optical fields.

The need for high quality non-conventional optical fields exposed a lack of sufficient beam evaluation techniques, which can be a major obstacle in the development of future SLM correction algorithms. The novel objective beam evaluation method, based on the optical vortex dynamics has been proposed. Various hologram generation functions and Spatial Light Modulator correction and evaluation techniques became the part of a Spatial Light Modulator controlling software, which is available as an open resource. This software together with the proposed algorithms have been examined in various research projects in terms of two aspects:

Versatility - pursued by the use of three different beam shaping devices: both transmissive and reflective Liquid Crystal Spatial on Silicon Light Modulator, and Digital Micromirror Device.

Purpose - fulfilled by the wide range of applications: fundamental beam shaping, metrology, and quantum-inspired optical communication.

The proposed method of evaluation offers a fast and simple measurement of beam quality by inspection of vortex trajectories. It can be applied in any system, where SLM is used. Together with the proposed method of correction it serves as a valuable tool for beam shaping purposes and can easily be applied to optical systems, which require the output beam of high-quality.

Keywords: spatial light modulator, laguerre-gaussian mode, laser beam shaping, laser beam evaluation