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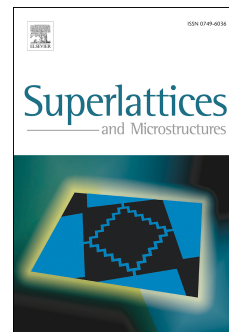
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Semirational rogue waves for the three-coupled fourth-order nonlinear Schrödinger equations in an alpha helical protein

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Abstract

Investigated in this paper are the three-coupled fourth-order nonlinear Schrödinger equations, which describe the dynamics of alpha helical protein with the interspine coupling at the higher order. We show that the representation of the Lax pair with Expressions (42) – (45) in Ref. [25] is not correct, because the three-coupled fourth-order nonlinear Schrödinger equations can not be reproduced by the Lax pair with Expressions (42) – (45) in Ref. [25] through the compatibility condition. Therefore, we recalculate the Lax pair. Based on the recalculated Lax pair, we construct the generalized Darboux transformation, and derive the first- and second-order semirational solutions. Through such solutions, dark-bright-bright soliton, breather-breather-bright soliton, breather soliton and rogue waves are analyzed. It is found that the rogue waves in the three components are mutually proportional. Moreover, three types of the semirational rogue waves consisting of the rogue waves and solitons are presented: (1) consisting of the first-order rogue wave and one soliton; (2) consisting of the first-order rogue wave and two solitons; (3) consisting of the second-order rogue wave and two solitons.

Keywords: Alpha helical protein; Three-coupled fourth-order nonlinear Schrödinger equations; Solitons; Semirational rogue waves; Generalized Darboux transformation

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