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Survey Report on system of L-band 2 × 10 Gb/s WDM transmission over conventional single mode fibre with 600 km by chirped fibre Bragg gratings dispersion compensation

Ankur Trivedi[1], Afreen Khursheed[2]
[1]*MTech Student, SIRTS, RGPV, ankur_t22021980@rediffmail.com, India;*
[2,] *Professor, SIRTS, RGPV, afreen.khursheed@gmail.com, India;*

Abstract – *This paper present the dispersion compensation done by Chirped Fiber Bragg grating as per ITU-T suggested L-band with different channel dispersion compensation is presented on a band selective amplified spontaneous emmision (ASE) basis of an erbium-doped fiber(EDF),which can work in either the C or L-band region. The band selective ASE source design converts between a backward and a forward pumped configuration alternately. To enhance the power of L-band ASE a laser diode are adopted for the design synchronously to enhance power of the band.*

Keywords*: Erbium-doped fiber (EDF), Amplified spontaneous emission (ASE) chirped fibre Bragg grating, dispersion compensation, L-band*

I. Introduction

With the increasing require of data trans- mission broadband optical supply with low spectral ripples and high spectral strength supported augmented spontaneous emission (ASE) from erbium-doped fiber (EDF) it conveys a good attention for his or her varied application in EDFA characterization testing. Many ideas wishing on the use of fibre general grating (FBG) technology are planned for strain– temperature discrimination. Most of them are supported completely different the various} wavelength shift responses of general gratings written in optical fibres with different diameters (different strain coefficients) [1], or in fibres with completely different co-dopants (different temperature sensitivities) [2]. These sensing heads are supported uniform FBGs. However, for a similar purpose many authors have planned different structures for strain–temperature measuring, like sampled FBG [3], structure FBG [4] and FBG cavity Fabry–Perot sensors [5]. Another chance is that the use of chirped fibre gratings. This chirp behavior may be a consequence of varied the grating amount or the effective ratio modification on the FBG length. many techniques for fabricating chirped gratings are incontestable , significantly by considering ways supported temperature and strain gradients [6], however additionally a inhomogeneous grating may be unreal by writing a FBG in tapered core fibre. Recently the capability of sensible point-to-point fibre communication system has reached up to a hundred and sixty × 10 GB/s. This means that over 19,000,000 digital speeches channels are often transmitted with bi-directions in 2 fibres simultane-ously, and therefore the capability of point-to-point transmission within the laboratory has reached up to 10.92Tb/s which implies with the aim of more than one billion digital speech guide may be transmitted with bi-directions in 2 fibres at the same time. However, the bit rate over a single wavelength is restricted to inside 40 GB/s because of polarization mode dispersion (PMD); hidden wavelength divisionmultiplexing (WDM) should be adopted in order to support such high bit rate. Because the entirely level-oped optical amplifier at the moment, erbium-doped fibre am-plifiers (EDFAs) have a really limited operational range of C-band. If the measurement lengthwise of erbium-doped fibre (EDF) will be increased 5 times additional, the Er3+ ions dis-tribution may be stabilised in low energy level so that L-band EDFA called gain-shift EDFA (GS-EDFA) will be realized by both route pump. How-ever, the length increase of EDF would result in more fibre loss, and then collect amplified spontaneous era-diation (ASE), decreased pump remodel efficiency of amplifier and increased noise coefficient. This paper proposes an L-band fibre transmission over G.652 fibre by using chirped fibre Bragg grating (CFBG) as disper-sion compensation device. A CFBG in keeping with ITU-T recommended L-band with over 1800 ps/nm single channel dispersion compensation is presented in this paper, of that the cladding mode loss, the delay curve ripple and therefore the power variation of the replicate spectrum are less than 0.5 dB, fifty ps and 0.25 dB, re-spectively. With this new fibre Bragg grating (FBG) as dispersion compensation device, a 2 × 10 GB/s wavelength division multiplexing (WDM) L-band transmission of 600 kilometre supported G.652 fibre is performed with-out forward error correction (FEC). The bit error rate (BER) is less than 10−12 and therefore the power penalties of second and eightieth channel of the L-band are 1.8 dB and 2.0 dB, respectively.

