Design and simulation of all optical optimized photonic crystal switch using ring resonator

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Abstract Title: Design and simulation of all optical optimized photonic crystal switch using ring resonator The ultrafast time response and low energy consumption of the photonic crystal optical switches allow us to use more bandwidth in optical fiber communication network. In this thesis two all-optical logical switches based on photonic crystal ring resonator are designed using dielectric rods in air substrate. In order to enhance the performance and decrease losses in the photonic crystal switches with multiple outputs, we have aimed to minimize the transmitted light the structure to the unwanted outputs and maximize the light entering the desired output. By employing the aforementioned plan in designing the structure and properties of the photonic crystal switches, it can be concluded that the designed switches can guide the input light to the output with maximum quality. In this thesis, switches are designed using ring resonator that have improved these properties. Plane wave expansion method is used for photonic band structure calculations and defect mode analysis and finite difference in time domain method is used to study the power curve and switching time. The photonic band gap diagram which is a function of some important design parameters is used for optimum design of the photonic crystal. In the first design, the structure for optical switch is a 3030 square array of dielectric rods in air substrate. The refractive index and radius of these rods are 3.1 and 120 nm respectively. The constant of the lattice is 650 nm. In this structure a ring resonator and two perpendicular and horizontal waveguides are designed and presented. The ring resonator is off at low power and turns on at high power. In the second design, the structure for optical switch is a 2030 square array of dielectric rods in air substrate. The refractive index and radius of these rods are 3.47 and 125 nm respectively. The constant of the lattice is 622 nm. In this structure a ring resonator is located between two waveguides. In this design the ring resonator is off

at low power and turns on at high power just like the first design which is the act of switching.

Keywords : Keywords: photonic crystal, photonic crystal optical switch, photonic crystal filter, ring resonator photonic crystal