MICRO-627 **Optical Design**

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Cursus	Sem.	Type
Photonics		Obl.

Language of teaching	English
Credits	2
Session	
Exam	Written & Oral
Workload	60h
Hours	**40**
Courses	20
Exercises	20
Number of positions	**16**

Frequency

Only this year

Remark

Block course, one week from September 2 to 6, 2019 - Registration at edpo@epfl.ch

Summary

The course is designed for scientists who want to acquire knowledge and expertise in optics and optical design and is relevant to practitioners in a broad range of fields. The main focus of the course is the layout and optimization of optical imaging systems using the optical design software Zemax.

Content

Introduction - optical systems Optical modeling, paraxial optics, raytrace, lenses, materials, optical systems, model, ray sets, pupil, vignetting, imaging, etendue, system complexity
Introduction into Zemax Basic handling
Aberrations I Ray aberrations, expansions, representations, primary aberrations
Aberrations II Wave aberrations, Rayleigh and Marechal criteria, Zernike coefficients, measurement
Aberrations III PSF, Strehl, MTF
Optimization Basic principles, correction process, constraints, bending, initial systems, global methods, lens splitting, lens removal, burried surfaces
Correction methods I Structure, symmetry, stop position, telecentricity, retrofocus, telesystem
Correction methods II Correction of primary aberrations, aplanatic surfaces, higher orders, wide field setups, vignetting
Chromatical correction Dispersion, partial dispersion, axial chromatical aberration, achromatization, classical achromate setup, negative, convergent light, aplanatic, apochromatic correction, miscellaneous
Simple systems Single lens, 4f systems, endoscopes, relays, eyepieces, scan lenses
Mirror systems and telescopes Telescopes, setup and formulas, reflecting telescopes, catadioptric sytems
Camera systems Overview, system classification, distinctive optical design features, examples
Field flattening Introduction, Petzval theorem, correction of field curvature, examples
Aspheres Surface types, Forbes approach, spherical correction, optimal location of aspheres, miscellaneous

Keywords

Optical system and lens design
Ray tracing with Zemax

Learning Prerequisites

Required courses

Basic knowldege on optics

Learning Outcomes

By the end of the course, the student must be able to:

- Choose optical design method for selected problems
- Specify critical design parameters for optical system
- Analyze optical systems
- Predict performance for imaging systems
- Judge quality of optical designs

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use a work methodology appropriate to the task.
- Continue to work through difficulties or initial failure to find optimal solutions.
- Demonstrate the capacity for critical thinking
- Access and evaluate appropriate sources of information.

Resources

Bibliography

Herbert Gross: Handbook of Optical Systems, Vol. 1-5, Wiley VCH, 2005