

Curriculum Vitae

NAIL H. IBRAGIMOV

- **Present address:**

Department of Mathematics and Science
School of Engineering
Blekinge Institute of Technology
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- **Degrees:** MSc in Mathematics

Thesis: *Classification of invariant solutions of the equations for two-dimensional transient-state gas flows*, Novosibirsk University, 1965
Supervisor - L.V. Ovsyannikov;

PhD in Mathematics and Physics

Thesis: *Group properties of some differential equations*, Institute of Hydrodynamics, USSR Ac. Sci, Novosibirsk, 1967
Supervisor - L.V. Ovsyannikov;

Dr.Sci. in Mathematics and Physics

Thesis: *Lie groups in some problems of mathematical physics*,
Institute of Mathematics, USSR Ac. Sci, Novosibirsk, 1973.

- **Current Position:**

- Professor, Department of Mathematics and Science, School of Engineering
- Director of the research centre ALGA: *Advances in Lie Group Analysis*
Blekinge Institute of Technology, 371 79 Karlskrona, Sweden
- Adjunct Professor, Department of Mechanical Engineering, New Mexico
Institute of Mining and Technology, Socorro, NM 87801, USA

- **Language proficiency:**

- *English, Russian and Swedish*
- Can read and translate into English from *French, German, Italian*

- **Research areas:**

- i. PURE MATHEMATICS: *Theory of differential equations, Lie groups and Lie algebras, Riemannian geometry, Theory of distributions and invariance principles in initial value problems, Symmetry in mathematical modelling, Theory of approximate transformation groups and perturbation methods in group analysis, Lie-Bäcklund transformation groups, Invariants of*

families of equations.

Published: 60 papers, 8 books and 15 chapters in books.

- ii. APPLIED MATHEMATICS: *Symmetry, conservation laws and group invariant solutions in fluid dynamics, Group theory in turbulence, Shallow-water motions, Group invariant solutions in gasdynamics, Group classification and integration of equations modelling soil water motions in irrigated systems, Lie symmetry analysis, analytical integration and solution of initial value problems for mathematical models in finance.*

Published: 30 papers, 4 books and 7 chapters in books.

- iii. MATHEMATICAL PHYSICS: *Classical and relativistic mechanics, General relativity, Conservation laws in continuum mechanics and quantum mechanics, Neutrinos in the de Sitter universe, Wave propagation in curved space-times, Conformal symmetry and Huygens' principle, Plasma theory, Nonlinear optics, Gas kinetics, Nonlinear diffusion.*

Published: 30 papers, 4 books and 5 chapters in books.

• **Teaching Experience:**

- *Undergraduate:* Calculus, Mathematical analysis, Linear algebra, Vector calculus, Ordinary differential equations, Analytical mechanics, Thermodynamics, Special relativity
- *Graduate:* Ordinary and partial differential equations, Theory of functions of a complex variable, Functional analysis, Course of mathematical physics, Tensors and relativity, Riemannian geometry, Differential forms, Theory of distributions, Boundary/initial value problems
- *Developed new courses:* Transformation groups and Lie algebras, Lie group analysis of differential equations, Course in partial differential equations based on invariance principles, Tensors and Riemannian geometry, Symmetry and conservation laws, Analytical methods in mathematical modelling, Distributions and invariance principle in initial value problems.

• **MSc and PhD Students:**

Doctoral student supervision:

Dr. B.V. Lapko (1977-1980), PhD thesis: *Group analysis of conformally invariant equations and gasdynamic equations*, Institute of Hydrodynamics, USSR Ac. Sci., 1980;

Dr. A.P. Chupakhin (1981-1984), PhD thesis: *Conformally invariant equations in Riemannian spaces with non-trivial conformal group*, Institute of Mathematics, USSR Ac. Sci., Novosibirsk, 1984;

Dr. R.K. Gazizov (1986-1989), PhD thesis: *Non-local and approximate symmetries of differential equations*, Institute of Mathematics, USSR Ac. Sci., Novosibirsk, 1989;

Dr. V.A. Baikov, Dr.Sci thesis: *Approximate group analysis of non-linear models in continuum mechanics*, Institute of Applied Mathematics, Russian Ac. Sci., Moscow, 1990;

Dr. S.V. Khabirov, Dr.Sci thesis: *Methods of Lie-Bäcklund groups in mathematical physics*, Institute of Mathematics, Russian Ac. Sci., Ekaterinburg, Russia, 1991;

