

Applications Of Lie Groups To Differential Equatio

Continuous Symmetries, Lie Algebras, Differential

Equations And Computer Algebra (2nd Edition) Willi-hans

Steeb.2007-07-26 This textbook comprehensively introduces students and researchers to the application of continuous symmetries and their Lie algebras to ordinary and partial differential equations. Covering all the modern techniques in detail, it relates applications to cutting-edge research fields such as Yang-Mills theory and string theory. Aimed at readers in applied mathematics and physics rather than pure mathematics, the material is ideally suited to students and researchers whose main interest lies in finding solutions to differential equations and invariants of maps. A large number of worked examples and challenging exercises help readers to work independently of teachers, and by including SymbolicC++ implementations of the techniques in each chapter, the book takes full advantage of the advancements in algebraic computation. Twelve new sections have been added in this edition, including: Haar measure, Sato's theory and sigma functions, universal algebra, anti-self dual Yang-Mills equation, and discrete Painlevé equations.

Symmetries of Partial Differential Equations A.M.

Vinogradov.2012-12-06 2 The authors of these issues involve not only mathematicians, but also specialists in (mathematical) physics and computer sciences. So here the reader will find different points of view and approaches to the considered field. A. M. VINOGRADOV 3 Acta Applicandae Mathematicae 15: 3-21, 1989. © 1989 Kluwer Academic Publishers. Symmetries and Conservation Laws of Partial Differential Equations: Basic Notions and Results A. M. VINOORADOV Department of

Mathematics, Moscow State University, 117234, Moscow, U. S. S. R. (Received: 22 August 1988) Abstract. The main notions and results which are necessary for finding higher symmetries and conservation laws for general systems of partial differential equations are given. These constitute the starting point for the subsequent papers of this volume. Some problems are also discussed. AMS subject classifications (1980). 35A30, 58005, 58035, 58H05. Key words. Higher symmetries, conservation laws, partial differential equations, infinitely prolonged equations, generating functions. o. Introduction In this paper we present the basic notions and results from the general theory of local symmetries and conservation laws of partial differential equations. More exactly, we will focus our attention on the main conceptual points as well as on the problem of how to find all higher symmetries and conservation laws for a given system of partial differential equations. Also, some general views and perspectives will be discussed.

CRC Handbook of Lie Group Analysis of Differential Equations, Volume I Nail H. Ibragimov. 2023-08-25 Today Lie group theoretical approach to differential equations has been extended to new situations and has become applicable to the majority of equations that frequently occur in applied sciences. Newly developed theoretical and computational methods are awaiting application. Students and applied scientists are expected to understand these methods. Volume 3 and the accompanying software allow readers to extend their knowledge of computational algebra. Written by the world's leading experts in the field, this up-to-date sourcebook covers topics such as Lie-Bäcklund, conditional and non-classical symmetries, approximate symmetry groups for equations with a small parameter, group analysis of differential equations with distributions, integro-differential equations, recursions, and symbolic software packages. The text provides an ideal introduction to the modern group analysis and addresses issues to both beginners and

experienced researchers in the application of Lie group methods.

Symmetries and Applications of Differential Equations

Albert C. J. Luo, Rafail K. Gazizov. 2021-12-14 This book is about Lie group analysis of differential equations for physical and engineering problems. The topics include: -- Approximate symmetry in nonlinear physical problems -- Complex methods for Lie symmetry analysis -- Lie group classification, Symmetry analysis, and conservation laws -- Conservative difference schemes -- Hamiltonian structure and conservation laws of three-dimensional linear elasticity -- Involutive systems of partial differential equations This collection of works is written in memory of Professor Nail H. Ibragimov (1939–2018). It could be used as a reference book in differential equations in mathematics, mechanical, and electrical engineering.

