



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

AN AUTONOMOUS INSTITUTION

Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai.



UNIT – II LASER AND FIBER OPTICS

TOPIC – IX: Fiber optic sensors

One of the most exciting applications of optical fibers is the fiber optic sensors. A *sensor is a transducer used to convert one form of energy (physical variable) into another. It is generally electrical in construction and provides a convenient form of electrical or optical signal.*

Sensors find wide applications in sensing and measuring acoustic fields, magnetic fields, current, rotation, acceleration, strain, pressure, temperature and so on.

Classification of fiber-optic sensors

Fiber –optic sensors are generally classified into two types. They are

- (i). Intrinsic sensors or Active sensors
- (ii). Extrinsic sensors or Passive sensors

(i) Intrinsic sensors or Active sensors

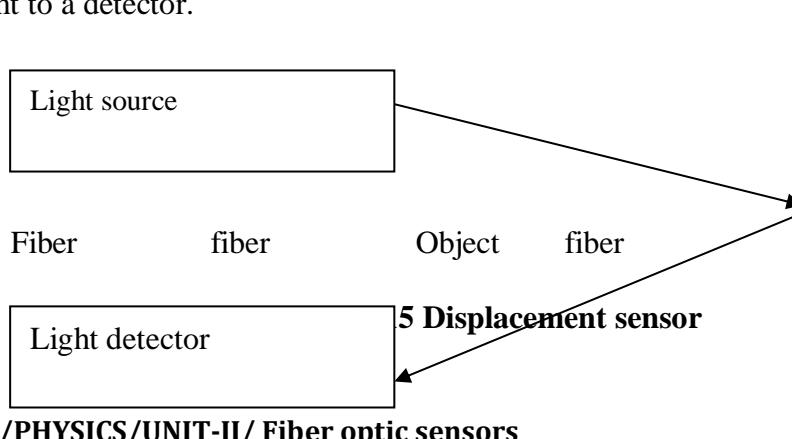
In this type of sensor, the physical parameter to be sensed directly acts on the fiber itself to produce the changes in the transmission characteristics. Example: Pressure sensor.

(ii). Extrinsic sensors or Passive sensors

In this type of sensor, separate sensing element is used and the fiber acts as a guiding media to the sensors. Example: Displacement sensor.

Displacement sensor This type of sensor involves two fibers, one of which carries or transmits light to the object from the source and the other receives light from the object to detector.

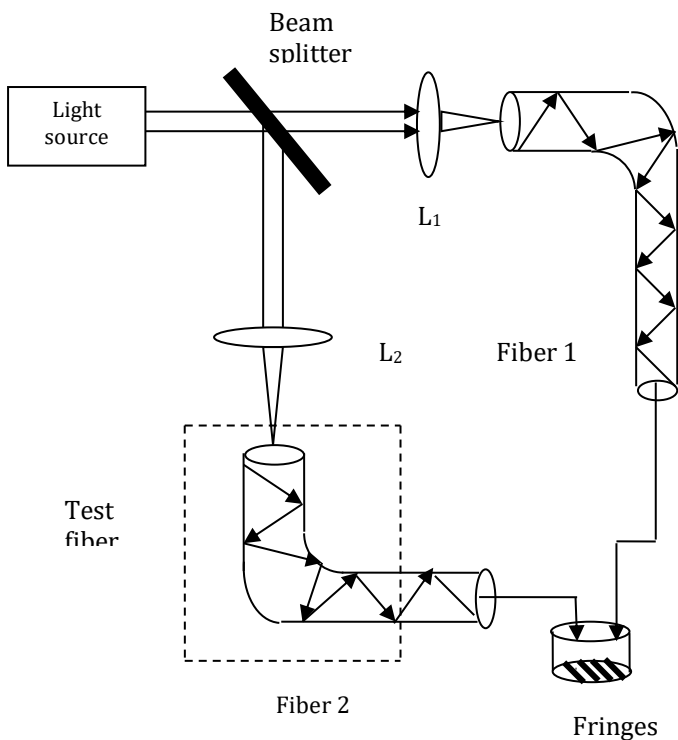
The displacement sensor transmits light through a fiber towards the object. The object reflects light towards the object. The object reflects light towards another fiber, which receives the light to a detector.



The change in position of the object will result in a change in the amount of reflected light received by the detector. This is used to measure the position of the object and hence the displacement.

Temperature sensors

Fig shows the temperature sensor. Detecting phase changes rather than the intensity of the transmitted light corresponding to the change in parameter of the medium is the basic principle behind temperature sensors. A monochromatic source of light is emitted from the laser source. A beam splitter is kept at 45° inclination divides the beam emerging from the laser source into two beams (i) Main beam (ii) splitted beam, exactly at right angles to the each other.



The main beam passes through the lens L_1 and is focused onto the reference fiber. The beam after passing through the reference fiber then falls on the lens L_2 . The splitted beam passes through the lens and is focused on to the test fiber kept in the environment to be sensed. Light from the test fiber is made to fall on the lens L_2 . The two beams after passing through the fibers produce a path difference due to the change in

parameters such as pressure, temperature and etc., The produced path difference causing the interference pattern. From this pattern we find the applied temperature.

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Endoscopy

Endoscopy allows physicians to peer through the body's passageways. Endoscopy is the examination and inspection of the interior of body organs, joints or cavities through an endoscope. An endoscope is a device that uses fiber optics and powerful lens systems to provide lighting and visualization of the interior of a joint. The portion of the endoscope inserted into the body may be rigid or flexible, depending upon the medical procedure.

An endoscope uses two fiber optic lines. A "light fiber" carries light into the body cavity and an "image fiber" carries the image of the body cavity back to the physician's viewing lens. There is also a separate port to allow for administration of drugs, suction, and irrigation. This

port may also be used to introduce small folding instruments such as forceps, scissors, brushes, snares and baskets for tissue excision (removal), sampling, or other diagnostic and therapeutic work. Endoscopes may be used in conjunction with a camera or video recorder to document images of the inside of the joint or chronicle an endoscopic procedure. New endoscopes have digital capabilities for manipulating and enhancing the video images.

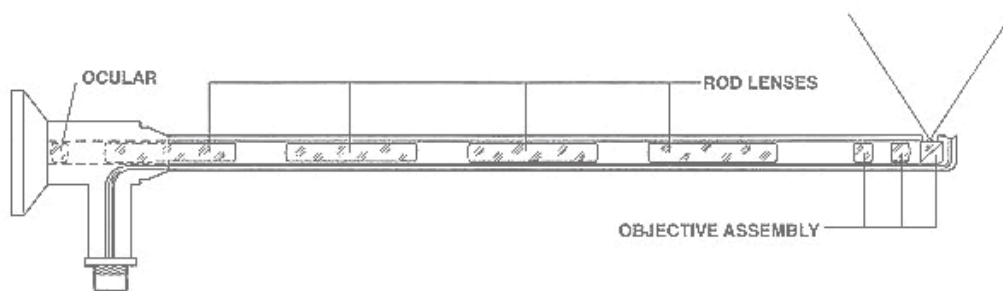


Fig 16 .Endocope

This figure shows a rigid endoscope used for arthroscopy. The "image fiber" leads from the ocular (eye piece) to the inserted end of the scope. The "light fiber" is below and leads from the light source to the working end of the endoscope.