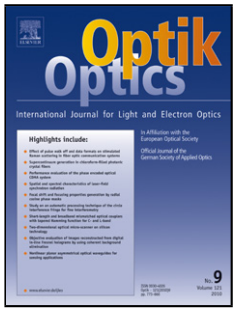

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Author: Shu-Liang Jia Yi-Tian Gao Lei Hu

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Rogue waves, breather-to-soliton transitions and modulational instability for the nonlinear Schrödinger equation with octic operator in an optical fiber

Shu-Liang Jia, Yi-Tian Gao*, Lei Hu

Ministry-of-Education Key Laboratory of Fluid Mechanics and National Laboratory for Computational Fluid Dynamics, Beihang University, Beijing 100191, China

Abstract

The nonlinear Schrödinger equation with octic operator in an optical fiber is investigated in this paper. Via the Darboux transformation with complex spectral parameter, we obtain the breathers and rogue waves for the equation. When the directions of propagation of the two colliding breathers coincide, breather-to-soliton transitions could be observed, and breathers can be transited to two kinds of solitons, i.e., the M-shape and W-shape solitons. It is found that the coefficient of the eighth-order term η is necessary in the transition condition. Interactions between the solitons and breathers are shown to be elastic. By virtue of the separating function, rogue waves are seen to be separated into the so-called "triangular cascades" or "pentagram" patterns. Number of the separated first-order rogue waves seems to be related to the order of the rogue waves. Modulational instability for the generalised plane wave solutions is conducted, and we find that η does not affect the stability of the solutions.

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Keywords: Nonlinear Schrödinger equation with octic operator; Breather-to-soliton transitions; Rogue waves; Modulational instability; Optical fiber

*Corresponding author, with e-mail address as gaoyt163@163.com