Applications of Group-Theoretical Methods in Hydrodynamics (Mathematics and Its Applications)

V.K. Andreev, O.V. Kaptsov, Vladislav V. Pukhnachev, A.A. Rodionov

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It was long ago that group analysis of differential equations became a powerful tool for studying nonlinear equations and boundary value problems. This analysis was especially fruitful in application to the basic equations of mechanics and physics because the invariance principles are already involved in their derivation. It is in no way a coincidence that the equations of hydrodynamics served as the first object for applying the new ideas and methods of group analysis which were developed by 1. V. Ovsyannikov and his school. The authors rank themselves as disciples of the school. The present monograph deals mainly with group-theoretic classification of the equations of hydrodynamics in the presence of planar and rotational symmetry and also with construction of exact solutions and their physical interpretation. It is worth noting that the concept of exact solution to a differential equation is not defined rigorously; different authors understand it in different ways. The concept of exact solution expands along with the progress of mathematics (solu tions in elementary functions, in quadratures, and in special functions; solutions in the form of convergent series with effectively computable terms; solutions whose searching reduces to integrating ordinary differential equations; etc.). We consider it justifiable to enrich the set of exact solutions with rank one and rank two in variant and partially invariant solutions to the equations of hydrodynamics.

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