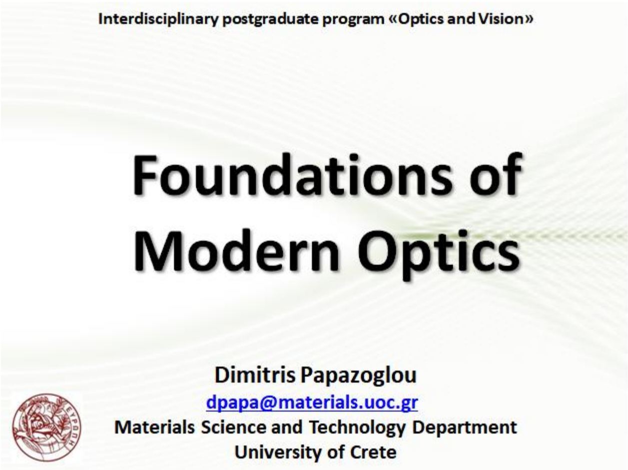
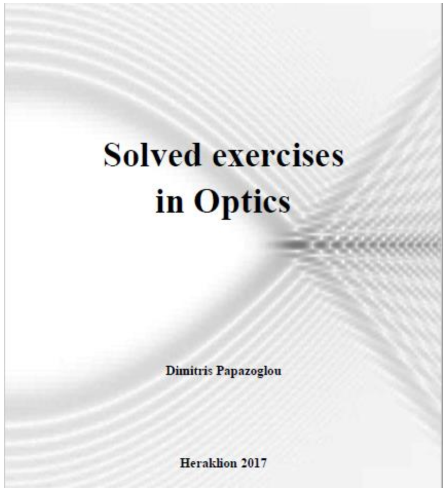
Bibliography: Foundations of Modern Optics



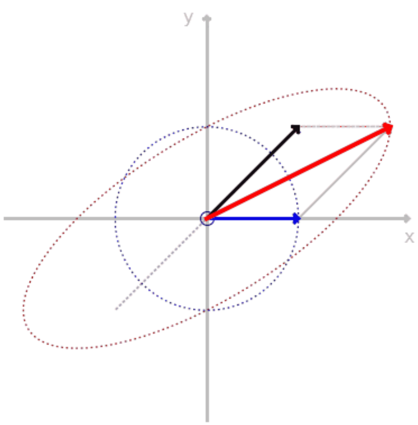


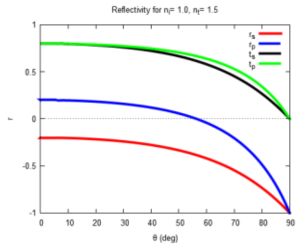
Foundations of Modern Optics
Dimitris Papazoglou

