

N8CWGK

Dielectric circular waveguide, determination of k

1. Check for positive values of argument for J0, J1 and K0, K1

Since $x = (\gamma a)^2$ and $y = (\beta a)^2$

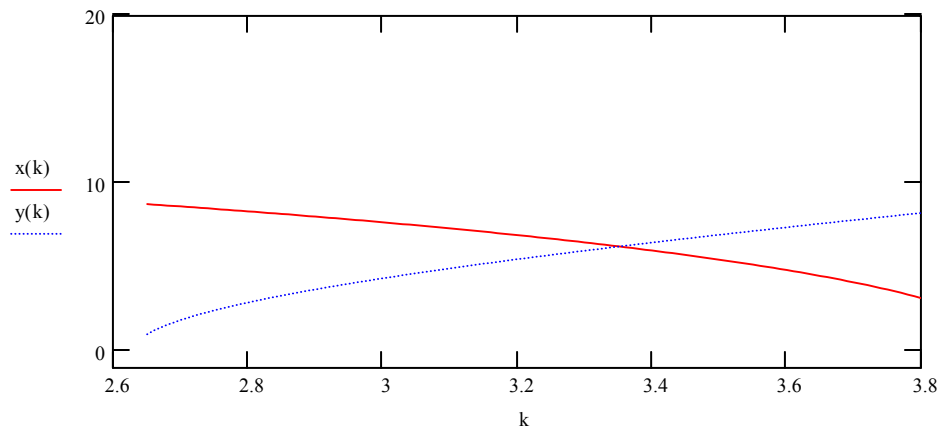
we have for the square of the arguments of the Bessel functions

$$xx(k) := a^2 \cdot \left(\frac{n1^2 \cdot 4 \cdot \pi^2}{\lambda^2} - k^2 \right) \quad yy(k) := a^2 \cdot \left(k^2 - \frac{no^2 \cdot 4 \cdot \pi^2}{\lambda^2} \right)$$

and for the arguments

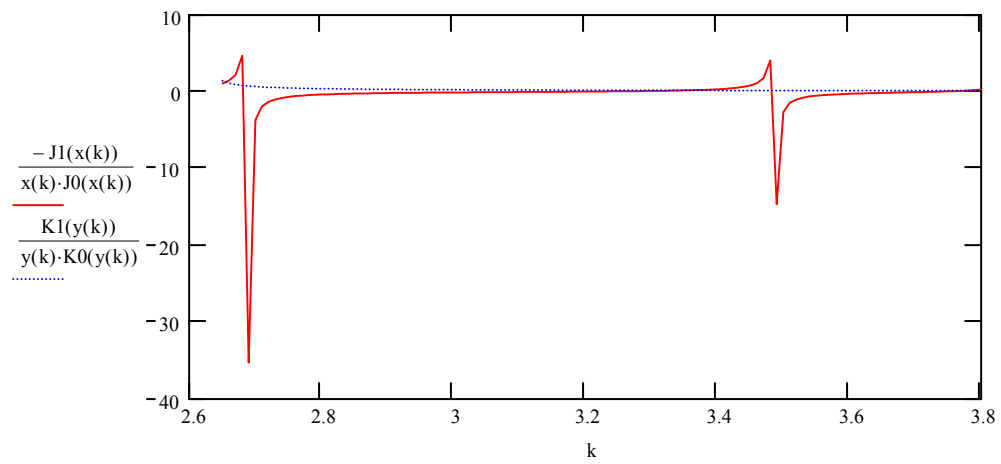
$$x(k) := \sqrt{xx(k)} \quad y(k) := \sqrt{yy(k)}$$

We try the interval $k := 2.65, 2.66 \dots 3.8$ and make a graph



Input Data: radius, wavelength and refractive indices

$$a \equiv 3 \quad \lambda \equiv 2.39 \quad n1 \equiv 1.5 \quad no \equiv 1$$



From graph: First intersection

$$kk := 2.66$$

$$\lambda\lambda := \frac{2 \cdot \pi}{kk}$$

$$\lambda\lambda = 2.362$$

Side calculation. If

$$\lambda\lambda\lambda := 8 \quad \text{we get}$$

$$kkk := 2 \cdot \frac{\pi}{\lambda\lambda\lambda}$$

and

$$kkk = 0.785$$