Elementary Lie Group Analysis and Ordinary Differential

Equations Nail' Khaïrulloviç Ibragimov. 1999-05-04 Lie group analysis, based on symmetry and invariance principles, is the only systematic method for solving nonlinear differential equations analytically. One of Lie's striking achievements was the discovery that the majority of classical devices for integration of special types of ordinary differential equations could be explained and deduced by his theory. Moreover, this theory provides a universal tool for tackling considerable numbers of differential equations when other means of integration fail. * This is the first modern text on ordinary differential equations where the basic integration methods are derived from Lie group theory * Includes a concise and self contained introduction to differential equations * Easy to follow and comprehensive introduction to Lie group analysis * The methods described in this book have many applications The author provides students and their teachers with a flexible text for undergraduate and postgraduate courses, spanning a variety of topics from the basic theory through to its many applications. The philosophy of Lie groups has become an essential part of the mathematical culture for anyone investigating mathematical

models of physical, engineering and natural problems.

An Introduction to the Lie Theory of One-parameter Groups

Abraham Cohen.1991

Symmetry Analysis of Differential Equations with Mathematica®

Gerd Baumann.2013-11-21 The first book to explicitly use Mathematica so as to allow researchers and students to more easily compute and solve almost any kind of differential equation using Lie's theory. Previously time-consuming and cumbersome calculations are now much more easily and quickly performed using the Mathematica computer algebra software. The material in this book, and on the accompanying CD-ROM, will be of interest to a broad group of scientists, mathematicians and engineers involved in dealing with symmetry analysis of differential equations. Each section of the book starts with a theoretical discussion of the material, then shows the application in connection with Mathematica. The cross-platform CD-ROM contains Mathematica (version 3.0) notebooks which allow users to directly interact with the code presented within the book. In addition, the author's proprietary MathLie software is included, so users can readily learn to use this powerful tool in regard to performing algebraic computations.

Problems and Solutions for Groups, Lie Groups, Lie Algebras with Applications Willi-Hans Steeb,Igor Tanski,Yorick

Hardy.2012-04-26 The book presents examples of important techniques and theorems for Groups, Lie groups and Lie algebras. This allows the reader to gain understandings and insights through practice. Applications of these topics in physics and engineering are also provided. The book is self-contained. Each chapter gives an introduction to the topic.

Lie Groups Wulf Rossmann.2006 This book is an introduction to the theory of Lie groups and their representations at the advanced undergraduate or beginning graduate level. It covers the essentials of the subject starting from basic undergraduate mathematics. The correspondence between linear Lie groups and

Lie algebras is developed in its local and global aspects. The classical groups are analyzed in detail, first with elementary matrix methods, then with the help of the structural tools typical of the theory of semisimple groups, such as Cartan subgroups, root, weights and reflections. The fundamental groups of the classical groups are worked out as an application of these methods. Manifolds are introduced when needed, in connection with homogeneous spaces, and the elements of differential and integral calculus on manifolds are presented, with special emphasis on integration on groups and homogeneous spaces. Representation theory starts from first principles, such as Schur's lemma and its consequences, and proceeds from there to the Peter-Weyl theorem, Weyl's character formula, and the Borel-Weil theorem, all in the context of linear groups.

Continuous Symmetries, Lie Algebras, Differential Equations and Computer Algebra W-H Steeb.1996-09-30 This book is a

comprehensive introduction to the application of continuous symmetries and their Lie algebras to ordinary and partial differential equations. It is suitable for students and research workers whose main interest lies in finding solutions to differential equations. It therefore caters for readers primarily interested in applied mathematics and physics rather than pure mathematics. The book provides an application-orientated text that is reasonably self-contained. A large number of worked examples have been included to help readers working independently of a teacher. The advance of algebraic computation has made it possible to write programs for the tedious calculations in this research field, and thus the book also makes a survey of computer algebra packages.

Applications of Lie's Theory of Ordinary and Partial

Differential Equations L Dresner.1998-01-01 Lie's group theory of differential equations unifies the many ad hoc methods known for solving differential equations and provides powerful new ways to find solutions. The theory has applications to both ordinary and

partial differential equations and is not restricted to linear equations. Applications of Lie's Theory of Ordinary and Partial Differential Equations provides a concise, simple introduction to the application of Lie's theory to the solution of differential equations. The author emphasizes clarity and immediacy of understanding rather than encyclopedic completeness, rigor, and generality. This enables readers to quickly grasp the essentials and start applying the methods to find solutions. The book includes worked examples and problems from a wide range of scientific and engineering fields.