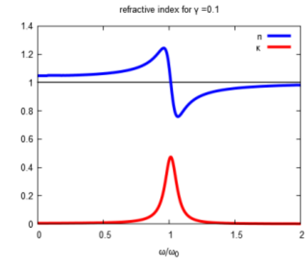
Lecture notes

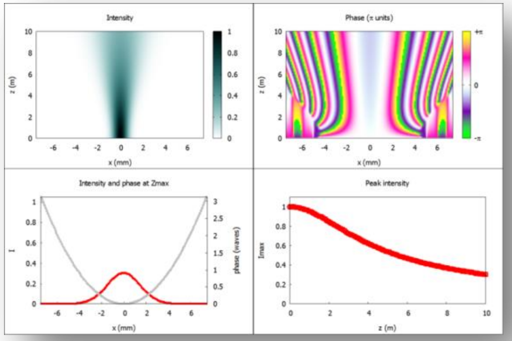
Solved exercises

- Numerical Examples in wxMaxima



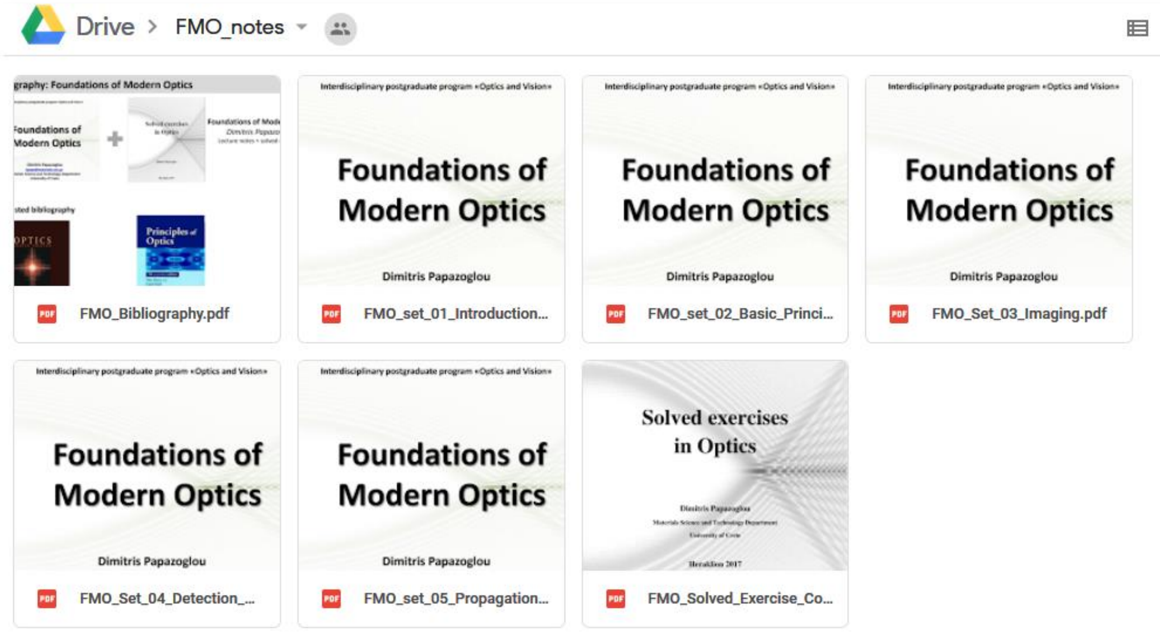




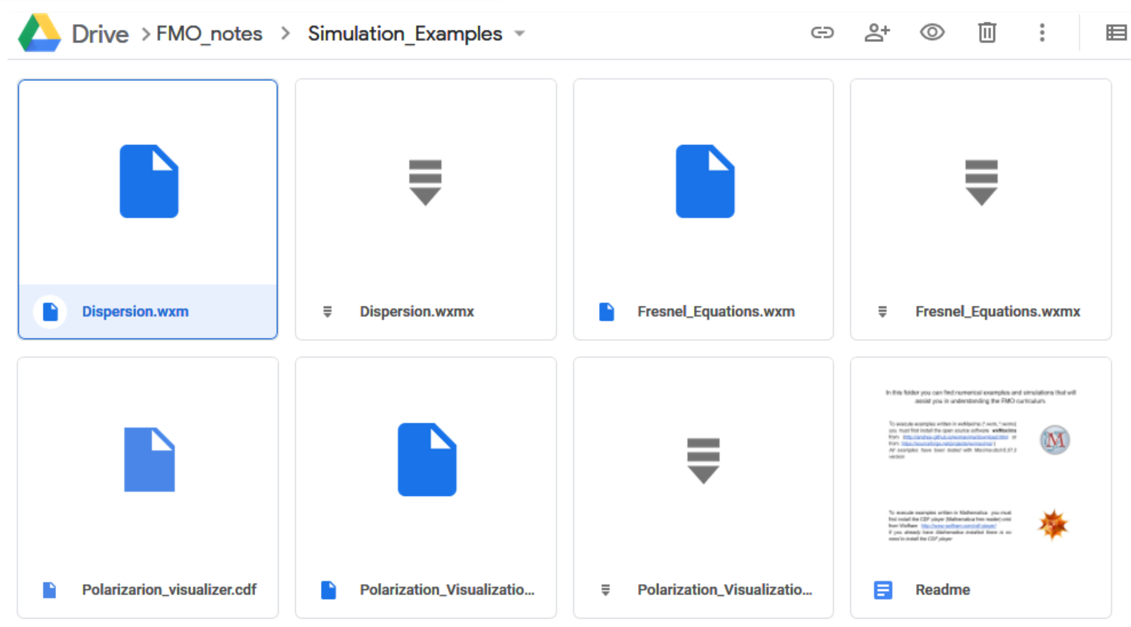


***wP* (wave propagator)**

Repository



Drive > FMO_notes
FMO_Bibliography.pdf
FMO_set_01_Introduction...
FMO_set_02_Basic_Princi...
FMO_Set_03_Imaging.pdf
FMO_Set_04_Detection_...
FMO_set_05_Propagation...
FMO_Solved_Exercise_Co...
Foundations of Modern Optics
Dimitris Papazoglou
Solved exercises in Optics



Drive > FMO_notes > Simulation_Examples
Dispersion.wxm
Dispersion.wxmx
Fresnel_Equations.wxm
Fresnel_Equations.wxmx
Polarizarion_visualizer.cdf
Polarization_Visualizatio...
Polarization_Visualizatio...
Readme

Weekly sets and Tests

Final Grade: 60 % Projects, 40% Final Exams

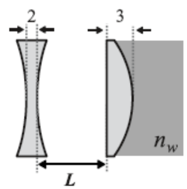
Projects Grade: 40 % Sets (Homework), 60% 15 min Tests

University of Crete, Interdisciplinary MSc "Vision and Optics"
Project Exercises in Foundations of Modern Optics

Exercises

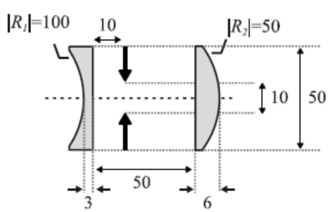