Dr. R.K. Gazizov , Dr.Sci thesis: *Approximate group analysis of non-linear models in continuum mechanics*, Institute of Applied Mathematics, Russian Ac. Sci., Ekaterinburg, Russia, 1999;

Dr. M.A. Egorov (1997-2000) PhD thesis: *Applications of group theoretical methods in problems of control theory illustrated by matrix Riccati equations*, Moscow Institute of Physics and Technology, Moscow, Russia, 2000;

Dr. V.F. Kovalev, Dr.Sci thesis: *Renormgroup algorithm for boundary value problems in mathematical models of nonlinear physical processes*, Institute of Applied Mathematics, Russian Ac. Sci., Moscow, 2002.

MSc students: Supervised about 30 MSc students (20 in Russia, 2 in South Africa, 8 in Sweden)

• **Honours, Awards, Membership of Professional Societies:**

- Fulbright Scholar, October 1976 – March 1977
- The USSR State Prize in Science and Technology, 1987
- A-rated researcher of FRD (Foundation for Research Development, Republic of South Africa), 1995 – 2000
- FRD Resarch Grant, 1996 – 2000
- Prize “Researcher of the year”, Blekinge Research Society, Sweden, 2004
- International *Lagrange’s award* for contributions to “Nonlinear Science”, Porto, Portugal, 2008

• **Membership in Editorial Boards of Journals:**

- Communications in Nonlinear Science and Numerical Simulation (Associate Editor), 2002 - present.
- Differential Equations, 1993-present.
- Journal of Mathematical Analysis and Applications (Associate Editor), 2003-2007.
- Nonlinear Dynamics: An International Journal of Nonlinear Dynamics and Chaos in Engineering Systems (Contributing editor), 1997-present.
- Dynamics of Continuous Media, During 1969–1981.
- Quaestiones Mathematicae: Journal of the South African Mathematical Society, 1997–2002.

- **Organization of Conferences:**

- Co-Chairman of the International Joint IMU/IUTAM Symposium "Group Theoretical Methods in Mechanics", Novosibirsk, USSR, 1978.
- Chairman of the Annual National conferences on "Lie Group Analysis of Differential Equations", Russia, 1983 – 1993.
- Chairman of the Scientific Committee of the International Workshop "Modern Group Analysis III", Ufa, Bashkiria, 1991.
- Chairman of the Scientific Committee of the International Workshop "Modern Group Analysis IV: Advanced Analytical and Computational Methods in Mathematical Physics", Catania, Italy, 1992.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis V: Theory and Applications in Mathematical Modelling", Johannesburg, South Africa, 1994.
- Member of the Organizing Committee of "Fourth Workshop on Differential Equations and Chaos", Johannesburg, South Africa, January 1996.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis VI: Developments in Theory, Computation and Applications", Johannesburg, South Africa, January 1996.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis VII: Lie Groups and Contemporary Symmetry Analysis", Nordfjordeid, Norway, June 30 - July 5, 1997.
- Chairman of the organizing Committee of the "Joint ISAMM/FRD Interdisciplinary Workshop on Symmetry Analysis and Mathematical Modelling", Pretoria, 8-10 December 1998.
- Chairman of the Scientific Committee of the International Conference MOGRAN-2000: "Modern Group Analysis VIII", Ufa, Russia, September 27 - October 3, 2000.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis IX", Moscow, Russia, August 19-23, 2002.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis X", Larnaca, Cyprus, October 24-31, 2004.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis XI", Karlskrona, Sweden, 28 May - 1 July, 2007.
- Chairman of the Scientific Committee of the International Conference "Modern Group Analysis XII", Porto, Portugal, July 28 - 31, 2008.

- **Invited Lectures:**

- Georgia Institute of Technology (Atlanta, USA), 1976-77
- Collège de France (Paris, France), 1979 and 1992

