Optical Science & Engineering 26/08/2014

$\Theta\epsilon\mu\alpha$ 1

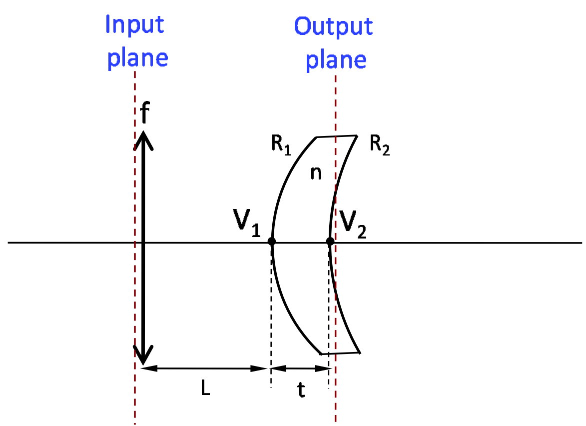

Figure 1: System of a thin and a thick lens. The input and output planes are shown.

(α)

$$\begin{pmatrix} A & B \\ C & D \end{pmatrix} = \begin{pmatrix} 0.7200 & 13.166\,mm \\ -0.0231\,mm^{-1} & 0.9665 \end{pmatrix}$$

(β)

$$B_{eq} = 0 \longrightarrow x = 63.3897\,mm \qquad \text{real image, inverted} \quad A_{eq} = m = -0.7443$$

$$\begin{aligned} x &= 63.3897\,mm \\ m &= -0.7443 \end{aligned}$$

(γ)

$$p = \frac{D}{C} = -41.83380\,mm$$

$$
\begin{aligned}
q &= -\frac{A}{C} = 31.1688\,mm \\
r = v &= \frac{D-1}{C} = 1.4520\,mm \\
s = w &= \frac{1-A}{C} = -12.1212,mm \\
f_1 &= \frac{1}{C} = -43.29\,mm \\
f_2 &= -\frac{1}{C} = +43.29\,mm
\end{aligned}
$$

(δ)

$$s = 101.4520\,mm, \qquad s' = 75.5108\,mm, (x = 75.51 - 12.1212 = 63.3896\,mm) \text{ and } m = -\frac{s'}{s} = -0.7443$$

