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Abstract:
In this paper,The Gaussian Apodization technique is used to design of apodized Fiber Bragg Grating.The effect of apodization on switching of FBG are studied and it can be seen that by changing the parameter of Gausian Parameter the slope of curve change.This paper also deal with design of optimized slope for optimum switching.Simulation result is found with the help of AOS softwrae.application of apodized FBG in optical communication for reduce dispersion.
Keywords: Apodization, Fiber Bragg Grating,Gaussian algorithm, dispersion

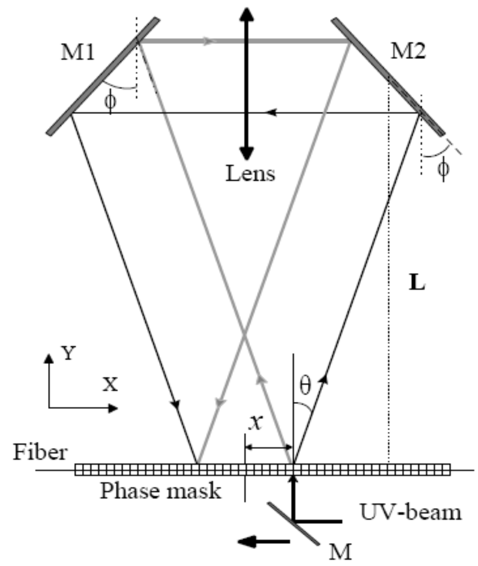
I.Introduction:

A Fiber Bragg Grating is a periodic or non-periodic perturbation of the effective refractive index in core. its is a periodic over a certain length of few nm of mm and period of hundred nm.There are various structure of FBG like uniform,apodized,chirped,tilted, and long period.When light propagate through the FBG in naaroe range of wavelength,the total reflection take place at Bragg wavelength and other wavelength not affected by the Bragg grating except some side lobes exist in refection spectrum .These side lobes can be suppressed using apodization techniques .The refection bandwidth depend on length and strength of refractive index modulation.The reflection of wavelength also depend on the temperature and strain. So this can be used in sensor technology.FBG are created by the using the process of interference and masking process which use the UV laser.the FBG can be apodized with the help of many method like Gaussian, cosine, rectangular algorithm. Each method have some special features and different method of fabrication. In this paper we will present the Gaussian algorithm to design the apodized FBG and its applications in optical communication and sensor technology.

There are two quantities that control the properties of FBG like grating length and grating strength.we require to control three properties of BFG like reflectivity,bandwidth and sidelobe strength .we know that bandwidth depend on the grating strength ,and grating length can be used to set the peak reflectivity ,which depend on both grating length and grating strength.the third quantity apodization is used to suppress the side lobe by apodization of refrective index .The apodized grating play very important role to suppress side lobe and maintaining the reflectivity and narrow bandwidth.in this paper apodization is done by Gaussian Algorithm.

II.Fabrication of apodized FBG

For the fabrication of apodized **Gaussian** Bragg gratings we use the two UV-pulse interfere with variable time delay,which strong reduce the reflectivity at side lobes and this method allows writing of truly apodized gratings by single exposure of a uniform phase-mask.In this context, the fabrication of apodized Bragg gratings has raised much interest because of its reduced reflectivity at sidelobes. It therefore increases the quality of optical filters and improves the dispersion compensation by simultaneously reducing the group-delay ripples .



III.Designing of apodized Gaussian FBG

In the Gaussian apodization done by using Gaussian apodization function as

$$A(z) = e^{\left[-a\left(\frac{z-0.5L}{L}\right)^2\right]}$$

where *a* is the Gaussian width. For this apodization function and given constant the reflection coefficient and functions are shown in Figure.In Table 2, slope of the transfer function is presented versus the Gaussian width parameter. It is shown that with decreasing of the Gaussian width the slope of the transfer function is increased.

IV. Results

The simulation results are shown in following figures which are drawn for different values of reflection coefficient at different value of apodized parameter(a=0.5 to 2.0 in 0.5 steps) and grating length 5mm and 10mm
Length =5mm,and a=0.5

