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Variable Optical Delay Unit

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External View of Comb Generator

Overview of Technology

This invention concerns the heart of an optical comb generator that generates high-density optical frequency standard signals at a regular interval. This unit is characterized in the placement of an optical SSB modulator in a fiber loop. The basic input into the optical SSB modulator is a light-wave (fo). When a frequency (fm) is applied from outside, the fo is shifted in frequency by fm (Fig. 1). An optical comb is generated through the continuous initiation of this phenomenon within a looped optical circuit. As shown in Fig. 2, the fiber loop of the optical comb generator is fitted with an optical SSB modulator to generate high-density optical frequency standard signals at a regular interval. This arrangement has the advantage of enabling control of the delay time for each optical signal and allows for easy adjustment to the amount of delay in accordance with the specific optical signal.

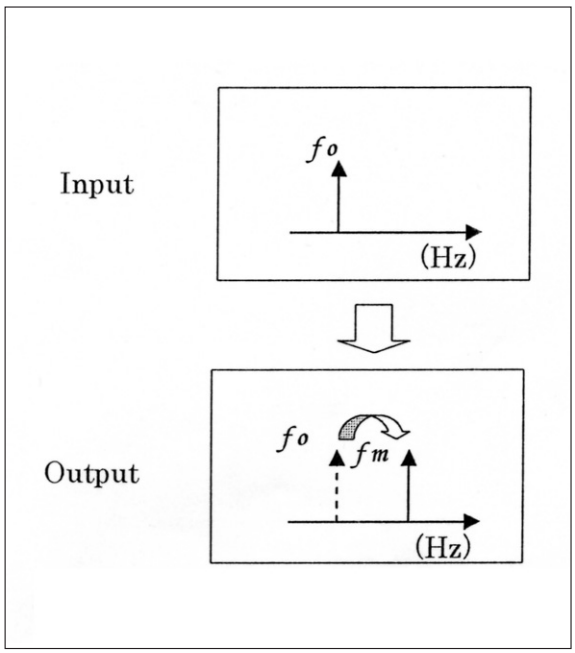

Fig.1: Input/Output Characteristics of Optical SSB Modulator

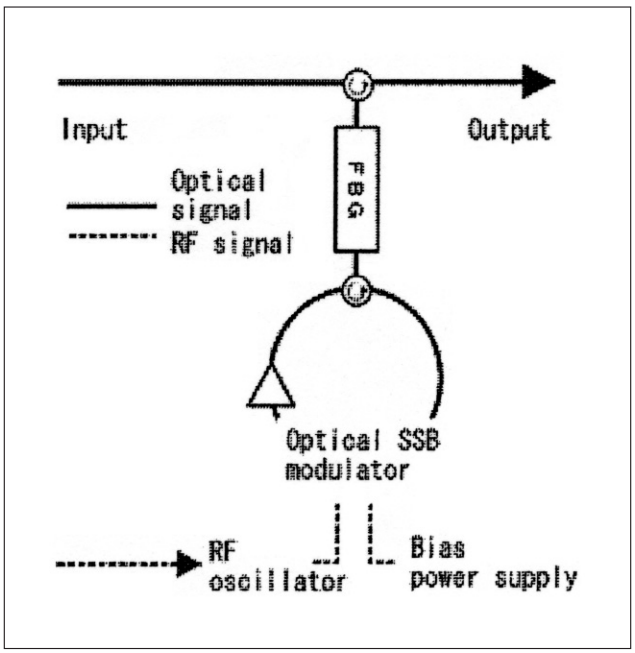

Fig.2: Principle of Optical Comb Generator

Background of Prototype Development

In response to today's increasing volume of optical communications data, a dense wavelength division multiplexing (DWDM) system has now come into use. To cope with high volumes of information, this system features tighter channel spacing relative to conventional systems; as a result it has now become indispensable to improve the accuracy of oscillation frequencies at