A Variable Separation Approach to Solve the Integrable and Nonintegrable Models: Coherent Structures of the (2+1)-Dimensional KdV Equation

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Abstract: We study the localized coherent structures of a generally nonintegrable (2+1)-dimensional KdV equation via a variable separation approach. In a special integrable case, the entrance of some arbitrary functions leads to abundant coherent structures. However, in the general nonintegrable case, an additional condition has to be introduced for these arbitrary functions. Although the additional condition has been introduced into the solutions of the nonintegrable KdV equation, there still exist many interesting solitary wave structures. Especially, the nonintegrable KdV equation possesses the breather-like localized excitations, and the similar static ring soliton solutions as in the integrable case. Furthermore, in the integrable case, the interaction between two travelling ring solitons is elastic, while in the nonintegrable case we cannot find even the single travelling ring soliton solution.

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