1) Calculate the distance L so that the optical system shown in the figure is telescopic. What is the angular magnification in this case? The optical power of the lenses that comprise the optical system (in air) is -20 m^{-1} and 5 m^{-1} respectively.

(all distances are in mm, the first lens is bi-concave, with the same radii of curvature, all lenses are made of glass of refractive index n = 3/2, and refractive index of water n = 4/3).

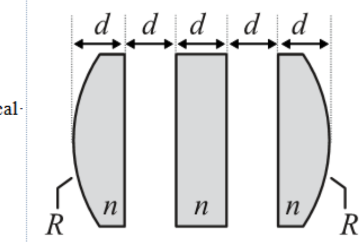


2) Estimate the effective focal length, the F-Number (#F), as well as the back focal length (BFL), of the optical system shown in the figure.

(assume an object at infinity, all distances are in mm, all lenses are made of glass of refractive index n = 3/2)

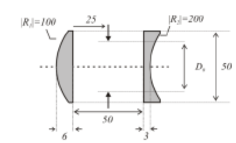


Estimate the optical power of the optical system



Solved examples

1) Calculate the diameter of the variable iris of the optical system shown in the figure so that #F ≈ 8. *(assume an object at infinity, all distances are in mm, all lenses are made of glass of refractive index n = 3/2).*



Solution

We define the following: $P_1 = \frac{n-1}{R_1}, P_2 = \frac{1-n}{R_2}, D_1 = \frac{d_1}{n}, D_2 = \frac{d_2}{n}, L' = L + D_1 + D_2,$

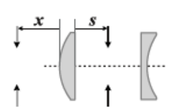
$$L = 50\,mm,\ d_1 = 6\,mm,\ d_2 = 3\,mm, s = 25\,mm$$

