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Wavelength affects the transmission of signals from one place to another

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Abstract
Laser diodes convert electrical power into a highly collimated beam of optical power that can travel hundreds of metres with minimal loss. Photovoltaic diodes can be used to retrieve electrical power at the other end of this optical link. If all of the optical power is accounted for using information feedback from the receiver, this point-to-point wireless power transmission is safe. Furthermore, safety can be ensured by monitoring the optical beam's periphery. Long wavelength optical fields with wavelengths greater than 1400nm have lower absorption losses and a higher threshold power density ((Poptical (W))/m^2) for human safety. We present various technological challenges in the design of such a system, as well as preliminary experimental results that could be integrated into small packages.

Keywords: Wavelength, signals, optical fiber, transmission, electrical power, dense wavelength division multiplexing

Introduction
However, the index of refraction (the ratio of the speed of light in vacuum to the speed of light in the medium) varies for different wavelengths in transparent media; this is how prisms "split" white light into colours. As a result, some wavelengths will travel further in the same amount of time. Because media absorbs light and the absorption coefficient varies with wavelength, some colours travel further than others [1]. Last but not least, atoms scatter light at different wavelengths, which is why the sky is blue (from scattered sunlight) and sunsets are red (less scattering). In this sense, red light travels further (in air) along its original path before being scattered in a different direction.

DWDM Basics
A fiber-optic transmission technique is dense wavelength division multiplexing (DWDM). It entails multiplexing many different wavelength signals onto a single fibre. Each fibre contains a series of parallel optical channels that use slightly different light wavelengths. Light wavelengths are used in fibres to transmit data in parallel or serial mode. DWDM is a critical component of optical networks that will enable the transmission of data such as voice, video-IP, ATM, and SONET/SDH over the optical layer.
Figure 1 depicts this technique in its most basic form [2].

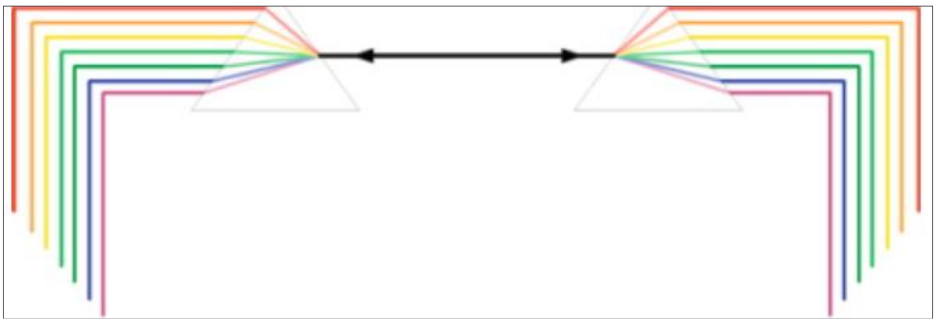

Fig 1: DWDM Basics

Long-distance Transmission Mode

According to the long distance transmission, the article proposed UHV transmission technology to solve the long-range, high-capacity transmission process. The transmission capacity of 500 kV voltage level is approximately 1000-1500 MW, and the transmission distance is approximately 300-1000 km [5], so it is unable to meet grid requirements regardless of length, transmission capacity, or short-circuit current limitation.

Half-wavelength the AC transmission

The half-wavelength AC transmission refers to the electrical distance transmission of nearly a half-wave power frequency, frequency 50HZ electrical energy situation for our workers, and the half-wave transmission distance of 3000 km. With a high level of social and economic development, it is impossible to deny that the future of electricity transmission is transnational, if not intercontinental, and that 3000 km ultra-long-range transmission technology is more practical [3]. The 3000km distance of half wavelength transmission of natural distance, and not in the long-distance transmis- sion process every time to ensure the transmission distance is precisely 3000km, when the transmission distance of more than or less than 3000km manual tuning technology need to take the actual line is tuned into a half-wavelength. Currently, only the shunt capacitance is increased to increase the series inductance and shunt capacitance. Whereas the former can transmit more power under the same over-voltage conditions, and the latter can transmit more power when a failure occurs at the same time, the power loss of the former is smaller than the latter, the latter's transient stability is preferred [4].

The Key Technical Issues of the Long-distance Transmission

1. Consolidated Potential Compensation Issues

Take on the task of even the receiving end of the system, and long-distance power plant or a different partition power system long-distance transmission, long-distance transmission will cause some inconvenience to the power system, how the power system to maintain stability in effective regulation has been the key issue the integrated electric potential compensation technology proposed for this problem Integrated potential compensation by the string in the appropriate place of the long-distance transmission lines into an amplitude and phase that can be adjusted continuously to achieve a variety of functions required to improve the power system's operating characteristics [15]. The potential compensation in the transmission process has been verified by simulation analysis, not only to improve the static stability of the system, but also to reduce the power of the generator shaft imbalance and improve the transient characteristics [5].