the light source. An "optical comb generator" is thus required as a reference light source to control optical frequencies. To date, a mode-locked fiber ring laser and a comb generator using Fabry-Perot optical modulator have been recommended as multiwavelength light sources for highly accurate optical frequencies. These light sources provide highly accurate, uniform component phases and optical frequency spacing. However, if the aim is to stabilize the length of optical circulation with a similar degree of accuracy, the systems quickly become complicated and expensive. In addition, conventional light sources feature a disadvantage—specifically, with a variation in the component phase status, the output optical spectrum will also become unstable. The newly-developed reference light source eliminates the need for such phase stabilization. In an experiment, the light source successfully generated 120 reference lightwaves with frequency spacing of 10 GHz without the need for stabilization control (Fig. 3). These results must force a re-evaluation of current common knowledge concerning the existing multiwavelength light sources using a fiber loop, and will make it possible to achieve a multiwavelength light source at a significantly lower cost.

Commercialization

This newly-developed optical comb generator will be marketed by Alnair Laboratories Corporation under license from NICT. This technology is expected to extend the scope of application to more compact and lower-priced optical comb generators, multiwavelength light sources, and more.

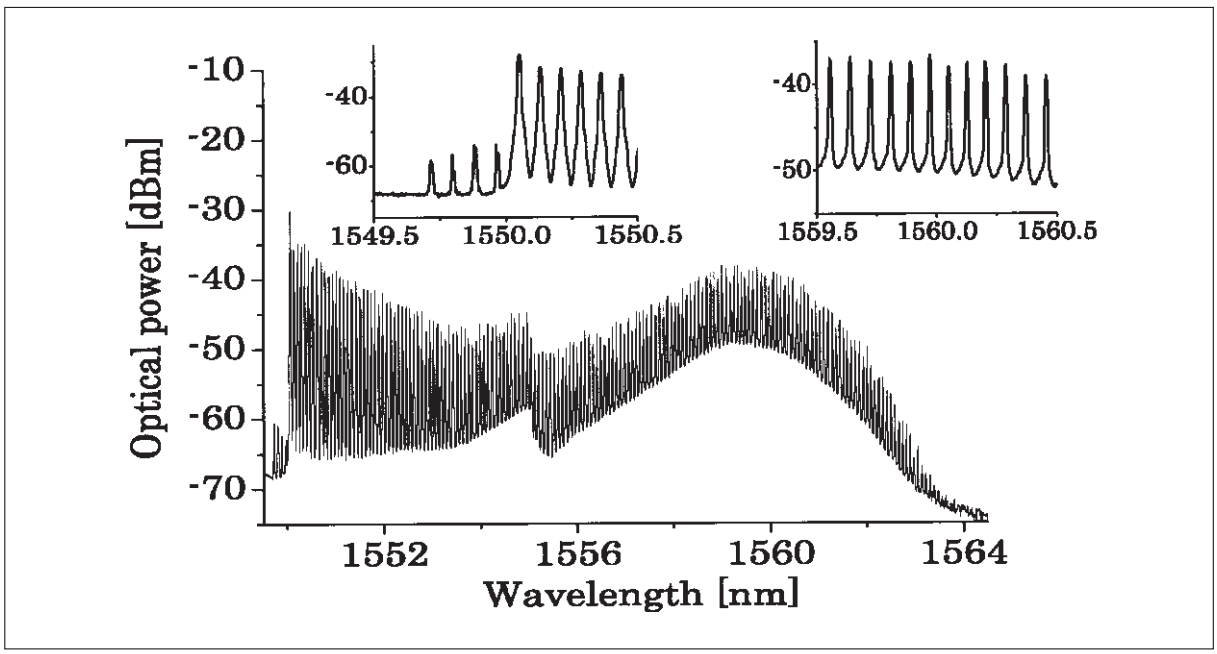

Fig.3: Output Optical Spectrum

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