Soliton interactions of the two-dimensional Boussinesq-type equation

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Abstract:

It is well known that the Kadomtsev-Petviashvili (KP) equation can be derived from a weak two-dimensional approximation of the Boussinesq-type equations in shallow water waves and ion-acoustic waves. The recent development in the study of line soliton interactions of the the KP equation [1,2] brings us to the detailed study of line soliton interactions of the two-dimensional Boussinesq-type equations in shallow water waves and ion-acoustic waves [3,4,5,6,7]. Since the two-dimensional Boussinesq-type equations are no longer integrable, we need to clarify which properties of line soliton interactions of the KP equation remain in the two-dimensional Boussinesq-type equations and what happens in line soliton interactions when the KP approximation is invalid.

Employing a pseudo-spectral method and a finite difference method, we study line soliton interactions of the two-dimensional Boussinesq-type equation. Based on numerical results, common properties and differences between soliton inteactions of the two-dimensional Boussinesq-type equation and of the KP equation are discussed. Some of numerical results are explained by using an analytical approximation method. The interpretation in shallow water waves is also discussed.

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