SKU-Fiber Optics

SKU-Fiber Optics possess all the fundamental topics of fiber optics communication. In this software we will study the fundamentals and applications of single mode, multi mode, dispersion, attenuation, scattering, various modes in different types of fiber, different types of fiber cables, power and loss budgets and so on.

Topics covered in SKU-Fiber Optics

Electromagnetic Spectrum & Optical Spectral Bands

Topics Covered: Electromagnetic Spectrum and Optical Spectral Bands.

Nature of Light

Topics Covered: Electromagnetic Wave Representation, Polarization, Polarizer, Faraday Rotator and Birefringent Crystal.

Basic Laws and Definition

Topics Covered: Refractive Index, Laws of refraction and reflection and Snell's Law.

Ray Theory Transmission

Topics Covered: Total Internal Reflection (TIR), Critical Angle, Acceptance angle, Numerical Aperture and Skew Rays.

Mode Theory for Optical Propagation

Topics Covered: Modes in planner guides, Phase and group velocity, Modes in Cylindrical Fiber and Mode Coupling.

Optical Fiber Types

Topics Covered: Single Mode Fibers, Multimode fibers, Plastic Clad Fibers, Comparison of single and multimode fiber.

Specialty Fiber

Topics Covered: Bend Insensitive Fiber, Termination Fiber and Polarization Preserving Fiber.

Signal Degradation in Optical Fiber

Topics Covered: Absorption, Attenuation, Scattering Losses and Bending Losses.

Signal Distortion in Optical Fiber

Topics Covered: Intermodal Delay, Chromatic Dispersion and Polarization Mode Dispersion (PMD).

Fiber Material

Topics Covered: Glass Fiber and Plastic Optical Fiber, Light Propagation in Optical Fiber and Fiber Fabrication.

Fiber Cable Structure

Topics Covered: Simplex Fiber Cables, Duplex Fiber Cables, Distribution Fiber Cables, Ribbon Cables, Loose Tube Fiber Cables, Breakout Fiber Cables, Armoured Fiber Cables and Submarine Fiber Cables.

Optical Fiber Joints

Topics Covered: Fiber Optics Rotatory Joints(FORJ), Single Channel FORJ and Dual Channel FORJ.

Optical Fiber Splices

Topics Covered: Fusion Splices, Mechanical Splices, Splice Loss in Fiber, Fresnel Reflection, Fiber Coupling Losses and Comparison Between Mechanical and Fusion Splice.

Optical Fiber Connectors

Topics Covered: Types of Fiber Connectors, SC Connectors, Fiber Optic Adapter and Types of Connectors and Faces.

Optical Fiber Couplers

Topics Covered: Fiber Couplers and Types of Fiber Couplers.

Optical Sources

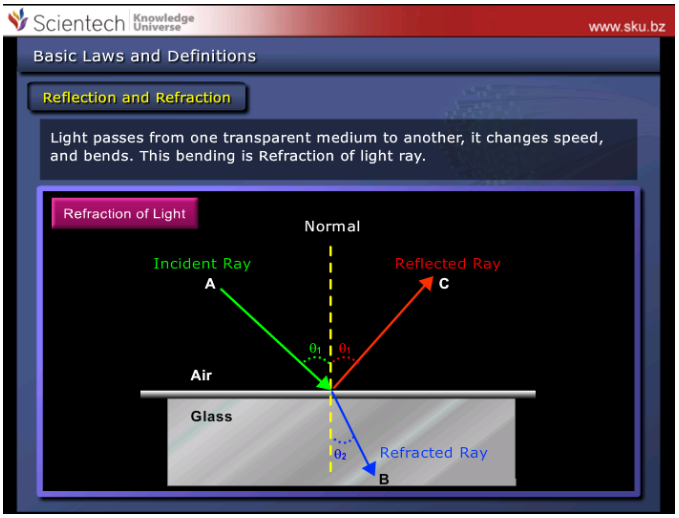
Topics Covered: Laser, principle of absorption, Spontaneous and Stimulated Emission, Pumping & Population Inversion, LED and LED Characteristics.

Optical Detectors

Topics Covered: Optical Detection Principle, Quantum Efficiency, Responsivity, p-n photodiode, p-i-n photodiode, Avalanche Photodiode, Phototransistors, Photoconductive Detectors and Detector Response Time.