- University of Paris–VI (Paris, France), 1984
- International Center for Theoretical Physics (Trieste, Italy), 1980
- University of Greifswald (Greifswald, Germany), 1984
- University of Leipzig (Leipzig, Germany), 1984
- University of Catania (Catania, Italy), 1990, 1991 and 1992
- University of Montréal (Montréal, Canada), 1991
- University of Oslo (Oslo, Norway), 1992
- University of Natal (Durban, South Africa), 1993
- University of New South Wales (Sydney, Australia), 1994
- Stanford University (Stanford, USA), 1996
- Lecture series on *Modern Group Analysis* for mathematicians of Thailand, Organised by the Ministry of University Affairs of Thailand (Bangkok, Thailand), 1996
- Universities of Rio de Janeiro, Brasilia and Campinas, Brazil, 1997
- University of Wollongong (Wollongong, Australia), 1998
- 35th Australia–New Zealand Industrial and Applied Mathematics (ANZIAM) Conference (Mollymook, Australia), 1999
- Institute of H. Poincaré, Paris, 2001
- University of Lund, 2001, Sweden, 2002
- University of Linköping, Sweden, 2001
- University of Cyprus (Nicosia, Cyprus), 2001 and 2004
- University of Växjö, Sweden, 2002
- University of Copenhagen, 2003
- University of Roskilde, Denmark, 2003
- University of Cottbus, Germany, 2006
- Institute of Applied Mathematics of Russian Academy of Sciences, Moscow, 2007.
- University of Tromsø, Norway, 2008
- Institute of Engineering of Porto (ISEP), Portugal, 2008.
- University of Iceland, Reykjavik, 2008

● **Number of publications:**

- Books: 23
- Editor of conference proceedings: 9
- Chapters in books: 27

- Translations: 9
- Papers: 150

- **List of publications:**

BOOKS:

1. Group properties of some differential equations, Nauka, Novosibirsk, 1967, 60 p.
2. Lie groups in some problems of mathematical physics, Novosibirsk University Press, Novosibirsk, 1972, 160 p.
3. Lie–Bäcklund transformations in applications, SIAM, Philadelphia, 1979 (with R.L. Anderson), 124 pages. Library of Congress Catalog Card Number: 78-78207.
4. Transformation groups applied to mathematical physics, Nauka, Moscow, 1983 (Awarded the USSR State prize in Science and Technics for 1987, English translation by Reidel, Dordrecht, 1985, 394 p. ISBN 90-277-1847-4) .
5. Primer on group analysis, Znanie, Moscow, 1989.
6. Essay on the group analysis of ordinary differential equations, Znanie, Moscow, 1991.
7. Handbook of Lie Group Analysis of Differential Equations. Vol.1: Symmetries, Exact Solutions and Conservation Laws, CRC Press, Boca Raton, 1994 (Editor), 429 p. ISBN 0-8493-4488-3.
8. Handbook of Lie Group Analysis of Differential Equations. Vol.2: Applications in Engineering and Physical Sciences, CRC Press, Boca Raton, 1995 (Editor), 546 p. ISBN 0-8493-2864-0.
9. Handbook of Lie Group Analysis of Differential Equations. Vol.3: New Trends in Theoretical Developments and Computational Methods, CRC Press, Boca Raton, 1996 (Editor), 536 p. ISBN 0-8493-9419-8.
10. Elementary Lie group analysis and ordinary differential equations, John Wiley, Chichester–New York, 1999, 347 p. ISBN 0-471-97430-7.
11. Introduction to Modern Group Analysis, Tau, Ufa, 2000, 113 pages. ISBN 5-93578-005-4.
12. Modern gruppanalys: En inledning till Lies lösningsmetoder av ick-elinära differentialekvationer, Studentlitteratur, Lund, 2002, 143 p. ISBN 91-44-02430-4.
13. A practical course in differential equations and mathematical modelling (Classical and new methods, nonlinear mathematical models, symmetry and invariance principles), ALGA Publications, Karlskrona. 1st ed., 2004, 203 p. ISBN 91-7295-998-3. 2nd ed., 2005, 332 p. ISBN 91-7295-995-9. 3rd ed., 2006, 370 p. ISBN 91-7295-988-6.

14. Lie group analysis: Classical heritage, ALGA Publications, Karlskrona, 2004 (Editor), 157 p. ISBN 91-7295-996-7.
15. Introduction to differential equations, (with A.S.A. Al-Hammadi), ALGA Publications, Karlskrona, 2006, 178 p. ISBN 91-7295-994-0.
16. Selected works, vol. I, ALGA Publications, Karlskrona, 2006, 290 p. ISBN 91-7295-990-8.
17. Selected works, vol. II, ALGA Publications, Karlskrona, 2006, 331 p. ISBN 91-7295-991-6.
18. Approximate groups and renormgroup symmetries, (with V.F. Kovalev), ALGA Publications, Karlskrona, 2008, 153 p. ISBN 978-91-7295-980-4.
19. Selected works, vol. III, ALGA Publications, Karlskrona, 2008, 317 p. ISBN 978-91-7295-992-7.
20. Tensors and Riemannian geometry with applications to differential equations and relativity, Lecture notes, ALGA Publications, Karlskrona, 2008, 116 p. ISBN 978-91-7295-978-1.
21. Approximate transformation groups, Lecture notes, ALGA Publications, Karlskrona, 2008, 116 p. ISBN 978-91-7295-977-4.
22. Approximate and Renormgroup Symmetries, Higher Education Press (China) and Springer, 2009 (with V.F. Kovalev)
23. Group analysis of integro-differential equations. With applications in Fluid Mechanics and Plasma Physics, Springer, accepted 2008 (with Yu.N. Grigoriev, V.F. Kovalev, S.V. Meleshko)

