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Nonlinear pulse dynamics in passive and active optical fibers

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Propagation of optical pulses with different shapes in optical fibers has created tremendous research interests because of the potential applications in ultra high speed optical systems, quantum optics, high power lasers, super-continuum generation. Nonlinear pulse reshaping towards Parabolic (PP), semi parabolic (SPP) and triangular (TP) pulses can be possible in optical fibers and it depends on fiber parameters such as dispersion, nonlinearity and gain; and also on pulse properties such as pulse energy, width and peak power. A Gaussian pulse propagating through a normal dispersion fiber amplifier can be changed to a linearly chirped PP of self similar nature in presence of nonlinearity and thus it does not suffer from the deadly effects of optical wave breaking. Any pulse from a CW laser asymptotically converts into a PP independent of its initial shape when Raman fiber amplifier is used to provide gain. However use of Erbium Doped Fiber Amplifier (EDFA) may change the dynamics of pulse propagation. For EDFA the dipole relaxation time and gain dispersion term control the pulse propagation by modifying the nonlinear Schrödinger equation. It is also seen that the evolved pulse may be parabolic or non-parabolic depending on the repetition rate of the input laser source, initial pulse parameters as well as fiber parameters. Some non-parabolic pulses are very close to PP, which are termed as semi-parabolic pulse. Those SPP can be again stabilized to PP using two stage fiber systems. At the same time pre-chirping technique in a normal dispersion fiber is also helpful to generate stable TP which are used as saw tooth pulses in optical signal processing.

Biography

Mousumi Basu received her MSc in Physics from Jadavpur University, India, MTech in Solid State Technology and PhD in Physics in the area of fiber optics from Indian Institute of Technology, Kharagpur, India. She has been a faculty member of physics in Indian Institute of Engineering Science & Technology, Shibpur, India. She has published several research papers in refereed journals and conferences. Her current research interest includes designing optical fibers in view of nonlinear pulse propagation and fabrication and characterization of optical nanofibers.

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