Optical Fiber Amplifiers

Topics Covered: Fiber Amplifiers.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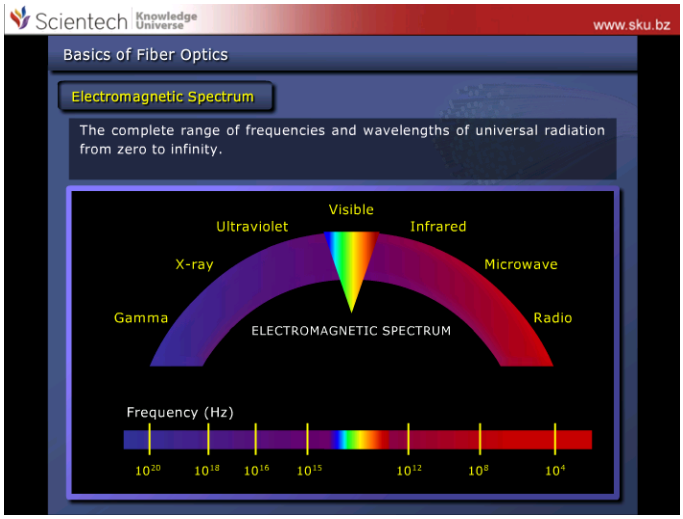
Basic Laws and Definitions
Reflection and Refraction
Light passes from one transparent medium to another, it changes speed, and bends. This bending is Refraction of light ray.
Refraction of Light
Normal
Incident Ray
A
Reflected Ray
C
θ1
θ1
Air
Glass
θ2
Refracted Ray
B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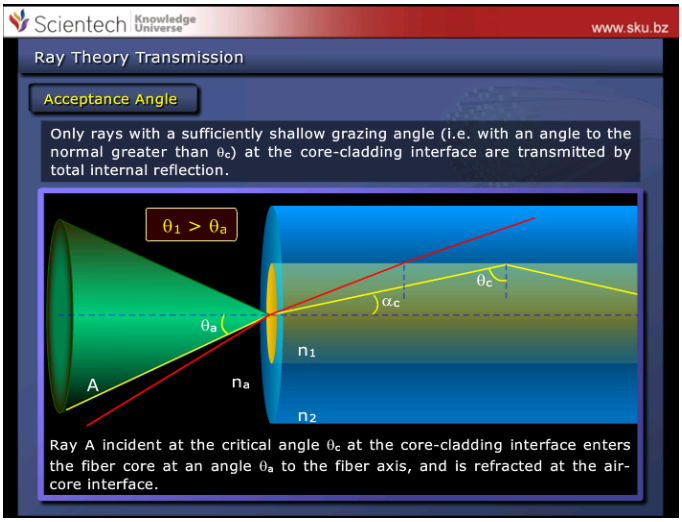
Basics of Fiber Optics
Electromagnetic Spectrum
The complete range of frequencies and wavelengths of universal radiation from zero to infinity.
Visible
Ultraviolet
Infrared
X-ray
Microwave
Gamma
Radio
ELECTROMAGNETIC SPECTRUM
Frequency (Hz)
10^20
10^18
10^16
10^15
10^12
10^8
10^4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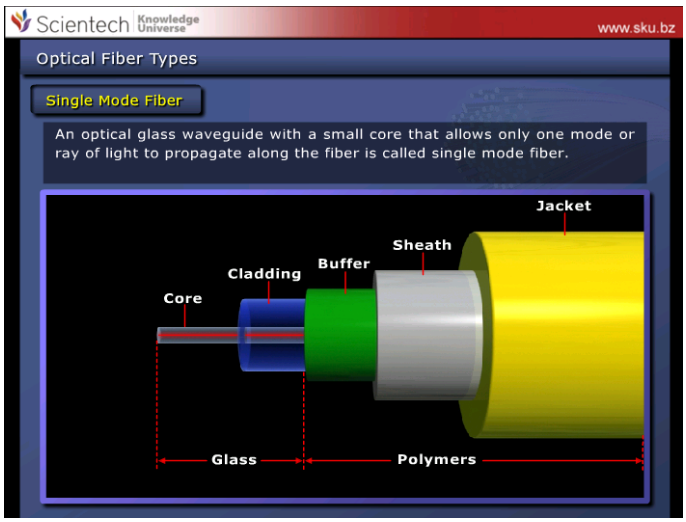
Ray Theory Transmission
Acceptance Angle
Only rays with a sufficiently shallow grazing angle (i.e. with an angle to the normal greater than θc) at the core-cladding interface are transmitted by total internal reflection.
θ1 > θa
θc
αc
θa
n1
A
na
n2
