Optics, Spring 2016

Exercise 8, 22.3.2016

1. Superposition of waves (Ch. 9.1)

Assuming that $\bar{E}_1(\bar{r},t) = \bar{E}_1(\bar{r})\exp[-i\omega t]$ and $\bar{E}_2(\bar{r},t) = \bar{E}_2(\bar{r})\exp[-i\omega t]$, where the wavefront shapes are not explicitly specified, show that the interference term is $I_{12} = \frac{1}{2}\left(\bar{E}_1\bar{E}_2^* + \bar{E}_2\bar{E}_1^*\right)$. Show that for plane waves the interference term reduces to $I_{12} = \bar{E}_1 \cdot \bar{E}_2 \cos\delta$.

2. Newton rings (Ch. 9.4)

If the 20th bright Newton ring has a radius of 1 cm, determine the radius of curvature of the lens (λ= 500 nm).

3. Michelson interferometer (Ch. 9.4)

Consider the interference pattern of a Michelson interferometer arising from two beams of equal flux density. Compute the half width of the fringes. What is the separation in δ between the adjacent maxima? What then is the finesse?

4. Antireflection coatings (Ch. 9.7)

Determine the refractive index and thickness of a film to be deposited on a glass surface (n = 1.54) such that no normally incident light is reflected.