A Guide To Lie Systems With Compatible Geometric

Structures Javier De Lucas Araujo, Cristina Sardon

Munoz.2020-01-22 The book presents a comprehensive guide to the study of Lie systems from the fundamentals of differential geometry to the development of contemporary research topics. It embraces several basic topics on differential geometry and the study of geometric structures while developing known applications in the theory of Lie systems. The book also includes a brief exploration of the applications of Lie systems to superequations, discrete systems, and partial differential equations. Offering a complete overview from the topic's foundations to the present, this book is an ideal resource for Physics and Mathematics students, doctoral students and researchers.

CRC Handbook of Lie Group Analysis of Differential

Equations Nail H. Ibragimov.1993-10-20 Today Lie group theoretical approach to differential equations has been extended to new situations and has become applicable to the majority of equations that frequently occur in applied sciences. Newly developed theoretical and computational methods are awaiting application. Students and applied scientists are expected to understand these methods. Volume 3 and the accompanying software allow readers to extend their knowledge of computational algebra. Written by the world's leading experts in

the field, this up-to-date sourcebook covers topics such as Lie-Bäcklund, conditional and non-classical symmetries, approximate symmetry groups for equations with a small parameter, group analysis of differential equations with distributions, integro-differential equations, recursions, and symbolic software packages. The text provides an ideal introduction to the modern group analysis and addresses issues to both beginners and experienced researchers in the application of Lie group methods.

Systems of Partial Differential Equations and Lie

Pseudogroups J. F. Pommaret.1978

Lie Groups and Lie Algebras B.P. Komrakov,I.S. Krasil'shchik,G.L.

Litvinov,A.B. Sossinsky.2012-12-06 This collection contains papers conceptually related to the classical ideas of Sophus Lie (i.e., to Lie groups and Lie algebras). Obviously, it is impossible to embrace all such topics in a book of reasonable size. The contents of this one reflect the scientific interests of those authors whose activities, to some extent at least, are associated with the International Sophus Lie Center. We have divided the book into five parts in accordance with the basic topics of the papers (although it can be easily seen that some of them may be attributed to several parts simultaneously). The first part (quantum mathematics) combines the papers related to the methods generated by the concepts of quantization and quantum group. The second part is devoted to the theory of hypergroups and Lie hypergroups, which is one of the most important generalizations of the classical concept of locally compact group and of Lie group. A natural harmonic analysis arises on hypergroups, while any abstract transformation of Fourier type is generated by some hypergroup (commutative or not). Part III contains papers on the geometry of homogeneous spaces, Lie algebras and Lie superalgebras. Classical problems of the representation theory for Lie groups, as well as for topological groups and semigroups, are discussed in the papers of Part IV. Finally, the last part of the collection relates to applications of the

ideas of Sophus Lie to differential equations.

Symmetry Methods for Differential Equations Peter

Ellsworth Hydon.2000-01-28 An introduction to symmetry methods, informally written and aimed at applied mathematicians, physicists, and engineers.

Lie Groups, Physics, and Geometry Robert Gilmore.2008-01-17

Describing many of the most important aspects of Lie group theory, this book presents the subject in a 'hands on' way. Rather than concentrating on theorems and proofs, the book shows the applications of the material to physical sciences and applied mathematics. Many examples of Lie groups and Lie algebras are given throughout the text. The relation between Lie group theory and algorithms for solving ordinary differential equations is presented and shown to be analogous to the relation between Galois groups and algorithms for solving polynomial equations. Other chapters are devoted to differential geometry, relativity, electrodynamics, and the hydrogen atom. Problems are given at the end of each chapter so readers can monitor their understanding of the materials. This is a fascinating introduction to Lie groups for graduate and undergraduate students in physics, mathematics and electrical engineering, as well as researchers in these fields.