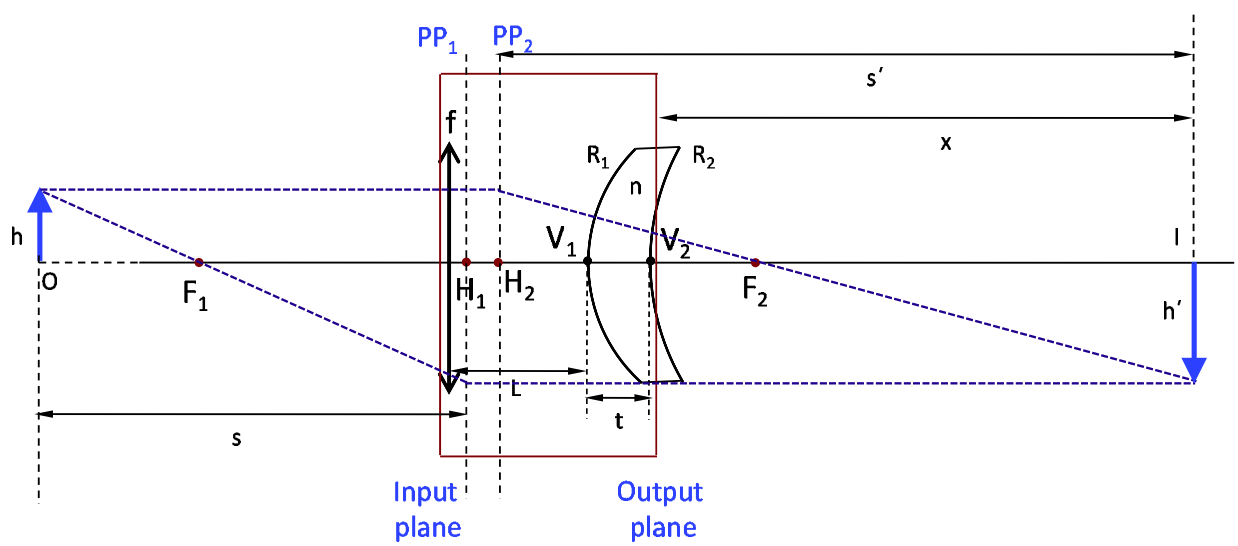

Figure 2: Ray diagram using the cardinal points of the thin-thick lenses system.

<u>$\Theta\epsilon\mu\alpha$ 2</u>

(α)

$$\Phi_v = L A_s \pi \sin^2(\theta)$$

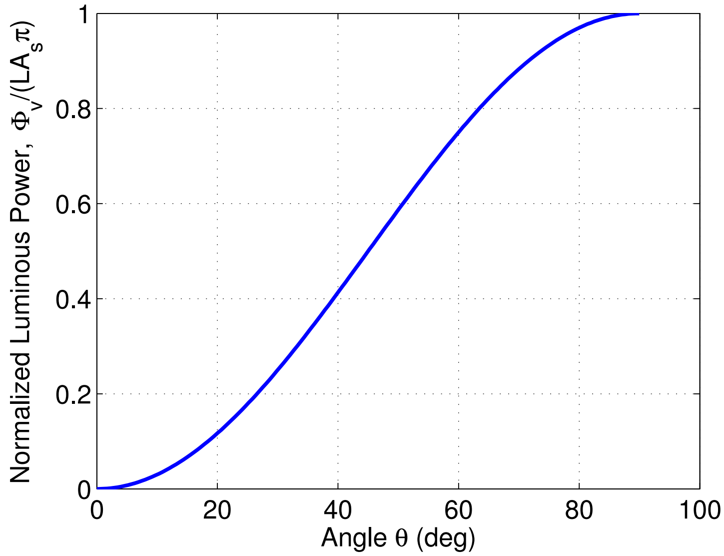

Figure 3: Normalized luminous power emiited as a function on angle θ.

(β)

$$M_v = L\pi = \pi 2 \times 10^4 \, lumen/m^2$$

(γ)

$$\Phi_e = 20.44 \, Watts$$

$\underline{\Theta\epsilon\mu\alpha\ \ 3}$

(α)

$$\Delta x_m = m\frac{L}{d}(\lambda_{0r} - \lambda_{0v}) = m0.2(cm)$$

(β)

$$\begin{aligned} x_m^v &= \frac{L}{d}(m + 132.7125)\lambda_{0v} \\ x_m^r &= \frac{L}{d}(m + 86.048333)\lambda_{0r} \\ \Delta x_v &= 132.7125 \ \ \text{peaks} \ \ \text{or} \ \ 530.85\, mm \\ \Delta x_r &= 86.048333 \ \ \text{peaks} \ \ \text{or} \ \ 516.29\, mm \end{aligned}$$

$\underline{\Theta\epsilon\mu\alpha\ \ 4}$

(α)

$$I(x) = I_0 \, \frac{\sin^2\left[k_0\frac{d}{2}(\frac{x}{L} = \sin\theta)\right]}{\left[k_0\frac{d}{2}\frac{x}{L}\right]^2}$$

$$d = 58.5929\mu m$$

(β)

$$\theta' = 4.657\, deg$$

(γ)

$$\begin{aligned} x_m(air) &= m10.8 \ \ (mm) \\ x_m(water) &= m8.12 \ \ (mm) \end{aligned}$$

Maxima (except central) can be found from the numerical solution of the following equation:

$$\tan\left(\pi\frac{d}{\lambda_0 L}x\right) = \pi\frac{d}{\lambda_0 L}x$$