Child Porn Essay, Research Paper

Fiber Optics Research Paper

Fiber optics is a branch of optics concerning the transmission of light by means of optical fibers, which are thin strands of glass or other optically transparent materials. Optical fibers can be used to guide light–which is electromagnetic radiation in a certain frequency range–in much the same way that metal wave guides or coaxial cables can be used to guide lower-frequency electromagnetic radiation.

Optical Fiber

An optical fiber is usually circular in cross section and consists of a core and cladding. An optical fiber for communication applications is typically between about 0.1 and 0.2mm (0.004 and 0.008 in) in diameter. In order that the light waves be guided by the fiber, the core must have a higher index of refraction than the cladding. One such fiber is called a step-index fiber because the index changes abruptly at the interface between the core and the cladding. An important variation of this structure is the graded-index fiber, so called because the index of refraction decreases smoothly outward from the

center with no abrupt step.

Transmission of Light

In the step-index fiber, the light wave is guided by a process called total internal reflection. Only rays that have an angle of incidence at the core-cladding interface greater than the critical angle will be reflected back into the core and thus guided by the

fiber. Some rays follow a longer path through the fiber than do others. Thus a pulse of energy entering the fiber undergoes dispersion. This effect limits the bandwidth of the fiber and reduces the amount of information it can transmit. This undesirable feature can be partly overcome by the use of graded-index fibers of proper design.

Applications

Fiber optics is used in several areas of telecommunications. Advantages of optical fibers include their wide bandwidth, low attenuation, lightness, small cross section, and non-conductivity of electricity. In telephone systems they can provide communication

channels to customers and wideband facilities for interconnecting switching offices. Because they are non-conducting, they can be used to provide telecommunications services to locations in electrically hostile environments, such as electric power stations.

Because they are completely immune to induced currents from external electromagnetic fields, optical fibers are also useful in environments where electrical noise exists, such as hospitals and factories. Finally, their lightness makes them attractive for use in aircraft and spacecraft as well as in portable communications systems required for tactical military applications. All these properties make them desirable for interconnecting computers and other sophisticated electronic equipment.

In communication-system applications, individual fibers usually are used to guide light waves. Other applications employ bundles of fibers. One such application is the transmission of light for illumination. Fibers used for this purpose need not have the cladding or the index gradient of single-fiber light guides because the index step at the glass-air interface serves to guide the light. Another application of fiber bundles is the

transmission of images. For this application the fibers must be arranged in the bundle in a coherent fashion. By arranging the locations of the fibers at one end (the output) of the bundle in certain ways with respect to their location at the other end (the input), such functions as magnification, inversion, rotation, distortion, and scrambling of the image can be performed. Bundles of this type can be used for viewing otherwise inaccessible areas, an example being the physician’s endoscope. In order to achieve high resolution, fibers with diameters as small as 0.02 mm (0.0008 in) are used in these applications. Fiber bundles are also used in photography, spectroscopy, and image processing.