Discrete solitons in a Bragg medium with carbon nanotubes

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Abstract

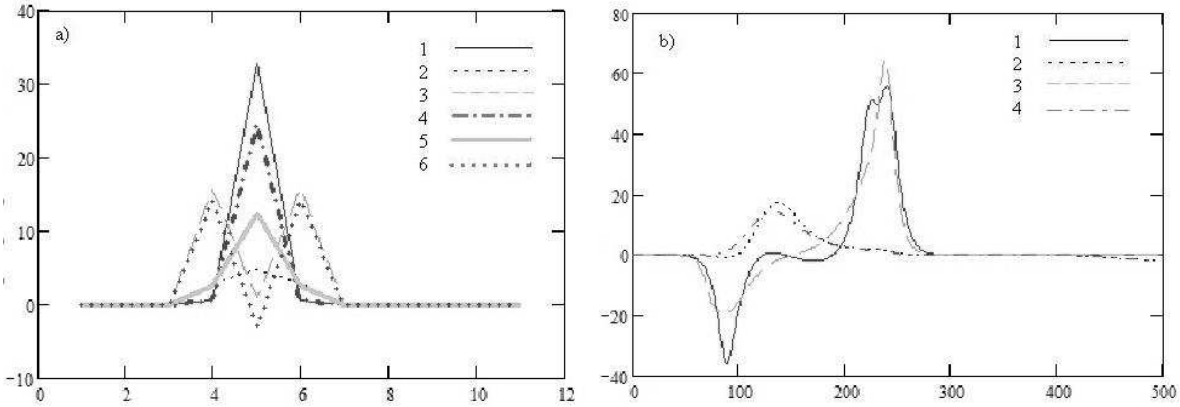
The propagation of few cycle optical pulses which can be considered as discrete solitons in the case when a medium in which carbon nanotubes are embedded has spatially-modulated refraction index is under investigation. The effective equation which has the form of classical sine-Gordon equation analogue was derived [1]. Analysis of dependence on the task options was performed.

As it is seen from figures pulse on central waveguide doesn't change its shape particularly dependent on initial pulse width in opposition to neighbor waveguide pulses. At side waveguides pulse has the same form as at the central one but with reduced amplitude. We can control the amplitude of electromagnetic field on neighbor waveguides by varying initial central pulse width. Moreover the wider the feeding to system pulse the greater the amplitude of neighbor pulses with the central one. This fact in its turn gives us possibility to manage few cycle pulse shape by varying both number of CNT layers and the distance between layers which is determined by a couple parameter.

References

[1] R.K. Bullough et al. Solitons, Berlin etc.,1980.
[2] E. Smirnov, M. Stepic, C.E. Ruter, D. Kip, **Opt. Let**, Vol. 31, No 15 (2006) P. 2338-2340.
[3] E. Smirnov, C.E. Rueter, M. Stepic, V. Shandarov and D. Kip, **Optics Express**, Vol. 14, No 23 (2006) P. 11248-11255.

Figures



The dependence of electric field determined by potential on waveguide number (fig. a). The waveguide number N is along x axis, dimensionless value of electric field is along y axis. In presence of Bragg grating with modulation depth α at moments of time t = 250 (1a), t = 200 (2a), t = 130 (3a); and with modulation depth 2α at moments of time t = 250 (4a), t = 200 (5a), t = 130 (6a). The dependence of electric field on time (fig. b). Dimensionless value of time is along x axis, dimensionless value of electric field is along y axis. In presence of Bragg grating with modulation depth α the waveguide numbers are N = 5 (1b), N = 6 (2b); and with modulation depth 2α the waveguide numbers are N = 5 (3b), N = 6 (4b).