

Major Unit - Optical Engineering (2 ECTS) RADMEP/ UJM semester 3

Course instructor: Arnaud Meyer / Language of instruction: English

Overview

From classical applications, such as telescopes, microscope objectives or camera lenses, to the more modern smartphone camera lenses or VR headsets, imaging systems are ubiquitous in both everyday life and scientific applications. Whether to design an experiment or as the object of research, knowledge and practice of optical design is not only part of the expected skills of a any student in the optical field, they are also an asset in order to fully understand and optimize such optical systems. This set of lectures and exercises aims to provide with the basic knowledge and concepts related to optical systems : from the basic definitions and conventions, to core parameters such as focal length, pupil, aperture and field. In addition to the classroom lectures and exercises, a set of lab sessions using the software Zemax OpticStudio aims to provide students with a practical experience on a professional optical design software, enabling more complex tasks such as analysis and optimization of the quality of optical systems. From the basic skills acquired in this course, students will be able to follow up on courses involving more advanced concepts, such as study of optical aberrations.

Learning outcomes

On successful completion of this course, students should have the skills and knowledge to:

- Know theoretical basis and conditions of use of geometrical optics;
- Modelize and simulate behavior of simple optical systems;
- Identify and evaluate the main parameters of an optical system.

The lab sessions using the software Zemax OpticStudio will focus on the following skills:

- Know and use basic functions and commands of Zemax OpticStudio;
- Define, simulate and analyze simple optical systems;
- Manipulate materials and polychromatic functionalities;
- Optimize parameters of an optical system using built-in tools.

Contents

- Theoretical framework of optical engineering, bases of geometrical optics
- Behavior of single rays: objects and images, ray tracing
- Focal length and power of an optical system, Aperture and field of an optical system
- Lab session 1: Defining and simulating an optical system in Zemax OpticStudio
- Lab session 2: Material and polychromatic functionalities in Zemax OpticStudio
- Lab session 3: Optimization of the quality of optical systems in Zemax OpticStudio

Teaching methods

- Lectures and exercises : 12 hours
- Zemax OpticStudio lab sessions: 12 hours

Study materials

- E. Hecht, "Optics", Pearson (2015)
- M. Katz, "Introduction to Geometrical Optics", WSPC (2002)
- H. Gagnaire, "Optique Géométrique et Physique", Casteilla (2006)
- JP. Parisot, P. Segonds, S. Le Boiteux, "Cours de physique: optique", Dunod (1997)

Assumed knowledge

- Bases of geometrical optics

Evaluation criteria

- For lectures and exercises: written exam
- For Zemax OpticStudio lab sessions : computer exam