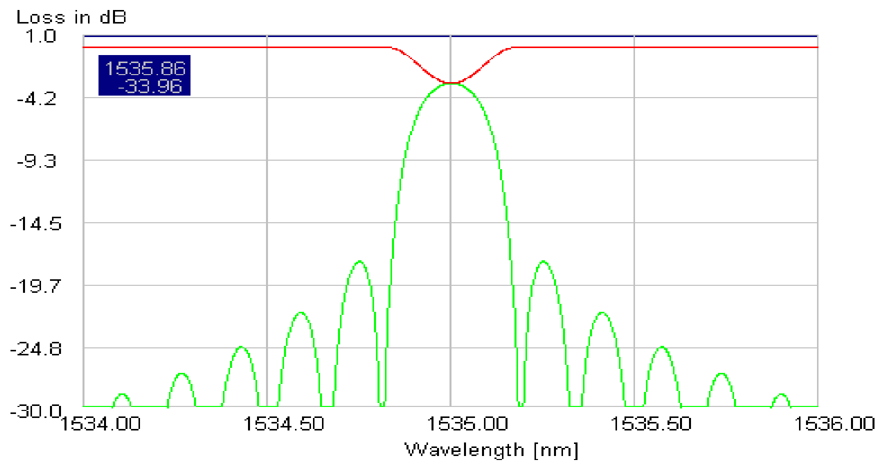


Figure 1

Length =10mm,and a=0.5

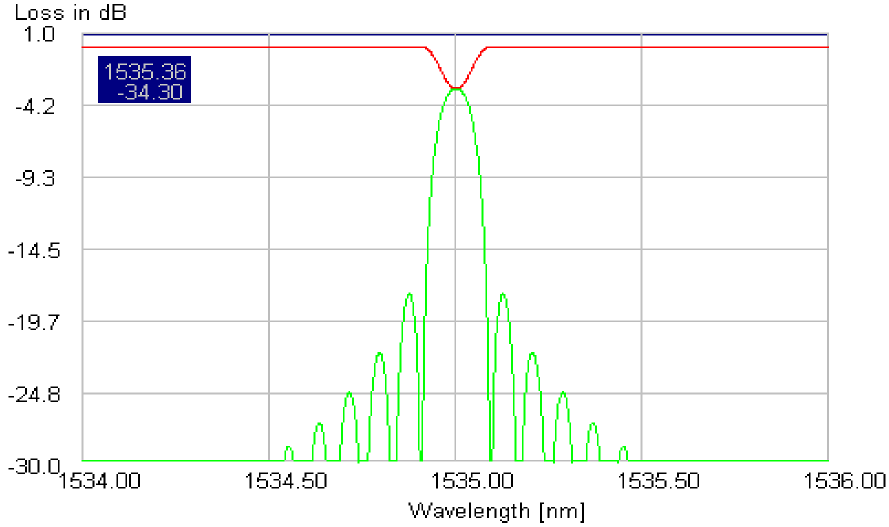


Figure 2

Length =5mm,and a =1.00

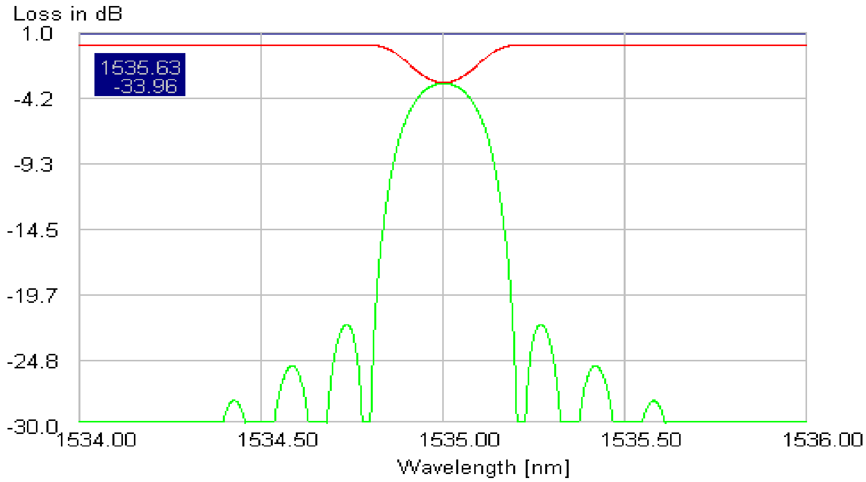


Figure 3

Length =10mm,and a=1.0