CRC Handbook of Lie Group Analysis of Differential

Equations Nail H. Ibragimov.1995-10-24 Today Lie group theoretical approach to differential equations has been extended to new situations and has become applicable to the majority of equations that frequently occur in applied sciences. Newly developed theoretical and computational methods are awaiting application. Students and applied scientists are expected to understand these methods. Volume 3 and the accompanying software allow readers to extend their knowledge of computational algebra. Written by the world's leading experts in the field, this up-to-date sourcebook covers topics such as Lie-Bäcklund, conditional and non-classical symmetries, approximate

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Applications of Lie Group Analysis in Geophysical Fluid Dynamics Nail? Kha?rullovi? Ibragimov,R. N. Ibragimov.2011 Quickly learn essential inventor tools and techniques This full-color Autodesk Official Press guide will help you quickly learn the powerful manufacturing software's core features and functions. Thom Tremblay, an Autodesk Certified Instructor, uses concise, straightforward explanations and real-world, hands-on exercises to help you become productive with Inventor. Full-color screenshots illustrate tutorial steps, and chapters conclude with a related and more open-ended project to further reinforce the

chapter's lessons. Based on the very real-world task of designing tools and a toolbox to house them, the book demonstrates creating 2D drawings from 3D data, modeling parts, combining parts into assemblies, annotating drawings, using advanced assembly tools, working with sheet metal, presenting designs, and more. Full-color screenshots illustrate the steps, and additional files are available for download so you can compare your results with those of professionals. You'll also get information to help you prepare for the Inventor certification exams. Introduces new users to the software with real-world projects, hands-on tutorials, and full-color illustrations Begins each chapter with a quick discussion of concepts and learning goals and then moves into approachable, hands-on exercises Covers the interface and foundational concepts, modeling parts, combining them into assemblies building with the frame generator, using weldments Includes material to help you prepare for the Inventor certification exams Autodesk Inventor 2014 Essentials provides the information you need to quickly become proficient with the powerful 3D mechanical design software.

Lie Symmetry Analysis of Fractional Differential Equations Mir Sajjad Hashemi, Dumitru Baleanu. 2020-07-09 The trajectory of fractional calculus has undergone several periods of intensive development, both in pure and applied sciences. During the last few decades fractional calculus has also been associated with the power law effects and its various applications. It is a natural to ask if fractional calculus, as a nonlocal calculus, can produce new results within the well-established field of Lie symmetries and their applications. In *Lie Symmetry Analysis of Fractional Differential Equations* the authors try to answer this vital question by analyzing different aspects of fractional Lie symmetries and related conservation laws. Finding the exact solutions of a given fractional partial differential equation is not an easy task, but is one that the authors seek to grapple with here. The book also includes generalization of Lie symmetries for

fractional integro differential equations. Features Provides a solid basis for understanding fractional calculus, before going on to explore in detail Lie Symmetries and their applications Useful for PhD and postdoc graduates, as well as for all mathematicians and applied researchers who use the powerful concept of Lie symmetries Filled with various examples to aid understanding of the topics

Introduction to Partial Differential Equations with Applications E. C. Zachmanoglou, Dale W. Thoe. 2012-04-20 This text explores the essentials of partial differential equations as applied to engineering and the physical sciences. Discusses ordinary differential equations, integral curves and surfaces of vector fields, the Cauchy-Kovalevsky theory, more. Problems and answers.

An Introduction to the Lie Theory of One-Parameter Groups

Abraham Cohen. 2015-06-24 Excerpt from An Introduction to the Lie Theory of One-Parameter Groups: With Applications to the Solution of Differential Equations The object of this book is to present in an elementary manner, in English, an introduction to Lie's theory of one-parameter groups, with special reference to its application to the solution of differential equations invariant under such groups. The treatment is sufficiently elementary to be appreciated, under proper supervision, by undergraduates in their senior year as well as by graduates during their first year of study. While a knowledge of the elementary theory of differential equations is not absolutely essential for understanding the subject matter of this book, frequent references being made to places where necessary information can be obtained, it would seem preferable to approach for the first time the problem of classifying and solving differential equations by direct, even if miscellaneous, methods to doing so by the elegant general methods of Lie; and this book is intended primarily for those who have some acquaintance with the elementary theory. To such persons it should prove of great interest and undoubted practical

