Abstract

Moustafa Hussein Aly

Wavelength Conversion Using Nonlinear Effects in Optical Fibers: Application of Nonlinear Fiber Optics

Wavelength conversion has been acknowledged as one of the most significant optical processing functions and various papers have been involved with investigating methods of translating very high bit-rate data into other wavelengths. Ultra-high data rate all-optical wavelength conversion is an enabling technology for providing wavelength flexibility, increasing the capacity of photonics networks and enhancing optimized all-optical routing and switching. Several all-optical wavelength conversion approaches have been studied and investigated, which are based on nonlinearities in optical fibers. Nonlinear effects mainly applied in fiber-based wavelength conversion are four wave mixing (FWM) and self phase modulation (SPM), all of which originate from the Kerr effect. However, to make use of this nonlinear phenomenon in optical signal processing, this requires that a suitable fiber be available. In this book, wavelength conversion based on both SPM and FWM at 1550 nm has been demonstrated using different types of fibers. A numerical simulation is used to predict the performance of each type of fibers and to address the potential of each fiber type in wavelength conversion applications. In the FWM based wavelength conversion application, it is shown that, wavelength conversion, covering the entire C-band, can be achieved with different fiber types at a reasonable optical pump power and for different fiber lengths. On the other hand, an SPM based wavelength conversion over ± 5 nm can be achieved with around 30 mW output peak signal power leading to a remarkable better performance compared to previously analyzed results.