A1SPHASS

Spherical aberration of a single refracting surface for two different values of n.
Definiton: Longitudinal spherical Aberration L.S.A. = xi - xisa.
We want to see if a small change in the refraction index may change LSA from a negative to a positve value.
Calculation of image point xi and corrected image point xisa
All length in cm.

1a. Calculation of xi for the paraxial case using n1.

$$xi1 := \frac{1}{\frac{n1 - 1}{n1 \cdot r} + \frac{1}{n1 \cdot xo}}$$

Input Data $ro \equiv 2 \quad r \equiv 10 \quad xo \equiv -30 \quad n1 \equiv 2.05$

$$xi1 = 28.605$$

1b. Calculation of xisa(xo) for the corrected case of L.S.A.

$$xisa1 := \frac{n1}{\left(\frac{n1 - 1}{r}\right) + \frac{1}{xo} + \frac{n1 - 1}{n1^2} \cdot \frac{ro^2}{2} \cdot \left[\left(\frac{1}{r} - \frac{1}{xo}\right)^2 \cdot \left(\frac{1}{r} - \frac{n1 + 1}{xo}\right)\right]}$$

1c. L.S.A.

$$xisa1 = 27.907$$

$$LSA := xi1 - xisa1$$

$$LSA = 0.698$$

2a. Calculation of xi for the paraxial case using n2

$$xi2 := \frac{1}{\frac{n2 - 1}{n2 \cdot r} + \frac{1}{n2 \cdot xo}}$$

Input Data $ro \equiv 2 \quad r \equiv 10 \quad xo \equiv -30 \quad n2 \equiv 2.5$

$$xi2 = 21.429$$

2b. Calculation of xisa(xo) for the corrected case of L.S.A.

$$xisa2 := \frac{n2}{\left(\frac{n2 - 1}{r}\right) + \frac{1}{xo} + \frac{n2 - 1}{n2^2} \cdot \frac{ro^2}{2} \cdot \left[\left(\frac{1}{r} - \frac{1}{xo}\right)^2 \cdot \left(\frac{1}{r} - \frac{n2 + 1}{xo}\right)\right]}$$

2c. L.S.A.

$$xisa2 = 21.094$$

$$LSA := xi2 - xisa2$$

$$LSA = 0.334$$