EDITOR OF CONFERENCE PROCEEDINGS:

1. Proc. Int. Symp. "Group Theoretic Methods in Mechanics", Novosibirsk, 1978, printed in Institute of Hydrodynamics, Novosibirsk, 1978 (with L.V. Ovsyannikov).
2. Proc. Int. Workshop "Modern Group Analysis: Advanced Analytical and Computational Methods in Mathematical Physics", Acireale (Catania), Italy, 27–31 October 1992, Kluwer Academic Publishers, Dordrecht, 1993 (with M. Torisi and A. Valenti).
3. Proc. Int. Conference "Modern Group Analysis V: Theory and Applications in Mathematical Modelling", Johannesburg, South Africa, 16–22 January 1994, in: Lie Groups and Their Applications, vol. 1, No 1, 1994 (with F.M. Mahomed).
4. Proc. Int. Conference "Modern Group Analysis VI: Development in Theory, Computation and Application", Johannesburg, South Africa, 15–20 January 1996, New Age International, New Delhi, 1996 (with F.M. Mahomed).
5. "Differential Equations and Chaos: Lectures on Selected Topics", Eds. N.H. Ibragimov, F.M. Mahomed, D.P. Mason and D. Sherwell, New Age International, New Delhi, 1996.

6. Proc. Int. Conference “Modern Group Analysis VII”, Nordfjordeid, Norway, 30 June-5 July 1997 (with R. Naqvi and E. Straume).
7. Proc. ISAMM/FRD Inter-disciplinary Workshop “Symmetry Analysis and Mathematical Modelling”, Pretoria, South Africa, 8-10 December 1998.
8. Proc. Int. Conference MOGRAN-2000, Ufa, Russia, September 27 - October 3, 2000 (with V.A. Baikov, R.K. Gazizov and F.M. Mahomed).
9. Proc. Int. Conference MOGRAN X, Larnaca, Cyprus, October 24-31, 2004 (with C. Sophocleous and P.A. Domianou).

TRANSLATIONS:

1. J. Leray, “Hyperbolic differential equations”, Institute for Advanced Study, Princeton, 1953, translation from English into Russian and edition, Nauka, Moscow, 1984.
2. J. Leray, “Gårding’s method”, Lecture notes, translation from French into Russian, Nauka, Moscow, 1984.
3. S. Lie, “On Integration of a class of linear partial differential equations by means of definite integrals”, Arch. for Math., Bd. VI, 1881, pp. 328-368, translation from German into English, in: CRC Handbook of Lie Group Analysis of Differential Equations, vol. 2, CRC Press, Boca Raton, 1995.
4. S. Lie, “General theory of partial differential equations of and arbitrary order”, Leipz. Berichte, Heft I, 1895, pp. 53-128, translation from German into English, in: Lie group analysis: Classical heritage, ALGA Publications, Karlskrona, 2004.
5. A.V. Bäccklund, “Surface transformations”, Mathematische Annalen, IX, 1876, S. 297-320, translation from German into English, in: Lie group analysis: Classical heritage, ALGA Publications, Karlskrona, 2004.
6. L.V. Ovsyannikov, “Group properties of the Chaplygin equation”, Applied Mechanics and Technical physics, No. 3, 1960, pp. 126-145, translation from Russian into English, in: Lie group analysis: Classical heritage, ALGA Publications, Karlskrona, 2004.
7. Louse Petréen, “Extension of Laplace’s method ...”, Lunds Universitets Årsskrift, N.F. Afd. 2, Bd.7, Nr. 3, 1911, translation from French into English, in: *Archives of ALGA*, vol. 3, ALGA Publications, Karlskrona, 2006.
8. E. Bessel-Hagen, “On conservation laws of electrodynamics”, Mathematische Annalen, Bd. 84, 1921, translation from German into English, in: *Archives of ALGA*, vol. 3, ALGA Publications, Karlskrona, 2006.
9. V.P. Ermakov, “Second-order differential equations: Conditions for complete integrability”, Translation from V.P. Ermakov’s ”Lectures

on integration of differential equations (Russian), in: *Archives of ALGA*, vol. 5, ALGA Publications, Karlskrona, 2008.

