

Read Chapters 7-8 in Pedrotti(s)

1. Find the phase difference between light that is reflected normally (angle of incidence $\theta_0 = 0$) from the inner and from the outer surfaces of a film of magnesium fluoride (MgF, $n = 1.38$) deposited on the surface of a lens ($n = 1.5$) if the film thickness is $t = 100$ nm for violet light with $\lambda_0 = 400$ nm and for red light with $\lambda_0 = 700$ nm; assume that the indices are identical for both wavelengths.
2. Consider a two-aperture experiment with $d = 0.1$ mm and the distance to the observation screen $L = 500$ mm; compute the distance between adjacent maxima on the screen for $\lambda_0 = 400$ nm and $\lambda_0 = 700$ nm.
3. Determine the number of fringe cycles per millimeter if the angle between two plane waves of light is 5° and $\lambda_0 = 632.8$ nm.
4. Consider a two-aperture experiment with the following characteristics: $\lambda_0 = 550$ nm, $d = 3.3$ mm, $L = 3$ m:
 - (a) Calculate the fringe spacing
 - (b) Place a sheet of glass with plane-parallel faces and thickness $\tau = 10$ μ m in front of one of the apertures; determine the direction of displacement of the fringes and derive the formula giving the relationship for their displacement
 - (c) In part (b), if the fringes are displaced by $\Delta x = 4.73$ mm, determine the refractive index of the glass
 - (d) (optional, bonus) if the error in the measurement of the fringe displacement is ± 0.01 mm, determine the error in the measurement of n .
5. If one mirror of a Michelson interferometer is translated by some distance, 200 fringes are observed to pass a specific point in the field of view. If $\lambda_0 = 624$ nm, determine the translation distance of the mirror.
6. A mercury source is positioned behind a bandpass filter that removes the ultraviolet portion and transmits only green light with $\lambda = 546.1$ nm. The light is allowed to pass through a narrow horizontal slit positioned 1 mm above a flat mirror surface. Describe both qualitatively and quantitatively what appears on a screen located 1 m away from the slit.