Ray A incident at the critical angle θc at the core-cladding interface enters the fiber core at an angle θa to the fiber axis, and is refracted at the air-core interface.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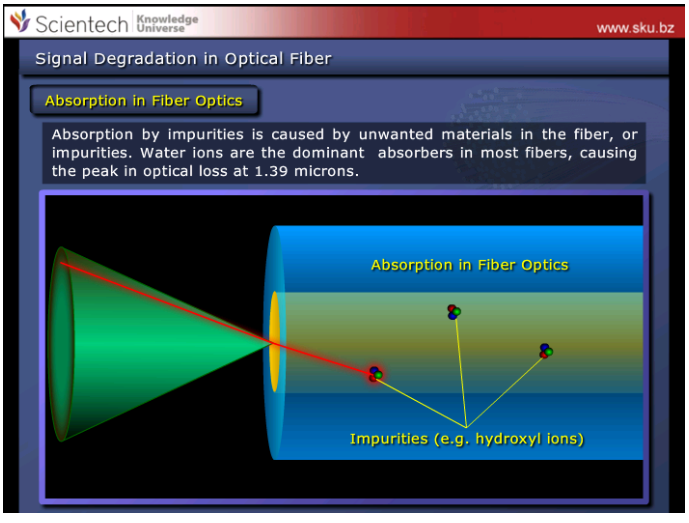
Optical Fiber Types
Single Mode Fiber
An optical glass waveguide with a small core that allows only one mode or ray of light to propagate along the fiber is called single mode fiber.
Jacket
Sheath
Buffer
Cladding
Core
Glass
Polymers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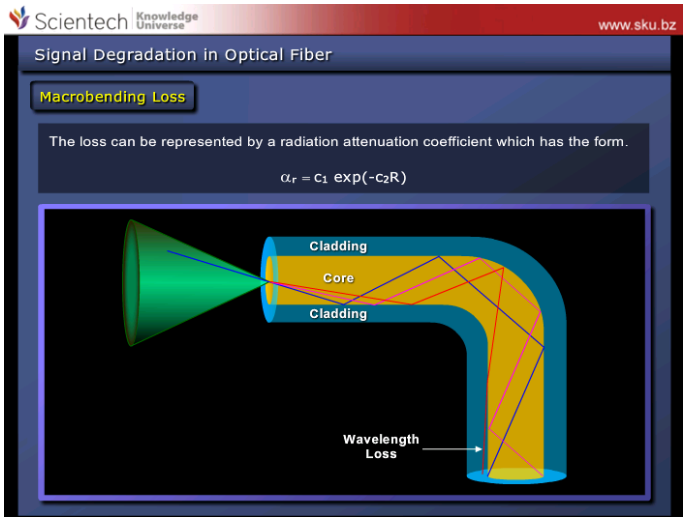
Signal Degradation in Optical Fiber
Absorption in Fiber Optics
Absorption by impurities is caused by unwanted materials in the fiber, or impurities. Water ions are the dominant absorbers in most fibers, causing the peak in optical loss at 1.39 microns.
Absorption in Fiber Optics
Impurities (e.g. hydroxyl ions)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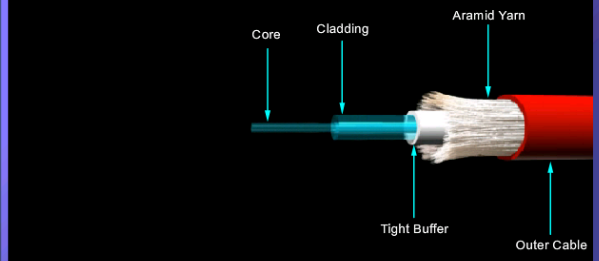
Signal Degradation in Optical Fiber
Macrobending Loss
The loss can be represented by a radiation attenuation coefficient which has the form.
αr = c1 exp(-c2R)
Cladding
Core
Cladding
Wavelength
Loss

