2D-REDUCTIONS OF THE MIKHALEV-PAVLOV EQUATION AND THEIR NONLOCAL SYMMETRIES

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Abstract

The Mikhalev-Pavlov equation (MPE) reads $u_{yy} = u_{tx} + u_y u_{xx} - u_x u_{xy}$ and belongs to the class of integrable linearly degenerate equations. It admits an infinite-dimensional Lie algebra of symmetries and all its 2D-symmetry reductions were described in [3]. Among these reductions, the following ones are of a special interest: (1) $u_y u_{xy} - u_x u_{yy} = e^y u_{xx}$, (2) $u_{xx} = (x-u_y)u_{xy} + (2y+u_x)u_{yy} - u_y$, (3) $u_{yy} = (u_y + y)u_{xx} - u_x u_{xy} - 2$ (the last one is equivalent to the Gibbons-Tsarev equation). Under the reductions, the isospectral Lax pair of MPE transforms to rational differential coverings of the form

$$w_x = \frac{a_2 w^2 + a_1 w + a_0}{w^2 + c_1 w + c_0}, \qquad w_y = \frac{b_2 w^2 + b_1 w + b_0}{w^2 + c_1 w + c_0} \tag{1}$$

for the reduced equations, where a_i, b_i, and c_i are real constants, [1]. The standard "reversion procedure", makes it possible to introduce a fake spectral parameter to (1) and construct infinite series of conservation laws together with the corresponding infinite-dimensional coverings. Using the known description of nonlocal symmetries for MPE, [2], it is proved that the algebras of nonlocal symmetries for reductions are isomorphic to the Witt algebra, cf. [4].

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