CHAPTERS IN BOOKS

1. Bäcklund transformation for evolution equations, in *Y. Choquet-Bruhat and C. DeWitt-Morette, Analysis, Manifolds and Physics, II, North-Holland, 1991*.
2. One-parameter transformation groups, in *Handbook of Lie Group Analysis of Differential Equations. Vol.1: Symmetries, Exact Solutions and Conservation Laws, CRC Press, Boca Raton, 1994*.
3. Integration of second-order ordinary differential equations, *ibid*.
4. Group classification of second-order ordinary differential equations, *ibid*.
5. Invariant solutions, *ibid*.
6. Lie–Bäcklund transformation groups, *ibid*, (with R.L. Anderson).
7. Noether-type conservation theorems, *ibid*, (with R.L. Anderson).
8. Ordinary differential equations, *ibid*.
9. Second-order partial differential equations with two independent variables, *ibid*, (with R.K. Gazizov).
10. Infinitesimal calculus of symmetry groups, in *Handbook of Lie Group Analysis of Differential Equations. Vol.2: Applications in Engineering and Physical Sciences, CRC Press, Boca Raton, 1995*.
11. Group classification of differential equations illustrated by equations of nonlinear filtration, *ibid*.
12. Invariance principle in linear second-order partial differential equations, *ibid*.
13. Huygens’ principle: conformal invariance, Darboux transformation, and Coxeter groups, *ibid*.
14. Applications to celestial mechanics and astrophysics, *ibid*.
15. Utilization of Vessiot–Guldberg–Lie algebra for integration of nonlinear equation, *ibid*.
16. Symmetry groups and fundamental solutions for linear equations of mathematical physics, *ibid*.
17. Incompressible fluids, *ibid*, (with V.A. Baikov).
18. Plasma theory: Vlasov–Maxwell and related equation, *ibid*.
19. Nonlinear optics and acoustics, *ibid*.
20. Lie–Bäcklund symmetries: representation by formal power series, in *Handbook of Lie Group Analysis of Differential Equations. Vol.3: New Trends in Theoretical Developments and Computational Methods, CRC Press, Boca Raton, 1996*, (with R.L. Anderson).
21. Approximate transformation groups and deformations of symmetry Lie algebras, *ibid*, (with V.A. Baikov and R.K. Gazizov).

22. Differential equations with distributions: group theoretic treatment of fundamental solutions, *ibid.*
23. Calculus of symmetry groups for integro-differential equations, *ibid.*, (with S.V. Meleshko).
24. Group theoretic modelling, *ibid.*
25. Ordinary differential equations, *ibid.*, (with F.M. Mahomed).
26. Differential equations with a small parameter: exact and approximate symmetries, *ibid.*
27. Differential constraints, *ibid.*, (with S.V. Meleshko).

PAPERS:

1. Classification of the invariant solutions to the equations for the two-dimensional transient-state flow of a gas, Zh. Prikl. Mekh. Tekh. Fiz., No. 4, 1966, 19-22 (English transl. in *J. Appl. Mech. Tech. Phys.*, **7**(4), 1966, 19-22).
2. Generalized motions in Riemannian spaces, Soviet Math. Dokl., v. 178, n. 1, 1968, pp. 27-30; English transl. vol. 9 (1968), p. 21.
3. Group properties of wave equations with zero mass, Soviet Math. Dokl., v. 178, n. 3, 1968, pp. 566-568
4. Transformations preserving harmonic coordinates, Soviet Math. Dokl., v. 181, no. 5, 1968, pp. 1050-1053; English transl. v. 9, n.4, 1968, p. 976-979.
5. On the group classification of differential equations of second order, Soviet Math. Dokl., v. 183, no. 2, 1968, pp. 274-277; English transl. v. 9, n.6, 1968, p. 1365-1369.
6. Invariance of Dirac's equations, Soviet Math. Dokl. 10, n.2, 1969
7. The wave equation in a Riemannian space, Continuum Dynamics 1, Novosibirsk, 1969
8. Groups of generalized motions, Soviet Math. Dokl. 10, n.4, 1969
9. Invariant variational problems and conservation laws, Theor. Math. Phys. 1, n.3, 1969
10. Sur le problème de J. Hadamard relatif à la diffusion des ondes, C.R. Acad. Sci. Paris, Sér. A, 270, 1970 (with E.V. Mamontov)
11. Conformal invariance and Huygens principle, Soviet Math. Dokl. 11, n.5, 1970
12. The Huygens principle, in: Some Problems of Mathematics and Mechanics, Nauka, Leningrad, 1970 (English transl.: Amer. Math. Soc. Transl. (2) 104, 1976)
13. Contributions to the problems of diffusion of waves, Fluid Dynamics Transactions, vol. 6, Part II, 1971
14. Conservation laws of Hydrodynamics, Dokl. Akad. Nauk SSSR, 210(6), 1973, pp. 1307-1309. English transl. Soviet Physics Dokl. 18, 1973/1974.

