

סמינר מדעי היסוד
יום שני 23.3.2015 בשעה 14:30-15:20 בקריה ה'7'
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Coupled nonlinear Schrödinger equations, Lotka-Volterra models, and control of soliton collisions in broadband optical waveguide systems

תקציר

Transmission rates in broadband optical waveguide systems are significantly enhanced by launching many pulse sequences through the same waveguide. Since pulses from different sequences propagate with different group velocities, intersequence pulse collisions are very frequent, and can lead to severe transmission degradation. On the other hand, the energy exchange in pulse collisions can be beneficially used for controlling the transmission.

In this work we show that collision-induced amplitude dynamics of soliton sequences of N perturbed coupled nonlinear Schrödinger equations can be described by N -dimensional Lotka-Volterra (LV) models, where the model's form depends on the perturbation. To derive the LV models, we carry out single-collision analysis, which is based on a perturbation expansion with respect to the perturbation coefficient and the reciprocal of the group velocity difference. Stability and bifurcation analysis for the equilibrium points of the LV models is used to develop methods for achieving robust transmission stabilization and switching that work well for a variety of waveguides. Further enhancement of transmission stability is obtained in hybrid waveguides and in waveguides with frequency-dependent linear loss.

**מתאמים: פרופ' י. גולדמן, ד"ר ש. מיברג, פרופ' י. סטאנצ'סקו
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