



Program of LABORATORY OF OPTICAL SYSTEMS DESIGN

Prof. E. Fazio A.A. 2017-2018

Electromagnetic waves and light

Electromagnetic waves. Types and spectrum of EM waves. Light propagation. Phase velocity. Refractive index. Sellmeier equation and Abbe table for glasses. Fermat "minimal action" principle and Snell Law. Fresnel coefficients. Lightning quantities.

Colour

Response of the human eye to light. Photopic and scotopic regimes. Tristimulus space. Fundamental equations of colorimetry. Colorimetric transformations. Colour system CIE. Colour coordinates and pantones.

Geometric Optics

Reflection and mirrors. Refraction and dioptric surfaces. Thin lenses. Centred optical systems. Thick lenses. ABCD matrices. Main matrices of refractive systems. The thick lens with the matrices. Main plans of the thick lens. Spherical lens (ball): characteristics. Design of optical systems with ABCD matrices. Exercises. Chromatic aberration of a thin lens. Acoustic doublet. Main aberrations. Design of optical systems using CAD.

Interference, propagation and diffraction of waves

Interference and diffraction, resonance and resonators, matrix formalism for thin-layer interference, multilayer systems, mirror and filter design.

Nanooptics

Problems of light propagation in the presence of nanostructured materials. Effective optical parameters. Diffraction and numerical codes.

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- **Prerequisites:** the students of the course are supposed to already know the basic principles of optics and of the EM wave propagation
 - **Prerequisites:** the students should have access to a personal computer (preferably a notebook)
 - **Direct explanations:** for an explanation meeting on unclear points send an e-mail to eugenio.fazio@uniroma1.it (write RICEVIMENTO in the object)
 - **Information:** <http://www.sbai.uniroma1.it/node/5747/edit>
 - **Books:**
 - F. Gori, *Elementi di Ottica*, ed. Accademica
 - P. Mazzoldi/M.Nigro/C. Voci, *Elementi di Fisica-Onde*, EdISES
 - K.D. Møller, *Optics*, Springer
 - A. Yariv, *Quantum Electronics*, John Wiley & Sons
 - Wyszecki & Stiles, *Color Science*, Wiley Classics Library
 - H. Zappe, *Fundamentals of Micro-Optics*, Cambridge University Press
 - The final exam will be performed by implementing the design of an optical system
 - **Thesis:** topics for stages are available on request. Please contact the professor for details.
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