Solitons in an extended nonlinear Schrödinger equation with a spatial-domain stimulated Raman scattering and decreasing dispersion

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Abstract

Dynamics of solitons is considered in the framework of an extended nonlinear Schrödinger equation (NLSE), which is derived from a system of the Zakharov's type for the interaction between high- and low-frequency (HF and LF) waves. The resulting NLSE includes a *pseudo-stimulated-Raman-scattering* (pseudo-SRS) term, i.e., a spatial-domain counterpart of the SRS term, which is a known ingredient of the temporal-domain NLSE in optics. The pseudo-SRS effect is induced by diffusion losses acting on the LF waves. Also included is inhomogeneity of the spatial second-order diffraction (SOD). It is shown that the wavenumber downshift caused by the pseudo-SRS may be compensated by the upshift provided by the SOD whose local strength is a decaying function of the coordinate. Considered are both the NLSE without linear losses of the HF waves [1] and the equation including such losses. Analytical soliton solutions with a permanent shape are found in an approximate form for both equations, and are verified by comparison with numerical results.

[1] E. M. Gromov and B. A. Malomed, *Soliton dynamics in an extended nonlinear Schrödinger equation with a spatial counterpart of the stimulated Raman scattering*, J. Plasma Phys., in press.

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