A survey on modern group analysis of linear and nonlinear problems

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Lie group analysis provides a rigorous mathematical formulation of intuitive ideas of symmetry and invariance and furnishes a universal approach to analytical investigations of linear and nonlinear mathematical models. It is particularly useful for solving nonlinear equations analytically when other means of integration fail.

The present talk is a survey of the basic methods from classical Lie group theory and recent investigations of the author. The methods are applied to Riemannian geometry (local theory) and differential equations. The main topics will be on:

1) Lie's method of integration of nonlinear ordinary differential equations,
2) Linear hyperbolic differential equations in Riemannian spaces with nontrivial conformal group: Huygens' principle and solution of Cauchy's problem,
3) Solution of Laplace's problem on invariants of hyperbolic equations,
4) Extension of Euler's method to parabolic equations,
5) Extension of Euler's equation,
6) Integrating factors for higher-order differential equations.