value. An attempt has been made throughout the work to emphasize the role played by the Lie theory in unifying the elementary theory of differential equations, by bringing under a relatively small number of heads the various known classes of differential equations invariant under continuous groups, and the methods for their solution. Special attention may be called to the lists of invariant differential equations and applications in §§ 19, 28, 30; while the two tables in the appendix include most of the ordinary differential equations likely to be met. About the Publisher Forgotten Books publishes hundreds of thousands of rare and classic books. Find more at www.forgottenbooks.com This book is a reproduction of an important historical work. Forgotten Books uses state-of-the-art technology to digitally reconstruct the work, preserving the original format whilst repairing imperfections present in the aged copy. In rare cases, an imperfection in the original, such as a blemish or missing page, may be replicated in our edition. We do, however, repair the vast majority of imperfections successfully; any imperfections that remain are intentionally left to preserve the state of such historical works.

An Introduction to the Lie Theory of One-Parameter Groups

Abraham Cohen.2014-01 This is a reproduction of a book published before 1923. This book may have occasional imperfections such as missing or blurred pages, poor pictures, errant marks, etc. that were either part of the original artifact, or were introduced by the scanning process. We believe this work is culturally important, and despite the imperfections, have elected to bring it back into print as part of our continuing commitment to the preservation of printed works worldwide. We appreciate your understanding of the imperfections in the preservation process, and hope you enjoy this valuable book. ++++ The below data was compiled from various identification fields in the bibliographic record of this title. This data is provided as an additional tool in helping to ensure edition identification: ++++

An Introduction To The Lie Theory Of One-parameter Groups: With Applications To The Solution Of Differential Equations; Cornell University Library Historical Math Monographs Abraham Cohen D.C. Heath & co., 1911 Continuous groups; Differential equations; Lie groups

A Survey of Lie Groups and Lie Algebras with Applications and Computational Methods Johan G. F. Belinfante, Bernard Kolman.1989-01-01 Introduces the concepts and methods of the Lie theory in a form accessible to the non-specialist by keeping mathematical prerequisites to a minimum. Although the authors have concentrated on presenting results while omitting most of the proofs, they have compensated for these omissions by including many references to the original literature. Their treatment is directed toward the reader seeking a broad view of the subject rather than elaborate information about technical details. Illustrations of various points of the Lie theory itself are found throughout the book in material on applications. In this reprint edition, the authors have resisted the temptation of including additional topics. Except for correcting a few minor misprints, the character of the book, especially its focus on classical representation theory and its computational aspects, has not been changed.

CRC Handbook of Lie Group Analysis of Differential Equations Nail H. Ibragimov.1994-11-28 Volume 2 offers a unique blend of classical results of Sophus Lie with new, modern developments and numerous applications which span a period of more than 100 years. As a result, this reference is up to date, with the latest information on the group theoretic methods used frequently in mathematical physics and engineering. Volume 2 is divided into three parts. Part A focuses on relevant definitions, main algorithms, group classification schemes for partial differential equations, and multifaceted possibilities offered by Lie group theoretic philosophy. Part B contains the group analysis of a variety of mathematical models for diverse natural

phenomena. It tabulates symmetry groups and solutions for linear equations of mathematical physics, classical field theory, viscous and non-Newtonian fluids, boundary layer problems, Earth sciences, elasticity, plasticity, plasma theory (Vlasov-Maxwell equations), and nonlinear optics and acoustics. Part C offers an English translation of Sophus Lie's fundamental paper on the group classification and invariant solutions of linear second-order equations with two independent variables. This will serve as a concise, practical guide to the group analysis of partial differential equations.

An Introduction to the Lie Theory of One-parameter Groups

Abraham Cohen.1911

Nilpotent Lie Groups Roe W. Goodman.2006-11-15

Symmetries and Differential Equations George W.