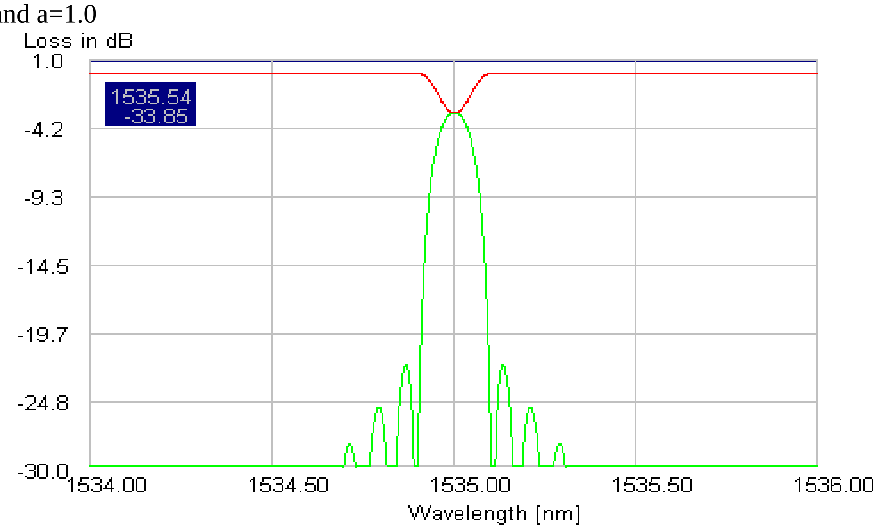


Figure 4

Length =5mm,and a =1.5

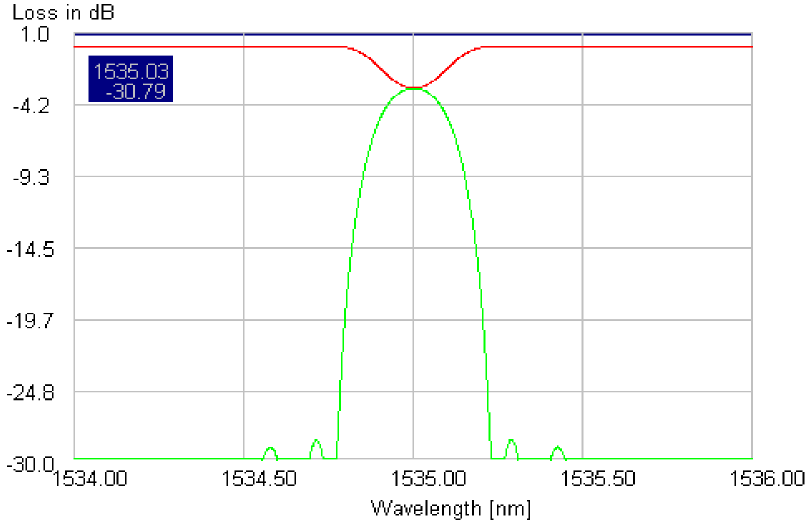


Figure 5

Length =10mm,and a=1.5

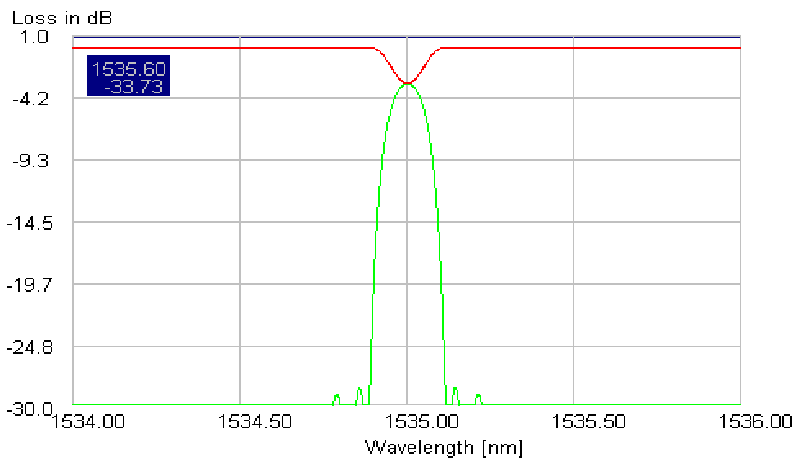
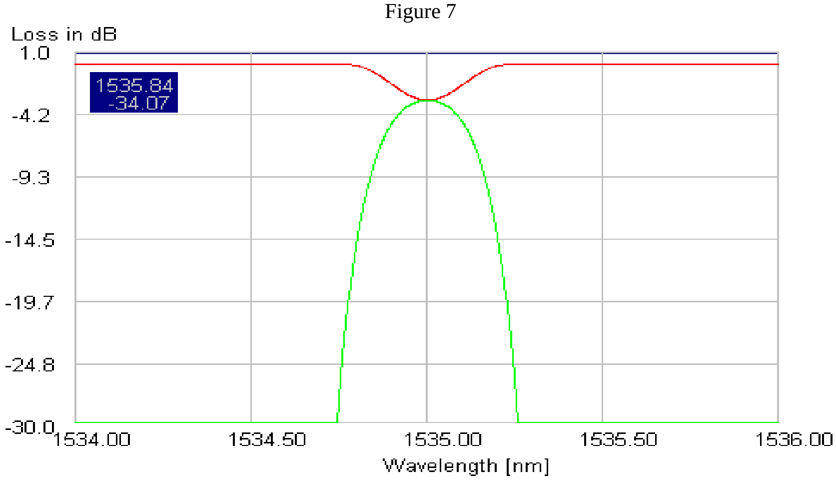


