Fiber Acceptance Angle

Light propagates down an optical fiber by repeated TIR at the sides of the fiber core (this is the simple, ray-based model). An important quantity is the acceptance angle of the fiber. This angle is the largest angle of incidence at the end of the fiber that will propagate by TIR down the length of the fiber.

The fiber core is modeled as a cylinder of index 1.6. In order to protect the fiber core from dirt and damage and to allow it to be handled and packaged in a cable, the central core is surrounded by a glass cladding layer of lower index. What is the acceptance angle if the cladding index is 1.55?

Solution

\[ \sin \theta_A = n_{FIBER} \sin \theta'_A \]

\[ \theta'_A = 90 - \theta_C \]

\[ \sin \theta_C = \frac{n_{CLADDING}}{n_{FIBER}} \]

\[ n_{FIBER} = 1.6 \quad n_{CLADDING} = 1.55 \]

\[ \theta_C = 75.64^\circ \quad \theta'_A = 14.36^\circ \]

\[ \theta_A = 23.38^\circ \]