Interplay Between Dispersion and Nonlinearity in Femtosecond Soliton Management

Ramaswamy Radha and Vaduganathan Ramesh Kumar

Centre for Nonlinear Science, Dept. of Physics, Govt. College for Women (Autonomous), Kumbakonam – 612001, India

Reprint requests to R. R.; E-mail: radha_ramaswamy@yahoo.com

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In this paper, we investigate the inhomogeneous higher-order nonlinear Schrödinger (NLS) equation governing the femtosecond optical pulse propagation in inhomogeneous fibers using gauge transformation and generate bright soliton solutions from the associated linear eigenvalue problem. We observe that the amplitude of the bright solitons depends on the group velocity dispersion (GVD) and the self-phase modulation (SPM) while its velocity is dictated by the third-order dispersion (TOD) and GVD. We have shown how the interplay between GVD, SPM, and TOD can be profitably exploited to change soliton width, amplitude (intensity), shape, phase, velocity, and energy for an effective femtosecond soliton management. The highlight of our paper is the identification of 'optical similaritons' arising by virtue of higher-order effects in the femtosecond regime.

Key words: Inhomogeneous Nonlinear Schrödinger (NLS) Equation; Bright Femtosecond Solitons; Gauge Transformation.

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