ANALYSIS OF WDM SYSTEM WITH DISPERSION COMPENSATION SCHEMES

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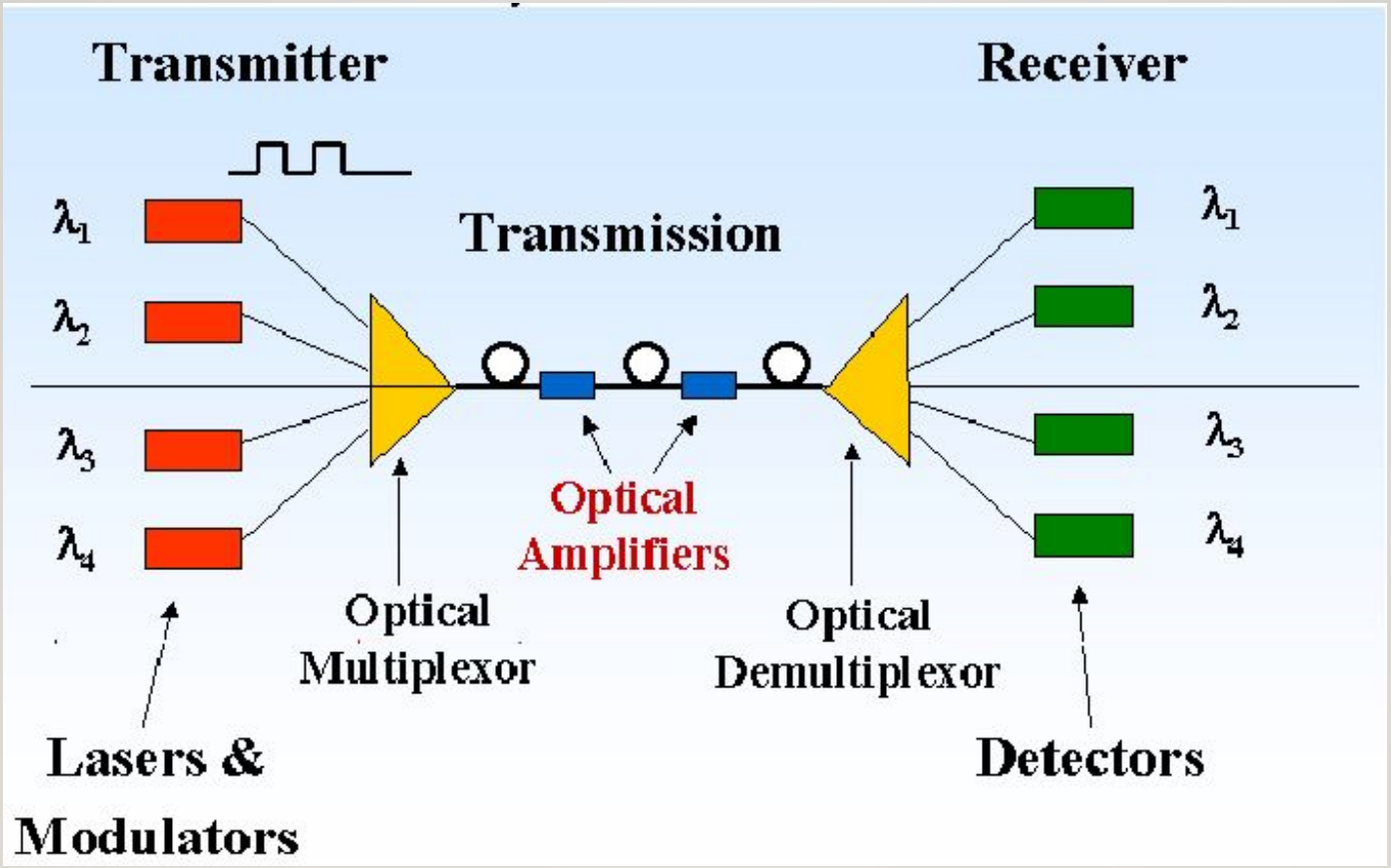
TOPIC SELECTION BACKGROUND AND SIGNIFICANCE

