OPTICAL LIGHT BEAM PROPAGATION CONTROL TROUGHT THE DEFECT IN ONE-DIMENSIONAL PHOTONIC LATTICE

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Abstract

Photonic lattices represent are periodic structures, suitable for investigation of wave propagation and localization. Within these systems, different phenomenon such as discrete difraction, lattice solitons, Anderson localization and defects localizations can be analyzed. The lattice periodicity in one or more dimensions leads to the zonal structure in terms of existing permitted and forbidden zones which can allow or stop light beam propagation. Manipulation with the zonal structure can be done by introducing different types of defects into the lattice. As a consequence, the defects can stop, trap, reflect and also shape localized light beam. Defects which can be formed during the fabrication process change the zonal structure and allow the occurence of differnt types of potentially stable localized defect modes. This gives additional opportunity for the light control in terms of suppressing waveguides, stoping light, trap and shape solitons and can be used for all-optical swithcing and routing. In this paper, we numerically analyzed the trapping effect in a one-dimensional lattice with a coupling defect as a function of wavelength and width of the input light beam. The input of 4 μm gives the best capturing effect at the 6 μm wide linear defect, while for 2 μm wide linear defect the narrower input beam 2 μm enables better capturing. The light propagation is modelled by the time-independent Helmholtz equation. The split-step Fourier method is used for the numerical simulations. These numerical findings may lead to interesting applications such as blocking, filtering and transporting light beams through the optical medium.

Keywords: photonic lattices, linear defect, light localization, trapping efficiency, control of light propagation.