Figure 6

Length =5mm,and a =2.0

Figure 7



Length =10mm,and a=2.0

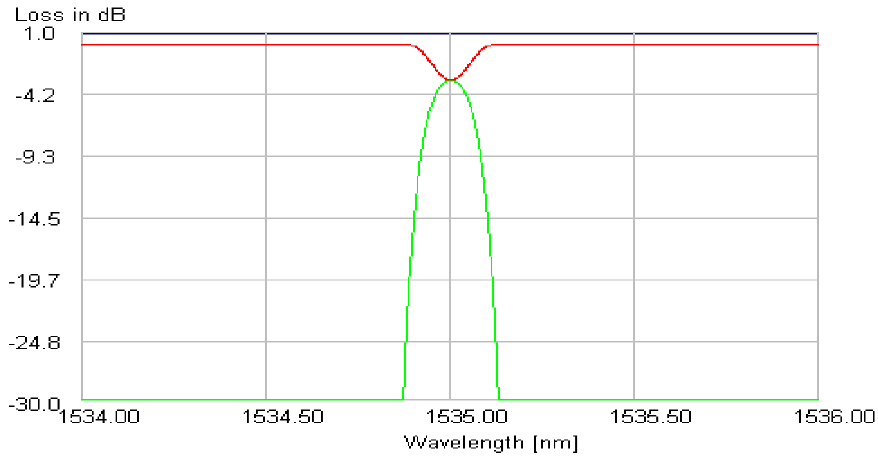


Figure 8

V.Analysis of results:

Above plots are drawn at Bragg wavelength 1535 nm and at two grating length 5mm&10 mm.we use the reflectivity 49.88% for all results.the used bandwidth for these are 76pm for -1db and 236pm for -20db.

We vary two parameter for design of apodized fiber bragg grating these are grating length and Gaussian width a.we see that as we increase the lenth of grating the height of side lobes decrease and width of reflection coefficient. We draw the results at two length 5mm and 10mm.
and we take different value of Gaussian width parameter i.e. 0.5,1.0,1.5,2.0.we see that as we increase the value of a the side lobes suppress continuosely and at a=2 all side lobes suppressed .

VI.Application of apodized Gaussian FBG
We are study two important application.
1.In Optical Communication

We can expand the capacity of Optical Fiber network using Dense wavelength division multiplexing (DWDM) This type of optical communication technique needs some basic blocks with capabilities including multiplexing, demultiplexing, switching, routing monitoring and attenuation of each individual wavelength within the packet of wavelengths propagating through optical fiber network. The fiber bragg grating is widely used for optical signal processing. The transfer of the switching function from electronics to optics will result in a reduction in the network equipment, an increase in the switching speed, and thus network throughput, and a decrease in the operating power. One of the most important schemes for optical switch is nonlinear Bragg grating. For realization of Bragg grating electro-optic effect is usually used.

Apodized amplitude of refractive index with different window functions is used to optimize the parameters of the introduced optical switch. Other methods such as optical micro electromechanically systems (Optical MEMS) were used for optical switching.In this paper we consider this subject and investigate effects of the apodization and chirp of refractive index on optical switching performance.

2.In Sensor Technology

Fiber Bragg gratings (FBG's) sensors have many application like electro-mechanical sensor systems, which are well established, have proven reliability records and manufacturing costs. They have important feature such as electrically passive operation, EMI immunity, high sensitivity, and multiplexing capabilities, market penetration of this technology has been slow to develop. In applications where fiber sensors offer new capabilities, however, such as distributed sensing, fiber sensors appear to have a distinct edge over the competition. Here fibers with sensor arrays can be embedded into the materials to allow measurement of parameters such as load, strain, temperature, and vibration, from which the health of the structure can be assessed and tracked on a real-time basis. Gratings may also prove to be useful as the optical sensing element in a range of other fiber sensor configurations; grating-based chemical sensors, pressure sensors, and accelerometers are examples

VII.Conclusion

In this paper we have proposed the use of apodizedization in fiber Bragg gratings for dispersion compensation in transmission. We showed that apodization effectively suppresses the sidelobes in the uniform grating spectrum so that the insertion losses at the grating output could be reduced to less than 0.25 dB. It is worth comparing the transmission dispersion compensator to reflection-based dispersion compensators. The application of apodized FBG in optical communication and sensor technology is described.

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