15. Invariance and conservation laws in Continuum Mechanics, Proc. Int. Symp. "Symmetry, Similarity and Group Theoretic Methods in Mechanics", ed. P.G. Glockner and M.C. Singh, Univ. of Calgary, Calgary, 1974
16. Groups of Lie–Bäcklund contact transformations, Dokl. Akad. Nauk SSSR, 1976 (with R.L. Anderson)
17. Lie–Bäcklund groups and conservation laws, Soviet Math. Dokl. 17, n.5, 1976
18. Applications of Transformations Groups to Differential Equations, Lecture notes, Georgia Tech, Atlanta, 1977
19. Lie–Bäcklund tangent transformations, J. Math. Anal. Appl. 59, n.1, 1977 (with R.L. Anderson)
20. On the Cauchy problem for the equation $u_{tt} - u_{xx} - \sum_{i,j=1}^{n-1} a_{ij}(x-t)u_{y_i y_j} = 0$, Math. USSR Sbornik 31, n.3, 1977
21. Group theoretical nature of conservation theorems, Lett. Math. Phys. 1, 1977
22. Utilization of symmetry groups in computation, Proc. Int. Symp. "Group Theoretic Methods in Mechanics", Novosibirsk, 1978 (with W.F. Ames)
23. Bianchi–Lie, Bäcklund and Lie–Bäcklund transformations, Proc. Int. Symp. "Group Theoretic Methods in Mechanics", Novosibirsk, 1978 (with R.L. Anderson)
24. Failure of a correlation between symmetry properties and Huygens principle, Proc. Int. Symp. "Group Theoretic Methods in Mechanics", Novosibirsk, 1978
25. The Noether identity, Continuum Dynamics 38, Novosibirsk, 1979
26. On the theory of Lie–Bäcklund transformation groups, Math. Sbornik 109, n.2, 1979
27. Korteweg–de Vries equations from group-theoretic point of view, Soviet Phys. Dokl. 24, n.1, 1979 (with A.B. Shabat)
28. Lie–Bäcklund algebras of nonlinear differential equations, Uspekhi Mat. Nauk 34, n.4, 1979 (with A.V. Zhiber and A.B. Shabat)
29. Equations of Liouville type, Soviet Math. Dokl. 20, n.6, 1979 (with A.V. Zhiber and A.B. Shabat)
30. Group-theoretic approach to nonlinear evolution equations, Study Group on Solitons, Partial Differential Equations and Spectral Methods, Lecture Notes, Trieste, 1979
31. Evolutions equations with a nontrivial Lie–Bäcklund group, Functional Anal. Appl. 14, n.1, 1980 (with A.B. Shabat)
32. Infinite Lie–Bäcklund algebras, Functional Anal. Appl. 14, n.4, 1980 (with A.B. Shabat)