2. Overvoltage and Insulation Problems

Transmission lines insulation technology is a test in the long-distance transmission process due to the general use of UHV overhead lines transmission line to withstand operating pressure, fault hazards, lightning impulse voltage is too high may cause problems This insulation consists of two parts: the insulation and the insulator insulating on the tower of the power transmission line. Insulation of transmission lines is critical to long-distance transmission because it takes into account voltage requirements on the one hand and economics on the other. Insulators for domestic overhead lines There are porcelain insulators, three types of glass insulators, composite insulators, and transmission line insulation. The insulator should be chosen based on the transmission's specific circumstances.

3. Electromagnetic Radiation

Long-distance transmission of electromagnetic radiation is primarily divided into two categories: active and passive jamming interference. Active interference is primarily from the wires of the corona discharge and the corona current to the space radiation of electromagnetic waves, resulting in an increase in background noise; passive interference includes high-voltage transmission lines as large metal grid to radio signals, which may produce secondary radiation, refractor radiation, and refractor radiation.

Wavelength Affect Refraction

The wavelength of a propagating wave is proportional to the velocity of light or a particle moving in a wave. The incident wave on the medium with the refractive index 'n1' will refract according to the variations of the wavelength while propagating in the medium with the refractive index 'n2'. [6]

The medium's refractive index is related to the speed of light by the equation

$n=c/v$

Where n is a refractive index of the medium

C is a speed of light, $c=3*10^8$m/s

And v is velocity of the light on refraction

As the wavelength of the particle beam increases, so does the frequency, and thus the energy of the particles. The wavelength of the light does not change as a result of refraction; that is, the wavelength of the light before and after refraction is the same.

However, the speed of wave propagation is determined by the wavelength of the light. The relationship between light speed and wavelength is expressed as

$f=v/\lambda$

Where f is a frequency of light

V is a velocity and

λ is a wavelength of the light

The particle's energy is directly proportional to the frequency of the oscillating particle, as shown by the equation,

$E=hf$

Where

'h' is a Planck's

Constant, $h=6.626*10^{-34}$J.s

The longer the wavelength, the less energy associated with the particle, and thus the particle's speed will be slower. A particle travelling with a shorter wavelength will have more energy and thus travel at a faster speed [7].

Objectives

- To study DWDM optical transmission with a minimum of four wavelengths

- To study wavelength conversion
- To study Optical transmission vs wavelength with the bias as parameter
- To study various optical impairments within the network.

Research Methodology

Research is a voyage of discovery; a journey; an attitude; an experience; a method of critical thinking; an activity motivated by a desire to gain new insights/answer questions/acquire knowledge. The data used to prepare this paper are secondary in nature, gathered from various published resources. The information for this paper was gathered from various relevant websites.

Result and Discussion

Figure 1 depicts various optical impairments within the network, as well as some other notable transmission impairments, such as [8-10].

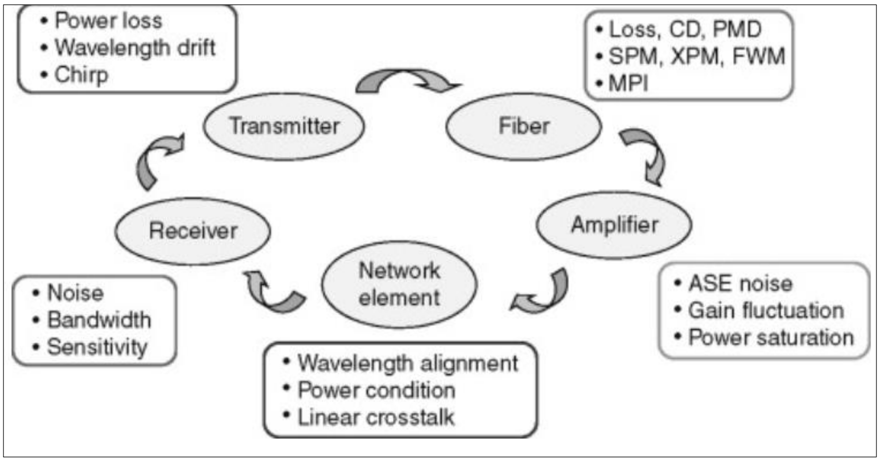

Fig 1: Overview of various optical impairments within the network.

Figure 2 depicts three different wavelengths that will be compared in the following. At 1560 nm, measured results agree well with simulation for all bias values. The residual transmission at 1550 nm and zero bias is 4.5 10^{-3}. (–23 dB). A bias of -1V results in 3 10^{-5} transmission (-45 dB) and an extinction ratio of 0.0066. (–22 dB). These values change as the wavelength changes [11-13].

