World Academy of Science, Engineering and Technology
International Journal of Electronics and Communication Engineering
Vol:9, No:07, 2015

Multiple-Channel Piezoelectric Actuated Tunable Optical Filter for WDM Application

Authors : Hailu Dessalegn, T. Srinivas

Abstract : We propose new multiple-channel piezoelectric (PZT) actuated tunable optical filter based on racetrack multi-ring resonators for wavelength de-multiplexing network applications. We design tunable eight-channel wavelength de-multiplexer consisting of eight cascaded PZT actuated tunable multi-ring resonator filter with a channel spacing of 1.6 nm. The filter for each channel is basically structured on a suspended beam, sandwiched with piezoelectric material and built in integrated ring resonators which are placed on the middle of the beam to gain uniform stress and linearly varying longitudinal strain. A reference single mode serially coupled multi stage racetrack ring resonator with the same radii and coupling length is designed with a line width of 0.8974 nm with a flat top pass band at 1dB of 0.5205 nm and free spectral range of about 14.9 nm. In each channel, a small change in the perimeter of the rings is introduced to establish the shift in resonance wavelength as per the defined channel spacing. As a result, when a DC voltage is applied, the beams will elongate, which involves mechanical deformation of the ring resonators that induces a stress and a strain, which brings a change in refractive index and perimeter of the rings leading to change in the output spectrum shift providing the tunability of central wavelength in each channel. Simultaneous wave length shift as high as 45.54 pm/V has been achieved with negligible tunability variation in the eight channel tunable optical filter proportional to the DC voltage applied in the structure, and it is capable of tuning up to 3.45 nm in each channel with a maximum loss difference of 0.22 dB in the tuning range and out of band rejection ratio of 35 dB, with a low channel crosstalk ≤ 30 dB.

Keywords : optical MEMS, piezoelectric (PZT) actuation, tunable optical filter, wavelength de-multiplexer
Conference Title : ICOP 2015 : International Conference on Optics and Photonics
Conference Location : Stockholm, Sweden
Conference Dates : July 13-14, 2015