Analysis of Evolution of Higher Order Solitons by Numerical Simulation

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Abstract : Solitons are stable solution of nonlinear Schrodinger equation. Their stability is due to the exact combination between nonlinearity and dispersion which causes pulse broadening. Higher order solitons are born when nonlinear length is N multiple of dispersive length. Soliton order is determined by the number N itself. In this paper, evolution of higher order solitons is illustrated by simulation using Matlab. Results show that higher order solitons change their shape periodically, the reason why they are bad for transmission comparing to fundamental solitons which are constant. Partial analysis of a soliton of higher order explains that the periodic shape is due to the interplay between nonlinearity and dispersion which are not equal during a period. This class of solitons has many applications such as generation of supercontinuum and the impulse compression on the Femtosecond scale. As a conclusion, the periodicity which is harmful to transmission can be beneficial in other applications.

Keywords : dispersion, nonlinearity, optical fiber, soliton

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