- The main advantage of WDM technology is that it allows you to overcome the limitations on the channel bandwidth and significantly increase the data transfer rate. Moreover, an already laid fiber-optic cable and standard time multiplexing equipment are used, and it is not necessary to increase the transmission speed over a separate channel to 10 Gbit/s or higher. Thanks to WDM, it is possible to organize two-way multi-channel traffic transmission over a single fiber (in conventional lines, a pair of fibers is used - for transmission in the forward and reverse directions).
- It is also significant that in the SONET/SDH networks, it is now possible to select a speed value (hierarchy level) for a particular channel that does not depend on the speed of other channels, and then use different transmission methods. Finally, the latest technological advances contribute to the spread of WDM: the creation of narrow-band semiconductor lasers with a radiation spectrum width of less than 0.1 nm, broadband optical amplifiers and optical filters for separating close channels.
- The optimal design and application of optical fiber are very important for the transmission quality of optical fiber transmission system. And the main goal of communication systems is to provide data transmission with high quality at a longer distance. Loss and dispersion are the major factor that affect WDM network.

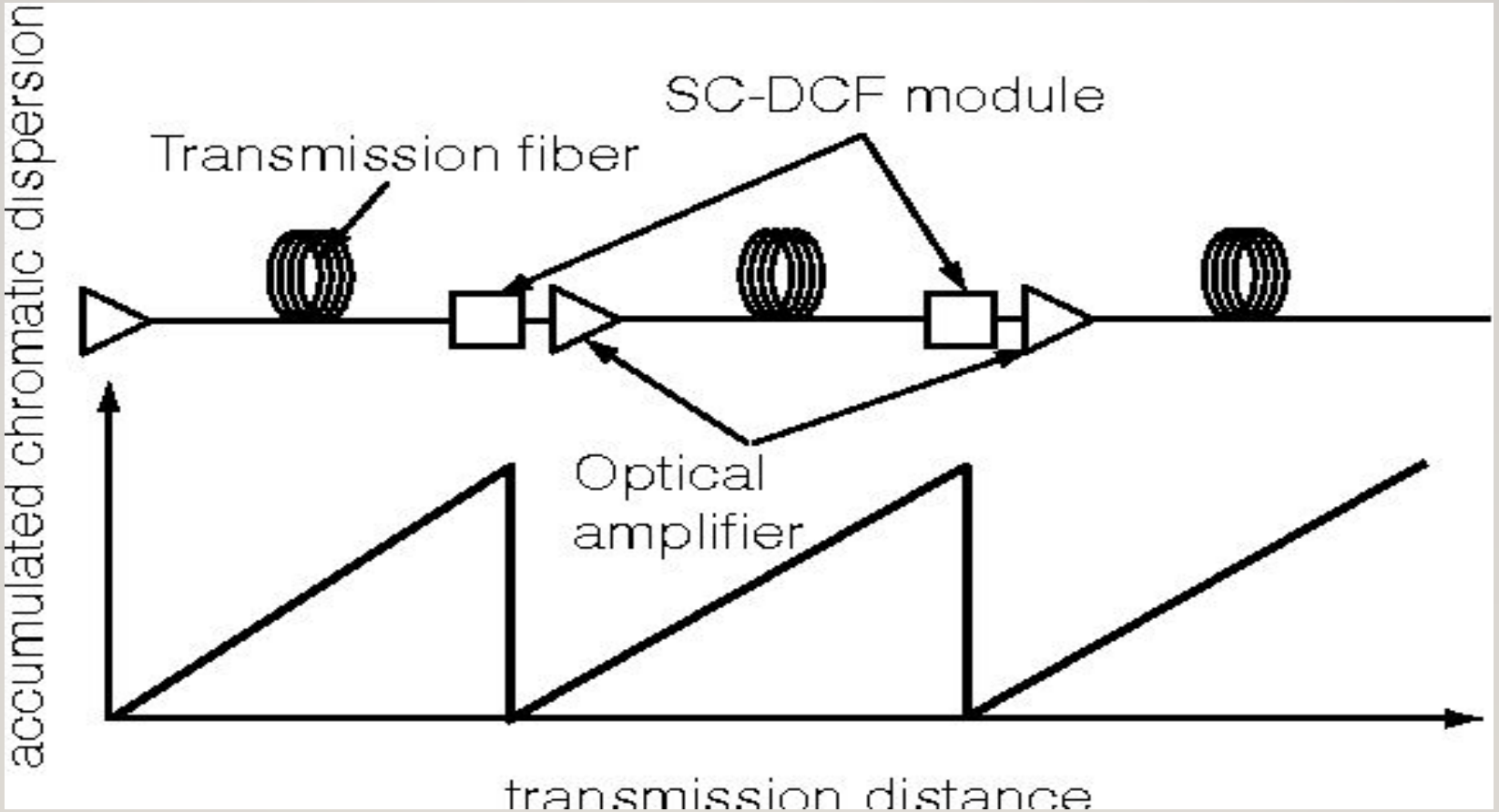

Transmitter
Receiver
Transmission
λ1
λ2
λ3
λ4
λ1
λ2
λ3
λ4
Optical
Amplifiers
Optical
Multiplexor
Optical
Demultiplexor
Lasers &
Modulators
Detectors

