Computer algebra application to numerical solving of nonlinear KdV-type equations

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Abstract

In the present talk we consider some nonlinear partial differential equations of Korteweg-de Vries (KdV) type with one temporal and one spatial independent variables. We analyze first a scalar equation with one dependent variable. This equation describes dynamics of viscous incompressible liquid interacting with cylinder shell under propagation of deformation waves. Then we study a system of coupled equations with two dependent variables that describes the nonlinear wave dynamics in physically nonlinear elastic cylindrical shells with viscous incompressible liquid inside them. By using our algorithmic approach [1] which combines the finite volume method and difference elimination by means of Gröbner bases, we construct finite-difference approximations to both problems and present the results of numerical simulation based on those approximations. In the case of the coupled system of two equations we also discuss consistency of its finite-difference approximation by using the ideas and methods of paper [2]. For computation of the relevant difference Gröbner bases one can apply the algorithmic approach proposed recently in [3].

References

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