위상천이 광섬유 브래그 격자를 이용한 다파장 광원 특성 연구

Study on the characteristics of multi-wavelength source using phase-shifted fiber Bragg grating

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Very narrow transmission peaks are generated by the phase-shifted fiber Bragg grating with phase-shift region. The width of the transmission peaks are about ~0.5nm. The characteristics of multi-wavelength source using the phase-shifted fiber Bragg grating are designed and analyzed. The source with two and three transmission peaks is analyzed

In this paper, the characteristics of the phase-shifted fiber Bragg grating were analyzed and its applications as multi-wavelength source were presented.

The phase-shifted fiber Bragg grating is fabricated by inserting phase-shift region in ordinary fiber Bragg grating[1]. Ordinary fiber Bragg grating has one reflection peak but phase-shifted fiber Bragg grating can have the several narrow transmission peaks[2][3]. In this paper, the variation of the stopband by the transmission peak, the shift of the transmission peak by the amount of phase-shift, the variation of the transmission peak in asymmetrical condition, the variation of the transmission peakwidth, the variation of spacing, and expansion of the stopband was analyzed.

The phase-shifted fiber Bragg grating as multi-wavelength source exhibits very narrow transmission peaks with different wavelength simultaneously and can select the transmission peaks with any wavelength by controlling the amount of phase-shift. Its other advantage is to be in-line assembly.

The width of the transmission peaks was reduced as outermost subsection lengths were increased. When outermost subsection lengths were about 500 μm, the width of the transmission peak was about 0.5nm. It was also shown that spacing was increased as inner subsection lengths were reduced. When multi-wavelength source has the two transmission peaks and middle subsection length was about 300 μm, spacing was about 1nm. By adjusting the amount of phase-shift, any center wavelength of the transmission peaks could be selected.

In this paper, multi-wavelength source with the two and three transmission peaks was designed and analyzed. The source with two transmission peaks is designed by inserting two phase-shift regions in ordinary fiber Bragg grating. In the case with two transmission peaks, an error of both the transmission peaks was about 0.08nm simultaneously (Fig. 1). In the case with three transmission peaks, an error was about 0.017nm (Fig. 2).

When multi-wavelength source with single phase-shifted fiber Bragg grating was used, the selection range of the center wavelength and the range of spacing between two peaks was restricted because of the narrow stopband width of 1.5nm. In the case with the number of the transmission peaks of 2, spacing cannot be wider than about 1nm. However, the stopband can be expanded when the phase-shifted fiber Bragg gratings of 2 are connected serially. In this case, spacing can be wider than 2nm.

Suggested source in this paper had a very small error and can be utilized as multi-wavelength source in DWDM system.

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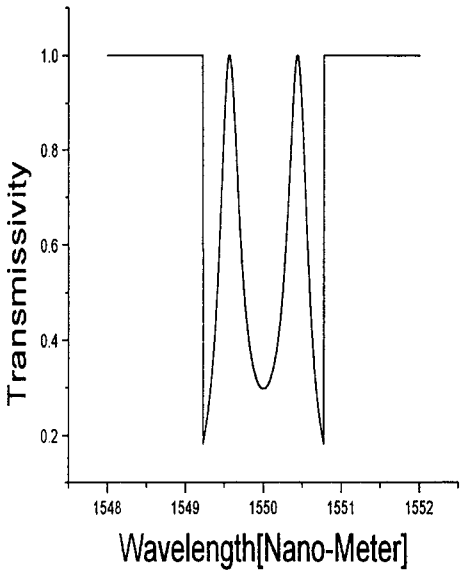

Fig. 1. Result with two phase-shift regions. Subsection lengths are 500 μm, 400 μm, 500 μm, respectively. The amount of phase-shift is 90 ° . An error between specifications and results is 0.08nm.

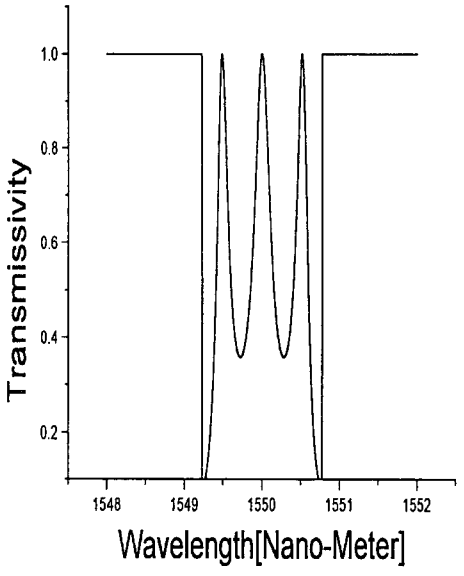

Fig. 2. Result with three phase-shift regions. Subsection lengths are 500 μm, 480 μm, 480 μm, 500 μm, respectively. The amount of phase-shift if 90 ° . An error between specifications and results is 0.017nm.