II. Literature Survey

Yan Feng-Ping et. al. [1] "The system of L-band 2 × 10 Gb/s WDM transmission over conventional single mode fibre with 600 km by chirped fibre Bragg gratings dispersion compensation" in this projected sysytem a chirped fibre Bragg grating consistent with ITU-T advised L-band single channel dispersion compensation is given in this paper, of that the cladding mode loss, the delay curve ripple and therefore the power fluctuation of the reflected spectrum. A CFBG in keeping with ITU-T instructed L-band with over 1800 ps/nm single channel dispersion compensation is given in this paper, of which the cladding mode loss, the delay curve ripple and also the power fluctuation of the reflected spectrum are less than 0.5 dB, fifty ps and 0.25 dB severally.

Karin Ennser et. al. [2] "Optimization of Apodized Linearly Chirped Fiber Gratings for Optical Communications" The dispersion characteristics of apodized, linearly chirped fiber Bragg gratings and their potential as dispersion compensators are studied consistently. it's shown that the positive hyperbolic-tangent profile results in an overall superior performance, because it provides extremely linearized time–delay characteristics with minimum reduction within the linear dispersion. To compensate for the linear dispersion of a hundred kilometer of normal telecommunication fiber over certain bandwidth (in nanometers), the specified grating length is 19.24 cm/nm. The reflection and dispersion characteristics of apodized linearly chirped fiber gratings are studied systematically. it's shown that optimum apodization profiles have a flat center region and apodized edges with continuously decreasing slopes.

Chao Wang et. al. [3] "Chirped Microwave Pulse Generation Based on Optical Spectral Shaping and Wavelength-to-Time Mapping Using a Sagnac Loop Mirror Incorporating a Chirped Fiber Bragg Grating" In this paper, we propose and demonstrate an approach to optically generating chirped microwave pulses with tunable chirp profile supported optical spectral shaping employing a Sagnac loop filter incorporating a chirped fiber Bragg grating (CFBG) and linear wavelength-to-time mapping in an exceedingly dispersive component. in the projected approach, the optical power spectrum of an ultrashort optical pulse is formed by a CFBG-incorporated Sagnac loop mirror that has a reflection spectral response with a linearly increasing or decreasing free spectral range. The spectrum-shaped optical pulse is then sent to a dispersive component to perform the linear wavelength-to-time mapping. A chirped microwave pulse with the pulse shape identical to that of the shaped spectrum is obtained at the output of a high-speed photodector. The key element in the projected system is the CFBG-incorporated Sagnac loop mirror, which features a spectral response with an increasing or decreasing FSR, utilized to act because the optical spectral filter to shape the spectrum of the input ultrashort optical pulse.

Pei ChinWon et. al. [4] "Distributed temperature sensing using a chirped fibre Bragg grating" A fully distributed temperature sensing element consisting of a chirped fibre Bragg grating has been demonstrated. By fitting a numerical model of the grating response including temperature change, position and width of localized heating applied to the grating, we tend to achieve measurements of those parameters to within The temperature profile of heat sources are often projected based on the Fabry–Perot effects internal to the grating by using a numerical model which permits the simultaneous determination of the temperature change, position and width of the heat sources with a deviation from linearity.

Avi Zeitouny et. al. [5] "Optical Generation of Linearly Chirped Microwave Pulses Using Fiber Bragg Gratings" We demonstrate a new methodology to generate broad spectrum chirped microwave pulses using an electrooptical system. Fiber Bragg gratings and a mode-locked fiber laser were used to generate pulses with a linear frequency chirp. The bandwidth of the microwave pulses may be considerably broader than the bandwidth that can be obtained using electronic systems. The parameters of the chirp may be easily controlled by adjusting the parameters of the optical system. a similar methodology may be used to generate microwave pulses with a complex FM. we've demonstrated theoretically and by experimentation a new methodology to generate linearly chirped broad-band pulses by using FBGs. The bandwidth of the microwave pulses can be considerably broader than the bandwidth that can be obtained using electronic systems. The frequency offset of the instantaneous frequency chirp may be easily controlled by adjusting an optical delay line. The technique may also be used to generate broad-band microwave pulses with a nonlinear chirp that may be tailored consistent with specifications and may be simply controlled by adjusting the parameters of the optical system.