33. L–A pairs and infinity of L–B groups and integrals for nonlinear evolution equations, Workshop on Nonlinear Evolution Equations and Dynamical Systems, Lecture Notes, Chania, Crete, 1980
34. Sur l'équivalence des équations d'évolution, qui admettent une algèbre de Lie–Bäcklund infinie, C.R. Acad. Sci. Paris, Sér I, 293, 1981
35. Group classifications of filtration equations, Dokl. Akad. Nauk SSSR, 1987 (with I.Sh. Akhatov and R.K. Gazizov)
36. Approximate symmetries of differential equations with a small parameter, Preprint, Keldysh Inst. of Appl. Math., 1987, 28 pages (with V.A. Baikov and R.K. Gazizov)
37. Quasi-local symmetries for equations of the nonlinear heat conduction type, Dokl. Akad. Nauk SSSR, Mat. Fiz., 295, no.1, 1987, 75-78. (with I. Sh. Akhatov, R. K. Gazizov)
38. Bäcklund transformations and nonlocal symmetries, Soviet Math. Dokl. 36, n.3, 1988 (with I.Sh. Akhatov and R.K. Gazizov)
39. Approximate group analysis of the nonlinear equation $u_{tt} - (f(u)u_x)_x + \varepsilon\varphi(u)u_t = 0$, Differential'nye uravnenia, 24, No. 7, 1988, 1127-1138. English transl. in Differential equations, 24, No. 7, 1989, 719-728 (with V.A. Baikov and R.K. Gazizov).
40. Nonlocal symmetries. Heuristic approach, Mod. Probl. Math. 34, VINITI, Moscow, 1989 (with I.Sh. Akhatov and R.K. Gazizov) (English transl: J. of Soviet Math. 55, n.1, 1991)
41. Nonlocal symmetries of equations of Mathematical Physics, in: Problems of Mathematical Physics, Nauka, Moscow, 1989 (with I.Sh. Akhatov and R.K. Gazizov)
42. Thirteen basic types of gas-dynamics equations, in: Mathematical Modeling, Nauka, Moscow, 1989 (with I.Sh. Akhatov and R.K. Gazizov)
43. Dynamics in the de Sitter Universe: Approximate representation of the de Sitter group, Preprint 144, Keldysh Inst. of Appl. Math., 1990
44. Approximate symmetries, Math. Sbornik 136, n.4, 1988 (with V.A. Baikov and R.K. Gazizov) (English transl.: Math. USSR Sbornik 64, n.2, 1989)
45. Perturbation methods in group analysis, Modern Problems of Math. 34, VINITI, Moscow, 1989, pp. 85-147 (with V.A. Baikov and R.K. Gazizov) (English transl.: J. of Soviet Math. 55, n.1, 1991)
46. Relationships between the symmetry properties of the equations of gas kinetics and hydrodynamics, *J. Mathematical Modeling*, vol. 1, n.3, 1989 (with A.V. Bobylev). (English transl. in *Mathematical Modeling and Computational Experiment*, 1(3), 1993).
47. Approximate symmetries and conservation laws, *Proc. V.A. Steklov Institute of Mathematics*, v. 200, Nauka, Moscow, 1991

48. Hierarchy of Huygens's equations in spaces with a nontrivial conformal group, *Soviet Math. Surveys*, 46, n.3, 1991 (with A.O. Oganessian)
49. Preliminary group classification of equations $v_{tt} = f(x, v_x)v_{xx} + g(x, v_x)$, *J. Math. Phys.*, 32, n.11, 1991 (with M. Torrisi and A. Valenti)
50. Simple method for the group analysis with applications in Detonation, *J. Math. Phys.*, 33, n.11, 1992 (with M. Torrisi)
51. Group analysis of ordinary differential equations and the Invariance Principle in Mathematical Physics, *Soviet Math. Surveys*, vol. 47, n.4, 1992
52. Approximate groups of transformations, *Differential equations*, 29, no. 10, 1993, 1712-1732 (with V.A. Baikov and R.K. Gazizov); English transl. *Differential equations*, 29, no. 10, 1993, 1487-1504
53. Approximate groups of transformations, *Differential equations*, 29, no. 10, 1993, 1712-1732 (with V.A. Baikov and R.K. Gazizov); English transl. *Differential equations*, 29, no. 10, 1993, 1487-1504
54. Linearization of ordinary differential equations, in *Differential Equations with Applications to Mathematical Physics*, Eds. W.F.Ames, E.M.Harrell II, J.V.Herod, Mathematics in Science and Engineering, Vol. 192, pp. 177-187 1993.
55. Group theoretic treatment of fundamental solutions, Proceedings of the Conference on *Analysis, Manifolds and Physics*, in honour of Y. Choquet-Bruhat, Paris, 1992. Published by Kluwer Academic Press, Dordrecht, 1994
56. Approximate equivalence transformations, *Differential equations*, 30, no. 10, 1994 (with V.A. Baikov and R.K. Gazizov)
57. Lie group analysis of differential equations: A mosaic of results and open problems, in Proc. of *Sophus Lie Memorial Conference*, Oslo, August 17-21, 1992, Published by Scandinavian University Press, Oslo, 1994, O.A.Laudal and B. Jahren, eds.
58. Conformal invariance, Huygens principle and fundamental solutions for scalar second order hyperbolic equations, Proceedings of the Int. Workshop on *Modern Group Analysis: Advanced Analytical and Computational Methods in Mathematical Physics*, Acireale (Catania), Italy, October 27-31, 1992, Kluwer Academic Publishers, Dordrecht, 1993 (with Yu.Yu. Berest and A.O. Oganessian).
59. Approximate Lie algebras and multy-parameter approximate groups, *Differential equations*, vol.29, n.10, 1993 (with V. A. Baikov and R. K. Gazizov)
60. Seven miniatures on group analysis, *Differential equations*, vol.29, n. 10, 1993
61. Vessiot-Guldberg-Lie algebra and its application in solving nonlinear differential equations, Proc. 11th National conference *Lie group analysis of differential equations*, Samara, Russia, June 1993.

