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PARAMETER CONTROL OF OPTICAL SOLITON IN ONE-DIMENSIONAL PHOTONIC CRYSTAL

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Interaction of laser pulse with nonlinear photonic crystal is one of the modern problems. There are many papers dealing with (i) constructing of all-optical switcher based on this interaction, (ii) light localization on defects of photonic crystal, (iii) application of photonic crystal in various laser systems. In our preceding papers [1]–[3] the optical soliton formation was found out both for self-action of laser pulse in photonic crystal with cubic nonlinear response and for dual-waves interaction in photonic crystal with combined nonlinearity. It should be emphasized that soliton appear under certain conditions on input light intensity of laser pulse, parameters of layered structure and wavelength of an optical radiation. A detail investigation of dependence of soliton formation on parameters, mentioned above, and revealing an opportunity for controlling the soliton parameters and soliton displacement in photonic crystal are the main goal of this report.

To realize the formulated goal we find soliton solution on the base of eigenfunction problem for nonlinear Schrödinger equation with periodic coefficients. To solve the eigenfunction problem we use a computer simulation. Mainly, appearance of solutions with one peak intensity is of interest for us because in previous computer simulation results deal with a such solution.

Our investigation allows to make some conclusions. First, the width of soliton essentially depends on peak intensity.This result ,obviously,is the similar to one for homogeneous medium with cubic nonlinear response. Nevertheless, for photonic crystal with alternating nonlinear and linear response there is some distinguish in comparison with homogeneous nonlinear medium. Such a way, decreasing or increasing maximum intensity of input laser pulse it is possible to create solitons spreading over several layers or localizing into one layer. Second, the area of soliton localization is sensitive to the defects of photon crystal. For example, the slightest non-symmetry in localization of the layers of the crystal can result in the shift of the soliton to the left or right boundary of layer. Third, the jump of the soliton out of the layer occurs, when the maximum intensity of light exceeds the its crucial value, which depends on such parameters as layer length or diffraction.

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REFERENCES

[1] V.A. Trofimov and E.B. Tereshin. Localization of Light Energy of a Femtosecond Laser Pulse upon Generation of the Second Harmonic in a One-Dimensional Nonlinear Photonic Crystal with Alternating Nonlinear Response. *Optics and Spectroscopy*, **104** (5), 2008, 737 – 743.

[2] V.A. Trofimov, E.B. Tereshin and M.V. Fedotov. Soliton-Like Propagation of Light Pulses in a Nonlinear Photonic Crystal. *Optics and Spectroscopy*, **97** (5), 2004, 773 – 781.

[3] V.A. Trofimov, E.B. Tereshin and M.V. Fedotov. Soliton-Like Propagation of Light Pulses in a Nonlinear Photonic Crystal. *Technical Physics*, **49** (5), 2004, 587 – 591.