2.4 FIBER OPTIC INSTRUMENTATION SYSTEM

Introduction

The communication engineers need the fiber characteristics to design the optical fiber link with an efficient waveguide without any loss or dispersion. Similarly, the fiber manufactures need the fiber characteristics for further development. Generally, the fiber attenuation measurement are used to determine repeaters spacing and light source power dispersion measurements are used to determine the maximum bit rate. Refractive index profile measurement are to know the number of modes propagating the fiber and to determine its numerical aperture.

Measurement of Attenuation (by cut back method)

Light from a halogen lamp or white light source is couple into the experimental fiber having length about 1 km. The lens placed in front of the source focuses the light on to the interference filter or monochromatic prism or grating. The light with a given wavelength is incident on the chopper which is used to convert d.c light into square pulses of light (a.c). It also sends the reference signal to the lock in amplifier. Monitor is used to view the intensity of the optical beams. The cladding mode strippers are connected at the input end and output end of fiber.

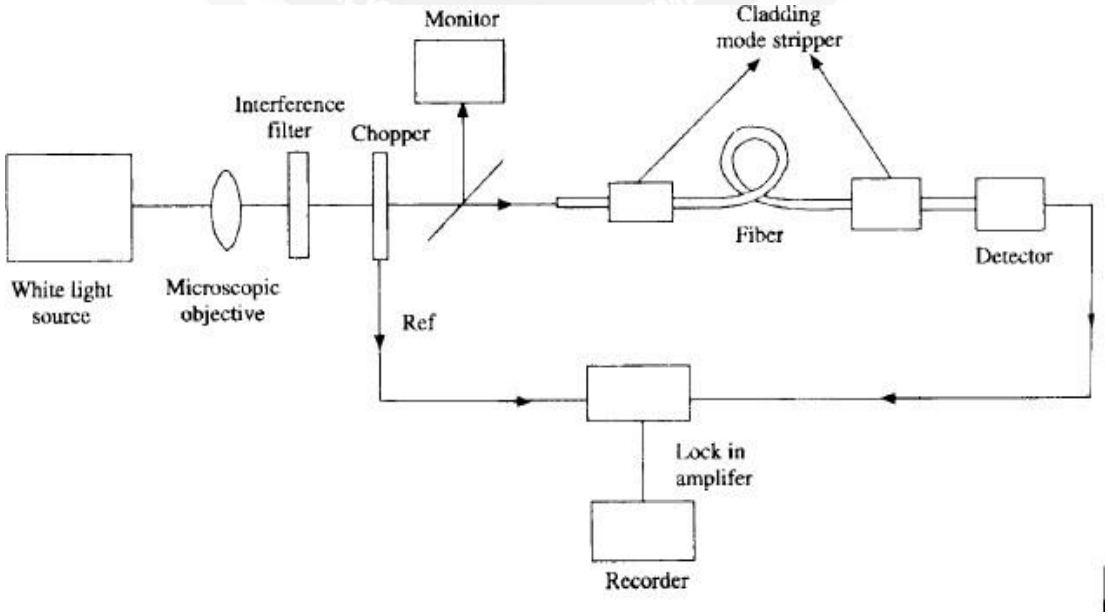

Figure 2.4.1 Measurement of Attenuation

[Source: "Optical Fibre Communications" by J.M.Senior, Page:246]

The cladding mode stripper is used to remove the cladding light or cladding modes. Then the jacket fiber is placed in an index matching liquid whose refractive index is slightly higher than that of cladding.

This arrangement is called cladding mode stripper which will attenuate the light propagating through the cladding. After travelling through the fiber of 1Km length, the given height reaches the index matched photodetector whose output is given to the lock amplifier. The lock amplifier delivers a output to the recorder or nanovoltmeter. Then the fiber is cut back, leaving typically 2m of the fiber and the experiment is repeated. In this case the output power is noted $P_{r\ (}\lambda)$ is noted. This procedure is repeated for other wavelength also. Thus the fiber attenuation at a given wavelength 'λ' is given by,

Where L is the length of the fiber cut back in Km. In the case of multimode fibers, there are mode scrambler used to get the uniform intensity distribution among all the modes and order sorting filter acting as a mode selector to determine the fiber loss for each mode.

Advantage:

This method is very accurate and simple.

Drawback

i) This method cannot be utilized to find the fiber attenuation in a working fiber optic link.

ii) It is a destructive testing method.