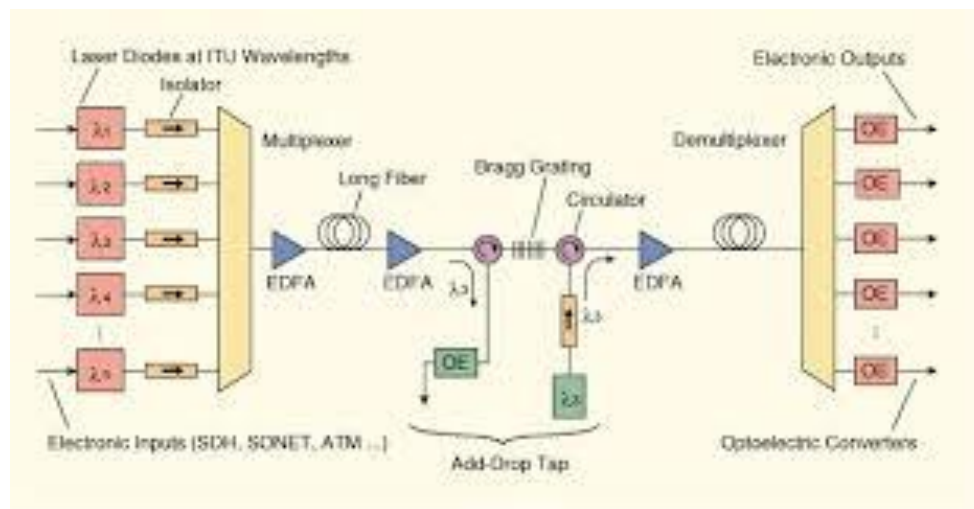


Optical Networks – Basic Concepts



Introduction

- What is an **optical network**?
- **Optical devices and components**
- Basic concepts in optical networking
- Optimization of optical network design
- How to handle faults in optical networks?
- Some recent research topics

What is an optical network?

- An optical network connects computers (or any other device which can generate or store data in electronic form) using optical fibers.
- Optical fiber is essentially very thin glass cylinders or filaments which carry signals in the form of light (optical signals).

Why do we need optical networks?

- Demand for bandwidth
- The tremendous growth of connected users online
- More and more bandwidth-intensive network applications:
 - Data browsing on the internet.
 - Applications requiring large bandwidth .
 - Video conferencing.
 - Download movie.

Advantages of optical networks

- High speed capability (theoretically possible to send 50 Terabits per second using a single fiber)
- Low signal attenuation
- Low signal distortion
- Low power requirement
- Low material usage
- Small space requirements
- Low cost
- Immunity to electrical interference

Wavelength Division Multiplexing

- ❑ The technology of using multiple optical signals on the same fiber is called Wavelength Division Multiplexing (WDM).

- ❑ WDM Optical Network
 - Divide the vast transmission bandwidth available on a fiber into several different smaller capacity “channels” non-overlapping bandwidths,
 - Each of these channels can be operated at a moderate bit rate (2.5-40 Gb/s) that electronic circuits can handle,
 - Each of these channels corresponds to a different carrier wavelength.

Optical Isolator

- An optical isolator is a device that allows light to propagate through it in one direction, but not in the opposite direction.
- Isolators are useful as valves that allow propagation in only one direction. They are used in high-power applications, for which one desires one-way transmission of light.

In many cases, backward propagation of light, reflected from a workpiece or other element, might send some light back into the laser and could be damaging. In laser amplifiers especially, it is desired to have one-way transmission. If a small amount of light is reflected back into an amplifier, it will be amplified as it passes through stages with progressively smaller cross sections, so that optical damage would become probable.

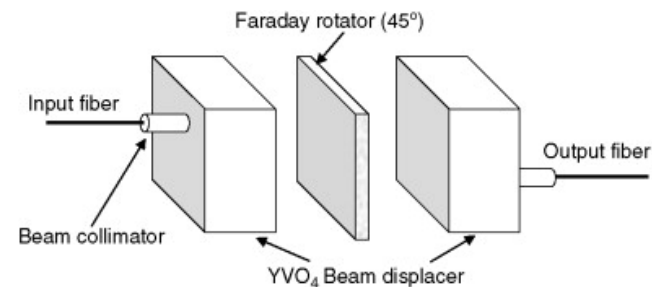
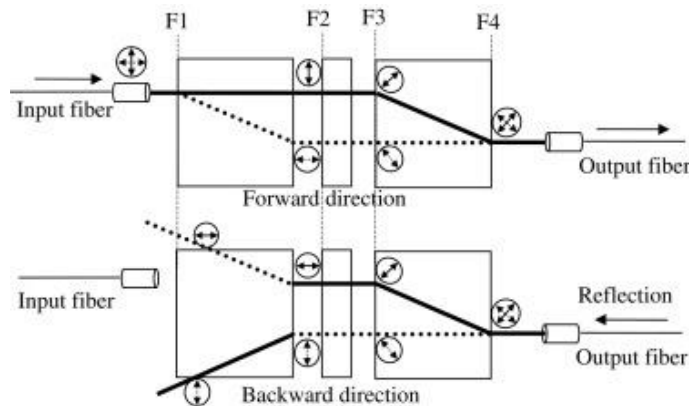
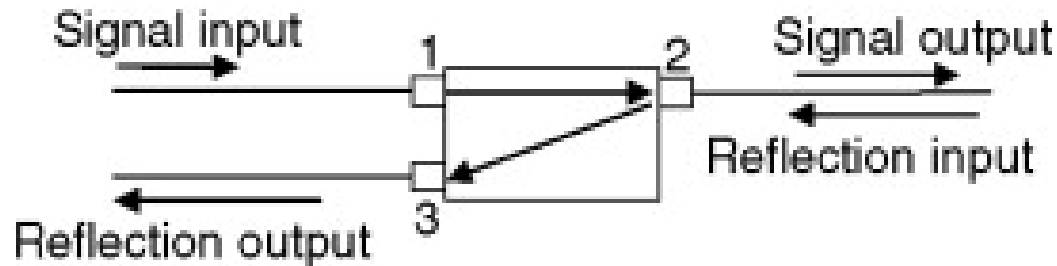


Illustration of the operating principle of a polarization-independent optical isolator.

Optical Circulator

- A basic optical circulator is a three-terminal device as illustrated in Figure, where terminal 1 is the input port and terminal 2 is the output port, while the reflected signal back into terminal 2 will be redirected to terminal 3 instead of terminal 1.
- An optical circulator is a device that is based on the nonreciprocal polarization of an optical signal by Faraday effect.



Basic function of a three-terminal optical circulator.

Thank You