III. Method

III.1 Carbon fiber reinforced plastic (CFRP)

Carbon fiber reinforced plastic (CFRP) laminates exhibit unique failure modes [1–2]. Above all, transverse cracks in off-axis plies occur at much lower stress than the ultimate tensile strength of the laminates. Hence, the authors have applied fiber Bragg grating (FBG) sensors to the detection of transverse cracks in CFRP cross-ply laminates. Though the FBG sensors are usually used for the measurement of strain or temperature that is almost uniform in the gage length of the sensors, they are also very sensitive to non-uniform strain distribution along the entire length of the gratings. The strain distribution deforms the reflection spectrum from the FBG sensors. Taking advantage of the sensitivity, the authors have applied FBG sensors for detecting transverse cracks that cause non-uniform strain distribution in CFRP laminates. For the detection of transverse cracks in the 908 ply of a CFRP cross-ply laminate, an FBG sensor was embedded in a neighboring 08 ply of the laminate, and the reflection spectra from the embedded FBG sensor were measured at various levels of tensile stress. The spectrum became broad and had some peaks with an increase in the transverse crack density, because of strain concentrations around the crack tips. This change in the spectrum was well reproduced by a theoretical calculation. Hence, the FBG sensors have a potential to detect the transverse cracks. This technique could also detect transverse cracks in CFRP quasi-isotropic laminates, sufficiently. Though the above technique can quantitatively evaluate crack density, locations of the cracks cannot be identified. In order to make it possible, in this research, chirped FBG sensors were introduced since the broad reflection spectrum from the chirped FBG was expressed as a function of the position along the grating [9]. In the same way as the above researches using uniform FBG sensors, the chirped FBG sensors were embedded in CFRP laminates, and the identification of the locations of the transverse cracks was attempted directly from the deformation of the reflection spectra.

III.2 Chirped FBG sensors

As shown in Fig. 1, normal FBG sensors used in the previous researches have uniform grating period along the entire length of the gratings, so that the Bragg wavelength is also uniform, and the reflection spectrum has one narrow peak at the Bragg wavelength. On the other hand, since chirped FBG sensors have grating period that increases monotonously, the Bragg wavelength is different depending on the position, and the reflection spectrum becomes broad [10–11]. Thus the reflection spectrum from the chirped FBG is expressed as a function of the position along the grating. In this research, two types of chirped FBG sensors were used. One is fabricated in a normal-size optical fiber, whose cladding and core are 125 and 8 mm in diameter, respectively, and the outside diameter of polyimide coating is 150 mm. The other is fabricated in a small-diameter optical fiber [12] that was developed for embedding inside a 125 mm-thick lamina without deterioration of the mechanical properties of the composite laminate. The diameters of cladding, core, and polyimide coating are 40, 6.5, and 52 mm, respectively. The grating length of the chirped FBG sensors is 50 mm, and the full width at the half maximum (FWQM) of the reflection spectrum from the chirped FBG sensors is 4.5, 5.0 nm.

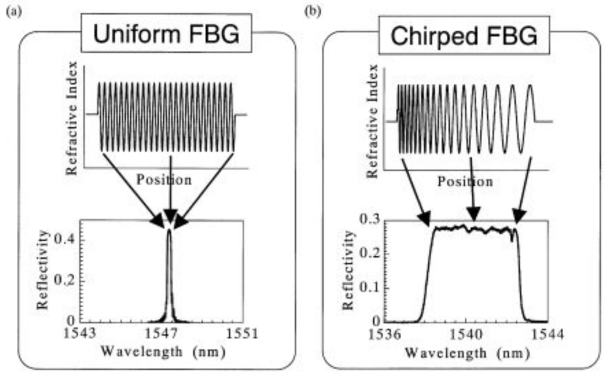

Fig.1 Profiles of refractive index and reflection spectra: (a) uniform FBG, and (b) chirped FBG.

IV. Conclusion

This paper show a Survey on a CFBG according ITU-T suggested L-band dispersion compensation is present in this paper, of which the shield form defeat, the wait curve ripple and the power fluctuation of the reflected spectrum are less this new CFBG as dispersion compensation device, a 2×10 Gb/s wavelength division multiplexing (WDM) L-band communication of 600 km based on G.652 fibre, as we know, it is first performed without FEC. The bit error rate (BER) is less.

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