Mathematical Physics

Complete group classification of a class of nonlinear wave equations

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Preliminary group classification became prominent as an approach to symmetry analysis of differential equations due to the paper by Ibragimov, Torrisi and Valenti [J. Math. Phys. 32, 2988-2995] in which partial preliminary group classification of a class of nonlinear wave equations was carried out via the classification of one-dimensional Lie symmetry extensions related to a fixed finite-dimensional subalgebra of the infinite-dimensional equivalence algebra of the class under consideration. In the present paper we implement, up to both usual and general point equivalence, the complete group classification of the same class using the algebraic method of group classification. This includes the complete preliminary group classification of the class and finding Lie symmetry extensions which are not associated with subalgebras of the equivalence algebra. The complete preliminary group classification is based on listing all inequivalent subalgebras of the whole infinite-dimensional equivalence algebra whose projections are qualified as maximal extensions of the kernel algebra. The set of admissible point transformations of the class is exhaustively described in terms of the partition of the class into normalized subclasses. A version of the algebraic method for finding the complete equivalence groups of a general class of differential equations is proposed.

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