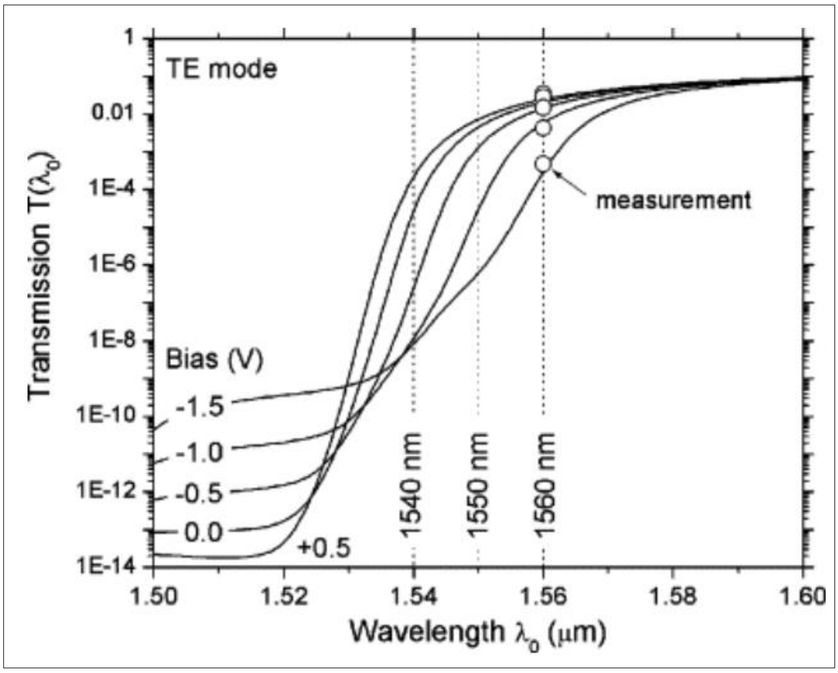

Fig 2: Shows optical transmission versus wavelength with bias as a parameter. The circles represent measured results at the same bias levels.

Wavelength conversion is required to improve network utilisation. Figure 3 shows a simple example to demonstrate this. Three wavelengths can be carried by each link in the three-node network. We currently have two lightpaths configured on each link in the network, as shown, and need to configure a new lightpath from node A to node C. [14]

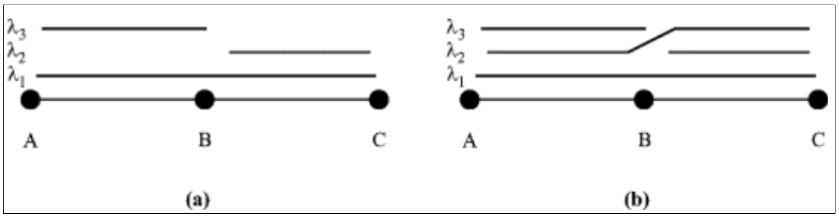

Fig 3: Depicts the need for wavelength conversion. (a) Wavelengths are not converted by Node B. (b) Node B has the ability to convert wavelengths.

Figure 3(a) depicts the case where node B is unable to perform wavelength conversion. Even though there are free wavelengths available in the network, the same wavelength is not available on both links. As a result, we are unable to create the desired lightpath. However, if node B can convert wavelengths, we can set up the lightpath shown in Fig 3. (b).

The emergence of DWDM technology has also fueled the development of a variety of specialty fibres and all-fiber components for the continued advancement of lightwave communication technology [15].

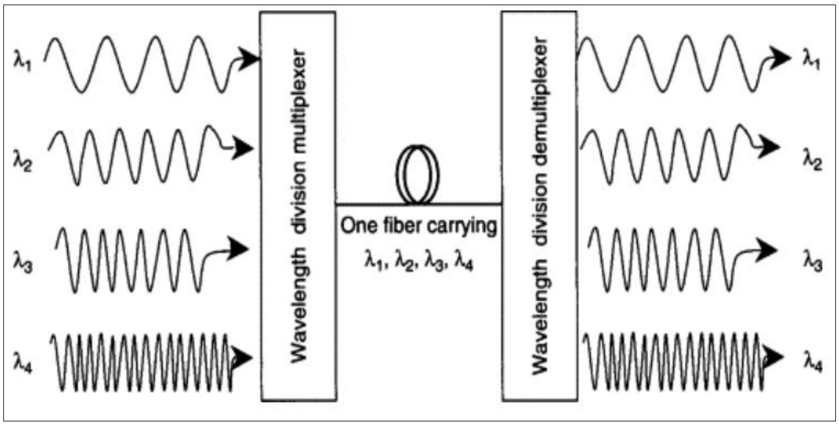

Fig 4: Shows a sample of DWDM optical transmission with a minimum of four wavelengths in the EDFA band.

These fibres had to address new features such as nonlinearity-induced potential impairments in optical transmission due to high optical throughput, broadband dispersion compensation, bend-loss sensitivity to signal wavelength variation, and so on.

Conclusion

The application of digital signal processing technology in communication is most visible in speech compression coding and software radio. Although its benefits are obvious and it is a future development trend, there are some drawbacks, such as signal quality and signal transmission rate. As a result, future research on digital signal processing technology in communication will be required to ensure more convenient and reliable communication. We can simulate the influence of each optical fibre effect on transmitted signals using WDM optical systems by using created specific blocks in Matlab Simulink.

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