Roman Smirnov

Applied Mathematics

The main objective of Dr. Smirnov's research program is the development of two intertwined areas of research whose common thread is the search of **invariant quantities** preserved by **continuous Lie group actions**.

The first area of research is the the development of a new invariant theory that forms a framework for characterization of **orthogonally separable natural Hamiltonians with scalar and vector potentials** defined on pseudo-Riemannian spaces of constant curvature. This theory, also known as the Invariant theory of Killing tensors, can be viewed as a natural extension of the classical invariant theory of homogeneous polynomials. The essence of the theory may be described as a development of algebraic and geometric properties of the Killing tensors (symmetry operators) arising in problems of classical (quantum) mechanics by means of invariants, covariants, joint invariants, etc. defined analogously to their counterparts in classical invariant theory. The aforementioned theory based on Lie groups theoretical approach to differential equations has proven to be quite potent in many applications to the problems of mathematical physics.

Dr. Smirnov is also concerned with the development of a new paradigm for mathematical modelling of **economic growth** that is also based on the study of invariants and covariants arising in the study of continuing Lie group transformation representing technical progress in economics. Extending the Lie group theoretical approach developed by R. Sato and R. V. Ramachadran it was possible to derive a new production function generalizing the classical Cobb-Douglas function. The new functions gives a better interpretation of current economic data and can be used in various neo-classical growth models in economics that originate from the Solow-Swan model.

Dr. Roman Smirnov
Department of Mathematics and Statistics
Dalhousie University
(902) 494-3265, Roman.Smirnov@dal.ca

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