Bluman,Sukeyuki Kumei.2013-03-14 A major portion of this book discusses work which has appeared since the publication of the book Similarity Methods for Differential Equations, Springer-Verlag, 1974, by the first author and J.D. Cole. The present book also includes a thorough and comprehensive treatment of Lie groups of transformations and their various uses for solving ordinary and partial differential equations. No knowledge of group theory is assumed. Emphasis is placed on explicit computational algorithms to discover symmetries admitted by differential equations and to construct solutions resulting from symmetries. This book should be particularly suitable for physicists, applied mathematicians, and engineers. Almost all of the examples are taken from physical and engineering problems including those concerned with heat conduction, wave propagation, and fluid flows. A preliminary version was used as lecture notes for a two-semester course taught by the first author at the University of British Columbia in 1987-88 to graduate and senior undergraduate students in applied mathematics and physics. Chapters 1 to 4 encompass basic material. More specialized topics are covered in Chapters 5 to 7.

Symmetries, Differential Equations and Applications

Victor G. Kac, Peter J. Olver, Pavel Winternitz, Teoman Özer. 2018-11-04

Based on the third International Conference on Symmetries, Differential Equations and Applications (SDEA-III), this proceedings volume highlights recent important advances and trends in the applications of Lie groups, including a broad area of topics in interdisciplinary studies, ranging from mathematical physics to financial mathematics. The selected and peer-reviewed contributions gathered here cover Lie theory and symmetry methods in differential equations, Lie algebras and Lie pseudogroups, super-symmetry and super-integrability, representation theory of Lie algebras, classification problems, conservation laws, and geometrical methods. The SDEA III, held in honour of the Centenary of Noether's Theorem, proven by the prominent German mathematician Emmy Noether, at Istanbul Technical University in August 2017 provided a productive forum for academic researchers, both junior and senior, and students to discuss and share the latest developments in the theory and applications of Lie symmetry groups. This work has an interdisciplinary appeal and will be a valuable read for researchers in mathematics, mechanics, physics, engineering, medicine and finance.

Group Analysis of Differential Equations

L. V. Ovsiannikov. 2014-05-10 Group Analysis of Differential Equations provides a systematic exposition of the theory of Lie groups and Lie algebras and its application to creating algorithms for solving the problems of the group analysis of differential equations. This text is organized into eight chapters. Chapters I to III describe the one-parameter group with its tangential field of vectors. The nonstandard treatment of the Banach Lie groups is reviewed in Chapter IV, including a discussion of the complete theory of Lie group transformations. Chapters V and VI cover the construction of partial solution classes for the given differential equation with a known admitted group. The theory of differential invariants that

is developed on an infinitesimal basis is elaborated in Chapter VII. The last chapter outlines the ways in which the methods of group analysis are used in special issues involving differential equations. This publication is a good source for students and specialists concerned with areas in which ordinary and partial differential equations play an important role.

Lie Groups, Lie Algebras, and Some of Their Applications

Robert Gilmore. 2012-05-23 This text introduces upper-level undergraduates to Lie group theory and physical applications. It further illustrates Lie group theory's role in several fields of physics. 1974 edition. Includes 75 figures and 17 tables, exercises and problems.

Continuous Symmetries, Lie Algebras and Differential Equations

Norbert Euler, W.-H. Steeb. 1992

Representations of Lie Algebras and Partial Differential Equations

Xiaoping Xu. 2017-10-16 This book provides explicit representations of finite-dimensional simple Lie algebras, related partial differential equations, linear orthogonal algebraic codes, combinatorics and algebraic varieties, summarizing the author's works and his joint works with his former students. Further, it presents various oscillator generalizations of the classical representation theorem on harmonic polynomials, and highlights new functors from the representation category of a simple Lie algebra to that of another simple Lie algebra. Partial differential equations play a key role in solving certain representation problems. The weight matrices of the minimal and adjoint representations over the simple Lie algebras of types E and F are proved to generate ternary orthogonal linear codes with large minimal distances. New multi-variable hypergeometric functions related to the root systems of simple Lie algebras are introduced in connection with quantum many-body systems in one dimension. In addition, the book identifies certain equivalent combinatorial properties on representation formulas, and the irreducibility of representations is proved directly related to algebraic varieties.

