MacroNano®

TECHNISCHE UNIVERSITÄT ILMENAU

Straylight Analysis of Diffractive and Refractive Optical Systems

Working principle:

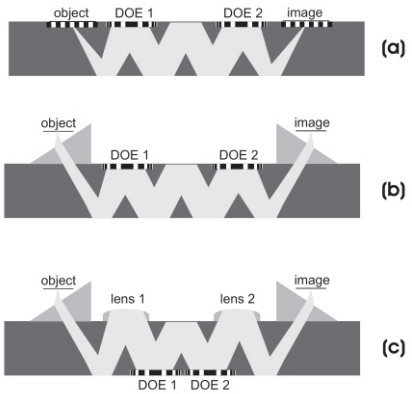
- Diffractive Optical Elements (DOEs) offer the necessary design freedom for the integration of different optical functionalities in only one optical element
- this is shown exemplarily for Planar Integrated Free-Space Optical Systems (PIFSO), wherein the optical axis is folded into the substrate material
- the combination of diffractive and refractive optical elements helps increasing the overall efficiency of these systems
- during the design process a main focus lied on preventing the reduction of the systems performance due to scattered light from rough substrate surfaces, fresnel reflections and unwanted diffraction orders
- the systems were fabricated at the Centre for Micro- and Nanotechnologies and successfully tested confirming the design considerations

General informations:

- depending on the given requirements and the type of optical system, the techniques used for the simulation are varied:
  - for the design and the analysis of purely refractive systems consisting of a multitude of different optical elements commercially available software tools (like ASAP, Zemax, CodeV) as well as self programmed tools are used
  - partly, these tools also meet the demands for the analysis of Diffractive Optical Elements (DOEs) especially on the field of straylight analysis
  - the design of DOEs mainly is done within the so-called Inverse Fourier Transform Algorithm (IFTA)

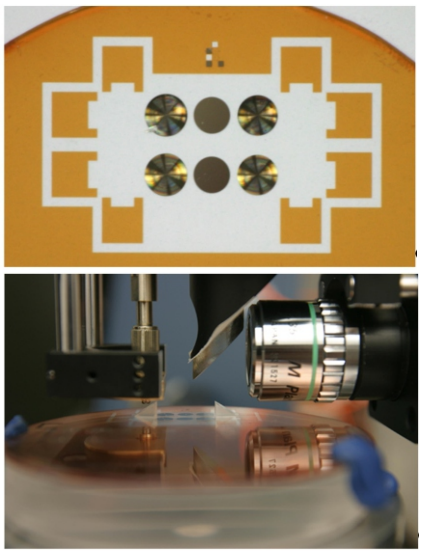
Possible use:

- combination of fluidic, biomedical and optical functionalities in complex MEMS devices → „lab-on-a-chip"-approach
- optical interconnects for security applications or information technology



Optical setups under investigation:
a) purely diffractive, b) combined and c) refractive systems

Raytrace results of a refractive systeme showing unwanted diffraction orders



Realized diffractive element and its optical characterization

Department of Mechanical Engineering
Institute of Micro- and Nanotechnologies
FG Technische Optik
Prof. S. Sinzinger

Phone +49 3677 69-2490
Fax +49 3677 69-1281
stefan.sinzinger@tu-ilmenau.de
www.tu-ilmenau.de/optik