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Optical pulse transformations beyond optical wave breaking: Study of passive pulse reshaping in optical fibers

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Needs of science and industry for compact laser sources with ultra-broad spectrum or specially shaped pulse waveforms can be satisfied on fiber-optic platform. Parabolic and triangular pulses are of great interest for a number of applications including amongst others the high power pulse generation, and all optical signal processing. Here we address transformation of ultrashort optical pulses in a variety of optical fibers aiming synthesis of specially shaped pulses. Nonlinear reshaping of ultrashort optical pulses in single-mode optical fibers is analyzed numerically applying extended nonlinear Schrödinger equation. It is shown that pulse can become fully smooth with a linear chirp after OWB cancellation. By matching properly initial pulse parameters and fiber parameters it is possible to change the pulse shape in the steady-state regime. Results are discussed in the context of possible applications and experimental implementations. It is found that triangular pulses can be formed from Gaussian or secant hyperbolic waveforms. The steady-state propagation regime ensures that pulse shape remains triangular during pulse propagation in the fiber. Conditions for producing of parabolic or triangular pulses from initial secant or Gaussian pulses were found. Formation of triangular pulses depending on soliton number and pulse chirp is analyzed. Recommendations are given concerning conditions for stable formation of triangular ultrashort pulses.

Biography

Igor A Sukhoivanov is a Full Professor in Laser and Optoelectronic Devices. He received a Doctorate in Science in 2002, PhD in 1985 and Postdoctoral study in the Humboldt-Universität. Currently, he is with the University of Guanajuato, USA. He is also the author of one book, 9 chapters in books and more than 130 papers in reputed journals and a senior member of IEEE and OSA, and a member of SPIE. He has been serving as an editorial board member and reviewer of different journals.

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