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All optical frequency encoded quaternary memory unit using symmetric configuration of MZI-SOA

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HIGHLIGHTS

- This is an all optical scheme for optical data storage unit associated with purely frequency encoding technique.
- It is implemented with all optical symmetric MZI-SOA switches.
- Data can be stored randomly without any mixing with the previously stored data in the system.
- This scheme can perform in GHz range and can be extended for higher bit memory storage too.

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ABSTRACT

Optical memory is an essential optical element for optical communication and computing system. Here the authors propose an optical scheme for developing a quaternary memory unit associated with wavelength encoding technique and based on Mach Zhender Interferometer based semiconductor optical amplifier (MZI-SOA) optical switches in symmetric configuration mode. Here the symmetry is introduced by injecting same biasing current to two SOAs of a MZI-SOA optical switch.

1. Introduction

Optics is playing an efficient role since decades with its high speed data carrying capacity. Optical computing and optical communication system is developed for faster communication since decades and it is still developing to achieve higher speed rate [1,2]. For this purpose many optical elements are developed to construct the optical communication network and optical computation system. Optical memory unit is such an essential optical element which is required to store and retrieve the optical data with very high speed response (in THz range). Sometimes optical memory is also required to store more than one command to execute multitasks in computational program. Many optical memories are successfully developed during last few decades [3–10]. Optical switch like Semiconductor Optical Amplifier (SOA) has been widely used to develop many optical elements due to its high frequency conversion efficiency as well as its very high speed operation (GHz range) [11–17]. SOA can be used in Mach-Zhender Interferometer in asymmetric and symmetric configuration for optical switching operation and many optical switches have been developed using the both configurations [11,18–25]. Some all optical memory cells with all optical switches are incorporated with photonic crystal of high speed response have been developed earlier [25–30]. Optical memory unit using optical switches based on MZI-SOA has been proposed earlier [31]. In that case the current data to be stored into the memory has a chance to mix up with the previously stored data as the previous data cannot be removed completely from the memory system when a new data is introduced i.e. the interference between the present and previous data is observed. A frequency encoded optical memory unit using polarization optical switch (PSW) and MZI-SOA has also been proposed earlier [32]. This scheme is polarization dependent as because the PSW switch is used and to operate the switching action of PSW it requires a polarization controller unit. And it is troublesome to maintain the specific polarization of the light throughout the entire operation of the scheme. So, a polarization independent system is always preferable than that of a dependent one. In the earlier scheme there is a limitation for consecutive and random data storage in the memory unit. The scheme is working fine to store a single bit data at a time but when one enters a new data for storage after the previous one (i.e. consecutively), the system does not work properly. Interference or mixing between the previously stored data and the newly entered data takes place as there

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