DYNAMICS OF RESEARCH AT HOME AND ABROAD

- The rapid growth in demand for high-capacity telecommunication links, and the speed limitation of singlewavelength links, has resulted in an extraordinary increase in the use of Wavelength-Division Multiplexing (WDM) in advanced lightwave networks. WDM is a technology which multiplexes a number of carrier signals onto a single optical fiber using different wavelengths of light. Hence the capacity of optical transmission systems can be increased using WDM. Dispersion is a major limiting factors in high speed optical WDM network which causes pulse broadening and crosstalk in the system. Therefore it is necessary to compensate dispersion. Dispersion Compensating Fiber (DCF), Fiber Bragg Grating (FBG) and Optical Phase Conjugator (OPC) and its various combinations are used for dispersion compensation in WDM system. Performance analysis of a conventional WDM system with various dispersion compensation schemes and their comparison on the basis of Q Factor is done using optisystem software in sample mode.

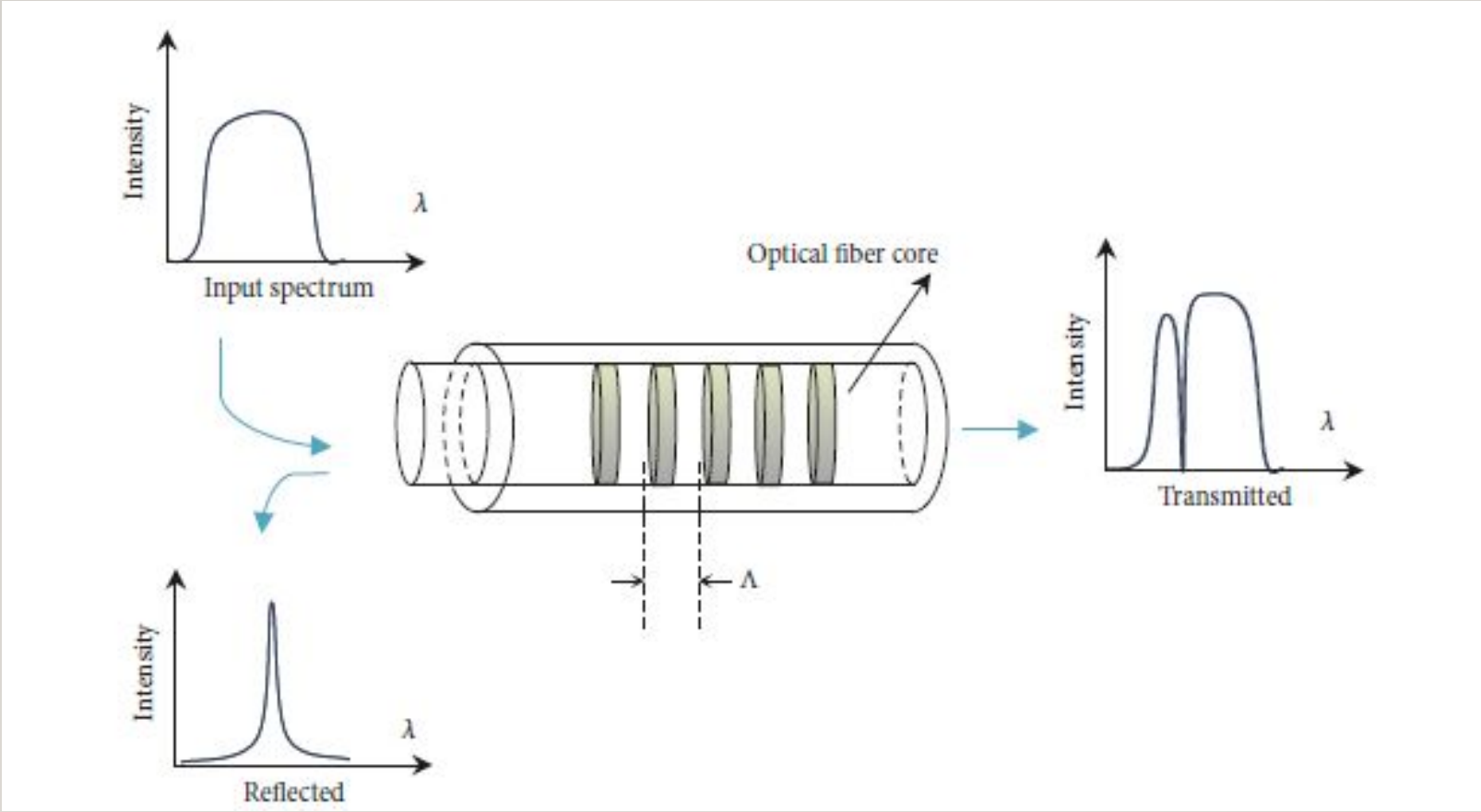
DISPERSION COMPENSATING FIBER (DCF)

