Abundant Symmetries and Exact Compacton-Like Structures in the Two-Parameter Family of the Estevez-Mansfield-Clarkson Equations

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Abstract: The two-parameter family of Estevez-Mansfield-Clarkson equations with fully nonlinear dispersion (called E(m,n) equations), $(u_z^m)_{zz\tau}+\gamma(u_z^n u_\tau)_z+u_{\tau\tau}=0$ which is a generalized model of the integrable Estevez-Mansfield-Clarkson equation $u_{zzz\tau}+\gamma(u_z u_{z\tau}+u_{zz}u_\tau)+u_{\tau\tau}=0$, is presented. Five types of symmetries of the E(m,n) equation are obtained by making use of the direct reduction method. Using these obtained reductions and some simple transformations, we obtain the solitary-like wave solutions of E(1,n) equation. In addition, we also find the compacton solutions (which are solitary waves with the property that after colliding with other compacton solutions, they reemerge with the same coherent shape) of E(3,2) equation and E(m,m-1) for its potentials, say, u_z, and compacton-like solutions of E(m,m-1) equations, respectively. Whether there exist compacton-like solutions of the other E(m,n) equation with m $\neq$n+1 is still an open problem.

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