MICRO-567

# Optical waves propagation

Psaltis Demetri

| Cursus | Sem. | Type |
|---|---|---|
| Advanced Manufacturing | | Obl. |
| Bioengineering | MA1, MA3 | Opt. |
| Electrical and Electronical Engineering | MA1, MA3 | Opt. |
| Microtechnics | MA1, MA3 | Opt. |
| Photonics | | Obl. |

| | |
|---|---|
| Language of teaching | English |
| Credits | 3 |
| Session | Winter |
| Semester | Fall |
| Exam | Written |
| Workload | 90h |
| Weeks | 14 |
| **Hours** | **3 weekly** |
| Courses | 2 weekly |
| Exercises | 1 weekly |
| **Number of positions** | |

## Summary

Give a tool for the treatment of electromagnetic wave propagation in linear and nonlinear media.

## Content

1. From Maxwell's equation to beam propagation methods (BPM)
2. Near field. Propagation of plane waves, Gaussian beams, periodic structures and non-diffracting beams.
3. Relationship to classical diffraction integrals (Fresnel, Fraunhofer, Sommerfeld (paraxial / non paraxial BPM))
4. Thin transparencies, lenses, imaging
5. Imaging systems, Point Spread Function (PSF)
6. Optical resolution, confocal and superresolution microscopy techniques. Rotating beams, vortices, helical beams
7. Waveguides
8. Optical fibers
9. Phase conjugation, holography
10. Volume holograms / grating
11. Nonlinear Optics and nonlinear BPM

## Learning Prerequisites

### Recommended courses

Fundamentals of optic and electromagnetism

## Learning Outcomes

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

- Analyze optical systems
- Design imaging systems

## Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.

## Teaching methods

Ex cathedra, exercises and simulations using MATLAB

## Assessment methods

Exercises, simulations using MATLAB and written exam

## Supervision

| | |
|---|---|
| Assistants | Yes |

## Resources

### Bibliography

Introduction to Fourier Optics, J.W. Goodman, Roberts & Company Publishers; 3rd Revised edition (2005)

### Ressources en bibliothèque

- Introduction to Fourier Optics / Goodman

### Websites

- http://lo.epfl.ch

### Moodle Link

- http://moodle.epfl.ch