Group analysis of variable coefficient Kawahara equations

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An exhaustive group classification of variable coefficient generalized Kawahara equations is carried out. Namely, we investigate the equations

$$u_t + \alpha(t)u^n u_x + \beta(t)u_{xxx} + \sigma(t)u_{xxxxx} = 0 \tag{1}$$

from the Lie symmetry point of view. Here n is an arbitrary nonzero integer, α, β and σ are smooth nonvanishing functions of the variable t.

As a result, we derive new variable coefficient nonlinear models admitting Lie symmetry extensions. This becomes possible due to an appropriate gauge of arbitrary elements of the class. Namely, the gauge $\alpha = 1$ is utilized. The use of different equivalence groups for the cases $n \neq 1$ and $n = 1$, which are found in the course of the study of admissible transformations in class (1), allows us to write down the classification list in a simple and concise form. For convenience of further applications, we also present the classification list extended by the equivalence transformations.

All inequivalent Lie reductions of these equations to ordinary differential equations are performed. Then we give some examples on the construction of exact and numerical solutions using Lie reduction method. A class of boundary value problems for variable coefficient Kawahara equations possessing scaling symmetry is considered. Numerical solution for the specific problem that could be of interest for applications is constructed.

The authors are grateful to Prof. Roman Popovych for useful discussions.

1. Kuriksha O., Pošta S. and Vaneeva O. Group classification of variable coefficient generalized Kawahara equations. J. Phys. A: Math. Theor., 2014, **47**, 045201.