The book offers a valuable reference guide for mathematicians and scientists alike. As it is largely self-contained – readers need only a minimal background in calculus and linear algebra – it can also be used as a textbook.

Geometrical Properties of Differential Equations Ljudmila A Bordag.2015-05-27 This textbook is a short comprehensive and intuitive introduction to Lie group analysis of ordinary and partial differential equations. This practical-oriented material contains a large number of examples and problems accompanied by detailed solutions and figures. In comparison with the known beginner guides to Lie group analysis, the book is oriented toward students who are interested in financial mathematics, mathematical finance and economics. We provide the results of the Lie group analysis of actual models in Financial Mathematics using recent publications. These models are usually formulated as nonlinear partial differential equations and are rather difficult to make use of. With the help of Lie group analysis it is possible to describe some important properties of these models and to obtain interesting reductions in a clear and understandable algorithmic way. The book can serve as a short introduction for a further study of modern geometrical analysis applied to models in financial mathematics. It can also be used as textbook in a master's program, in an intensive compact course, or for self study. The textbook with a large number of examples will be useful not only for students who are interested in Financial Mathematics but also for people who are working in other areas of research that are not directly connected with Physics (for instance in such areas of Applied Mathematics like mathematical economy, bio systems, coding theory, etc.).

Applications of Lie Groups to Difference Equations Vladimir Dorodnitsyn.2010-12-01 Intended for researchers, numerical analysts, and graduate students in various fields of applied mathematics, physics, mechanics, and engineering sciences, *Applications of Lie Groups to Difference Equations* is the first

book to provide a systematic construction of invariant difference schemes for nonlinear differential equations. A guide to methods
Stratified Lie Groups and Potential Theory for Their Sub-Laplacians Andrea Bonfiglioli, Ermanno Lanconelli, Francesco Uguzzoni. 2007-08-24 This book provides an extensive treatment of Potential Theory for sub-Laplacians on stratified Lie groups. It also provides a largely self-contained presentation of stratified Lie groups, and of their Lie algebra of left-invariant vector fields. The presentation is accessible to graduate students and requires no specialized knowledge in algebra or differential geometry.

Applications of Lie Groups to Differential Equations Peter J. Olver. 2012-12-06 This book is devoted to explaining a wide range of applications of continuous symmetry groups to physically important systems of differential equations. Emphasis is placed on significant applications of group-theoretic methods, organized so that the applied reader can readily learn the basic computational techniques required for genuine physical problems. The first chapter collects together (but does not prove) those aspects of Lie group theory which are of importance to differential equations. Applications covered in the body of the book include calculation of symmetry groups of differential equations, integration of ordinary differential equations, including special techniques for Euler-Lagrange equations or Hamiltonian systems, differential invariants and construction of equations with prescribed symmetry groups, group-invariant solutions of partial differential equations, dimensional analysis, and the connections between conservation laws and symmetry groups. Generalizations of the basic symmetry group concept, and applications to conservation laws, integrability conditions, completely integrable systems and soliton equations, and bi-Hamiltonian systems are covered in detail. The exposition is reasonably self-contained, and supplemented by numerous examples of direct physical importance, chosen from classical mechanics, fluid mechanics, elasticity and other applied areas.

An Introduction to Lie Groups and Lie Algebras Alexander A. Kirillov.2008-07-31 Contemporary introduction to semisimple Lie algebras; concise and informal, with numerous exercises and examples

Applications of Lie Groups to Differential Equations Peter J. Olver.1993 A solid introduction to applications of Lie groups to differential equations which have proved to be useful in practice. The computational methods are presented such that graduates and researchers can readily learn to use them. Following an exposition of the applications, the book develops the underlying theory, with many of the topics presented in a novel way, emphasising explicit examples and computations. Further examples, as well as new theoretical developments, appear in the exercises at the end of each chapter.

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