The total matrix that describes the system is:

$$M = \begin{pmatrix} 1 & 0 \\ -P_2 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & L' \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 \\ -P_1 & 1 \end{pmatrix} = \begin{pmatrix} 1 - L'P_1 & L' \\ -(P_1 + P_2 - L'P_1P_2) & 1 - L'P_2 \end{pmatrix} = \begin{pmatrix} 0.72 & 56\ mm \\ -3.2\,m^{-1} & 1.14 \end{pmatrix}$$

Thus the effective focal length of the system is: $f = f' = \frac{1}{P_1 + P_2 - L'P_1P_2} = 312.5\,mm$

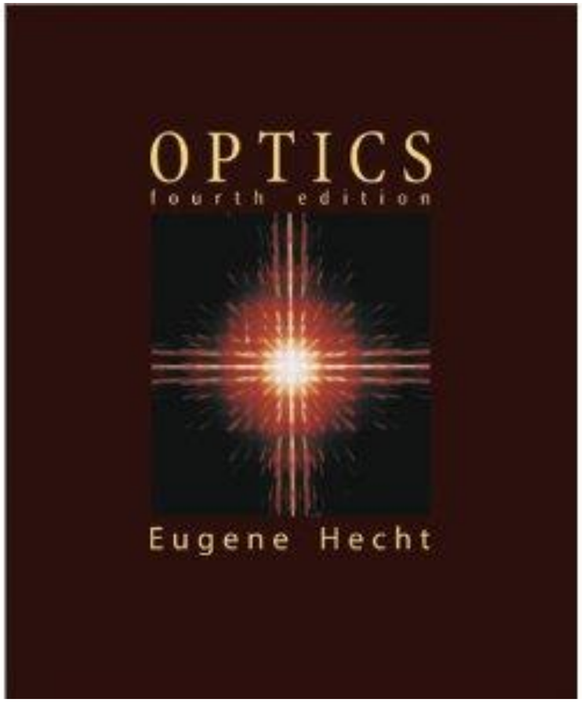
The $\#F$ of an optical system is defined as the ratio of the effective focal distance to the diameter of the entrance pupil $\#F \equiv f / D_{in}$. In order to estimate the diameter of the entrance pupil we must first identify the aperture stop of the system. To do this we must find the position of the image of the iris, and the 2[nd] lens, in the object space. Assuming that this image is located at a distance x from the first lens, while the aperture of interest is located at a distance s from the 1[st] lens we can write:



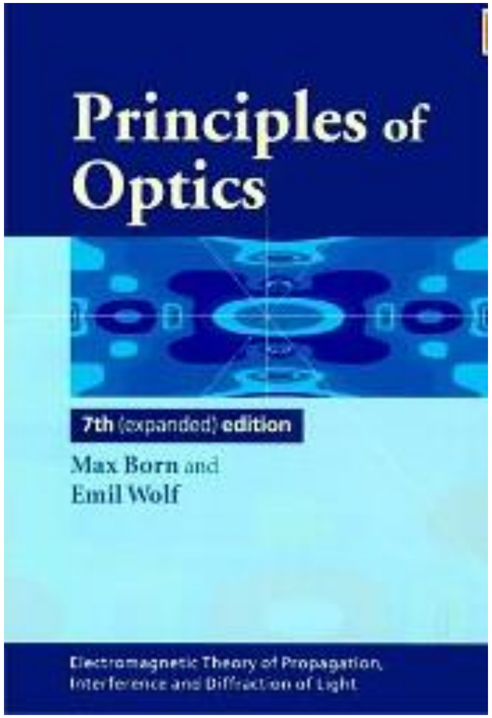
$$M_d = \begin{pmatrix} 1 & s \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & D_1 \\ 0 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & 0 \\ -P_1 & 1 \end{pmatrix} \cdot \begin{pmatrix} 1 & x \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 1-(s+D_1)P_1 & s + D_1 + x[1-(s+D_1)P_1] \\ -P_1 & 1 - xP_1 \end{pmatrix}$$

Bibliography: Foundations of Modern Optics

Suggested bibliography



Optics
Eugene Hecht



Principles of Optics
Max Born , Emil Wolf