62. Sophus Lie and harmony in mathematical physics, on the 150th anniversary of his birth, *The Mathematical Intelligencer*, vol.16, n.1, 1994
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• **Previous Appointments:**

- Professor, Department of Mathematical Sciences and Director of ISAMM (Institute for Symmetry Analysis and Mathematical Modelling), University of North-West, South Africa, January 1998 - September 2000.
- Professor, Department of Computational and Applied Mathematics and Director of the Center for Symmetry Analysis and Differential Equations, University of the Witwatersrand (Wits University), Johannesburg, South Africa, July 1994 - Dec. 1997.
- Professor, Institute of Mathematical Modelling, Russian Academy of Sciences, Moscow, May 1990 – September 1993.
- Professor, Department of Applied Mathematics, Moscow State University, January 1988 – June 1993.
- Professor, Department of Mathematics, Moscow Institute of Physics and Technology, September 1987 – June 1991.
- Professor, Department of Engineering Sciences, Faculty of Science and Letters, Istanbul Technical University, Istanbul, Turkey, October 1993 - July 1994.
- Visiting Professor, Department of Mathematics, University of Catania, Catania, Italy, January–February 1991, January–February 1992.
- Visiting Professor, Department of Physics and Astronomy, University of Georgia, Athens, Georgia, USA, March–May, 1992.
- Visiting Scientist, Laboratoire de Physique Theorique, Universite de Pierre et Marie Curie, Paris, June, 1992.
- Visiting Professor, Department of Mathematics and Applied Mathematics, University of Natal, Durban, November–December, 1992.
- Visiting Professor, Centre de recherches mathématiques, Université de Montréal, Montréal, Canada, March–April, 1991.
- Member of the Institute of Applied Mathematics, USSR Academy of Sciences, Moscow, March 1987 to May 1990.
- Director of the Research laboratory of Mathematical Physics, Bashkir Branch of USSR Academy of Sciences, Ufa, Bashkir Republic, USSR, 1980–1987.
- Professor, Department of Mathematics, Ufa Aviation University, Ufa, September 1980 to March 1983.
- Head of Department of Applied Mathematics, Ufa Aviation Institute, Ufa, March 1983 to March 1987.
- Visiting Professor, Department of Mathematics, University of Greifswald, Greifswald, Germany, May–June, 1984.
- Professor of Mathematical Physics, Collège de France, Paris, Spring, 1980.

- Visiting Scientist, International Center for Theoretical Physics, Trieste, Italy, July–August, 1980.
- Professor, Department of Hydrodynamics, Novosibirsk State University, Novosibirsk, September 1973 to June 1980.
- Member of the Institute of Hydrodynamics, Siberian Branch of USSR Academy of Sciences, Novosibirsk, June 1969 to November 1980.
- Visiting Professor, Department of Mathematics, Georgia Institute of Technology, Atlanta, Georgia, USA, October–December, 1976.
- Visiting Professor of Mathematical Physics, Department of Physics, University of the Pacific, Stockton, California, USA, January–March, 1977.
- Associate Professor, Department of Hydrodynamics, Novosibirsk State University, Novosibirsk, September 1967 to September 1973.
- Lecturer, Department of Mathematics, Novosibirsk State University, Novosibirsk, June 1965 to September 1967.
- Senior Researcher, Institute of Hydrodynamics, Siberian Branch of USSR Academy of Sciences, Novosibirsk, October 1964 to June 1965.
- Research Fellow, Institute of Hydrodynamics, Siberian Branch of USSR Academy of Sciences, Novosibirsk, May 1963 to October 1964.

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