- The dispersion compensating fiber for dispersion compensation was proposed in 1980's. The components of DCF are not easily affected by temperature and bandwidth, because DCF is more stable. The use of DCF in an efficient way to reduce the overall dispersion in WDM network. Because they have higher negative dispersion coefficient and therefore can be connected to the transmission fiber having the positive dispersion coefficient


SC-DCF module
Transmission fiber
Optical
amplifier
accumulated chromatic dispersion
transmission distance

FIBER BRAGG GRATING (FBG)

- FBG is a type of distributed Bragg reflector which reflects a particular wavelength of light and transmits all others. A Fiber Bragg Grating is either used as an inline optical filter to block certain wavelength or as a wavelength specific reflector. There is a periodic variation of refractive index in Bragg grating within the propagating medium. Fresnel reflection is the fundamental principle behind the operation of FBG, where light travelling between media having different refractive indices may reflect or refract at the interface. The refractive index will alternate over a particular length. During refraction small amount of light is reflected. These reflected light signals combine to one large reflection at a particular wavelength in which the grating period is approximately half the input lights wavelength. This is Bragg condition on the wavelength at which reflection occurs is called Bragg wavelength.


Intensity
λ
Input spectrum
Optical fiber core
Intensity
λ
Transmitted
Λ
Intensity
λ
Reflected

BRIEF GLOSSARY OF WDM TECHNOLOGY

- **ADM (add/drop multiplexer) - channel input/output multiplexer.**
- **AON (all-optical network) - a fully optical network.**
- **DEMUX, DMUX (demultiplexer) - demultiplexer**
- **DSF (dispersion-shifted fiber) - fiber with shifted dispersion**
- **DWDM (dense wavelength division multiplexing) - dense multiplexing with wavelength division**
- **RX (receiver) - receiver.**
- **SPM (self-phase modulation) - FSM (phase modulation).**
- **WDM (wavelength division multiplexing) - MRDV (wavelength division multiplexing).**
- **EDFA (erbium-doped fiber amplifier) is an optical amplifier based on an erbium-doped fiber.**
- **FWM (four-wave mixing) - four-wave mixing.**
- **MUX (multiplexer) - multiplexer.**
- **NZDSF (non-zero dispersion-shifted fiber) is a fiber with a shifted non-zero dispersion.**
- **SBS (stimulated Brillouin scattering)-stimulated Mandelstam-Brillouin scattering (VRMB).**
- **SRS (stimulated Raman scattering) - stimulated Raman scattering.**
- **TX (transmitter) - the transmitter.**
- **XPM (cross-phase modulation).**

OPTISYSTEM 7.0

- Familiar with how to use the software

CIRCUIT SIMULATION EXPERIMENT

- Simulation test of the design implementation circuit
- Collation and analysis of simulation results
- Optimize circuit design

Project schedule

序号	时间	内容
1	01-15-2021	Collect of literature materials
2	18-02-2021	Finish the literature
3	28-02-2021	Work on proposal
4	15-03-2021	End of the proposal
5	16-03-2021to 20-03-2021	Collect of information for the thesis
6	21-03-2021 to 28-03-2021	Research on WDM and principle of dispersion compensation
7	29-03-2021 to 10-04-2021	Acknowledge the software OPTISYSTEM
8	11-04-2021 to 20-05-2021	Build the simulation optical link in the software and simulate the performance
9	20-05-2021 to 25-05-2021	Problems of optical link
10	25-05-2021 to 30-05-2021	Solutions of WDM simulation problems
11	01-06-2021	THESIS

THANK YOU FOR YOUR ATTENTION