Structure of an Optical Fiber

Simplex Fiber Cables

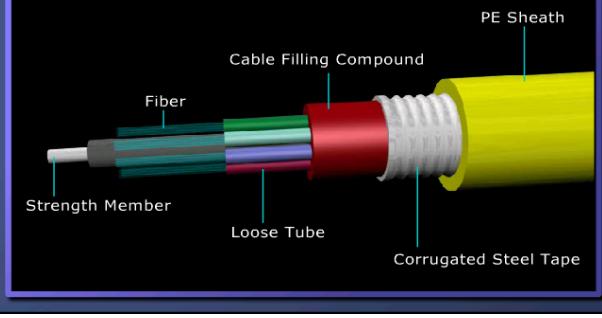
Simplex fiber cables are single cable structures with a single fiber. Simplex cable varieties include 1.6mm and 3mm jacket sizes.



Structure of an Optical Fiber

Loose Tube Fiber Cable

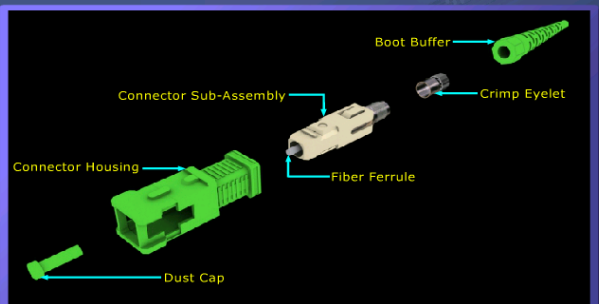
Loose tube structure isolates the fibers from the cable structure. This is a big advantage in handling thermal and other outdoor stresses that is why most loose tube fiber optic cables are built for outdoor applications.



Optical Fiber Connectors and Couplers

SC Connector

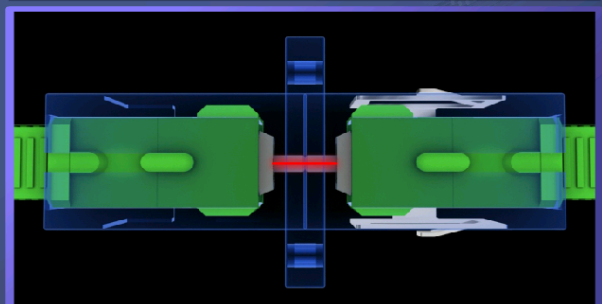
An SC connector is a push on, pull off connector with a locking tab. These are used with single mode and multimode fiber optic cables. SC connectors provide accurate alignment via their ceramic ferrules and it is low cost, simple and durable.



Optical Fiber Connectors and Couplers

Fiber Optic Adapter

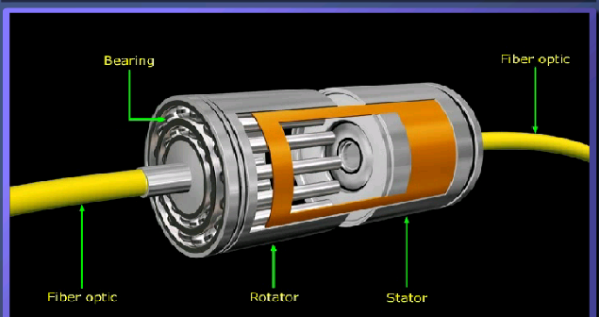
Fiber optic adapters are designed to connect two fiber optic cables together. They come in versions to connect single fibers together i.e. simplex, two fibers together i.e. duplex.



Optical Fiber Connectors and Couplers

Single Channel Rotary Joint

Single channel rotary joint (1x1 FoRJ) is the simplest version of these FoRJs. It provides a 1x1 transmission of light i.e. from 1 optical fiber to 1 optical fiber.



Optical Fiber Connectors and Couplers

Fusion Splicing

Highly accurate equipment is used to align the fiber ends. Once properly aligned the fusion splicer unit then uses an electrical arc to melt the fibers, permanently welding the two fiber ends together.