Uniqueness of the Kadomtsev-Petviashvili and Boussinesq Equations

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The Kadomtsev-Petviashvili and Boussinesq equations $(u_{xxx} - 6uu_x)_x - u_{tx} \pm u_{yy} = 0$, $(u_{xxx} - 6uu_x)_x + u_{xx} \pm u_{tt} = 0$, are completely integrable, and in particular, they possess the three-soliton solution. This article aims to expose a uniqueness property of the Kadomtsev-Petviashvili (KP) and Boussinesq equations in the integrability theory. It is shown that the Kadomtsev-Petviashvili and Boussinesq equations and their dimensional reductions are the only integrable equations among a class of generalized Kadomtsev-Petviashvili and Boussinesq equations $(u_{x_1 x_1 x_1} - 6uu_{x_1})_{x_1} + \sum_{i,j=1}^{M} a_{ij} u_{x_i x_j} = 0$, where the a_{ij}'s are arbitrary constants and M is an arbitrary natural number, if the existence of the three-soliton solution is required.

Key words: Integrable Equations; Hirota's Bilinear Form; Three-Soliton Condition.
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