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Generation mechanism of rogue waves for the discrete nonlinear Schrödinger equation

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Abstract

In this paper, we analyze the generation mechanism of rogue waves for the discrete nonlinear Schrödinger (DNLS) equation from the viewpoint of structural discontinuities. First of all, we derive the analytical breather solutions of the DNLS equation on a new nonvanishing background through the Darboux transformation (DT). Via the explicit expressions of group and phase velocities, we give the parameter conditions for existence of the velocity jumps, which are consistent with the derivation of rogue waves via the generalized DT. Furthermore, to verify such statement, we apply the Taylor expansion to the breather solutions and find that the first-order rogue wave can be obtained at the velocity-jumping point. Our analysis can help to rich the understanding on the rogue waves for the discrete nonlinear systems.

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Keywords: Darboux transformation; Breathers; Rogue wave; Structural discontinuities

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