Developments in Mathematics

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Nonautonomous Linear Hamiltonian Systems: Oscillation, Spectral Theory and Control

Springer

Nonautonomous Linear Hamiltonian Systems Oscillation Spectral Theory And Control Developments In Mathematics

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Nonautonomous Linear Hamiltonian Systems Oscillation Spectral Theory And Control Developments In Mathematics:

Nonautonomous Linear Hamiltonian Systems: Oscillation, Spectral Theory and Control Russell Johnson,Rafael Obaya,Sylvia Novo,Carmen Núñez,Roberta Fabbri,2016-03-25 This monograph contains an in depth analysis of the dynamics given by a linear Hamiltonian system of general dimension with nonautonomous bounded and uniformly continuous coefficients without other initial assumptions on time recurrence Particular attention is given to the oscillation properties of the solutions as well as to a spectral theory appropriate for such systems The book contains extensions of results which are well known when the coefficients are autonomous or periodic as well as in the nonautonomous two dimensional case However a substantial part of the theory presented here is new even in those much simpler situations The authors make systematic use of basic facts concerning Lagrange planes and symplectic matrices and apply some fundamental methods of topological dynamics and ergodic theory Among the tools used in the analysis which include Lyapunov exponents Weyl matrices exponential dichotomy and weak disconjugacy a fundamental role is played by the rotation number for linear Hamiltonian systems of general dimension The properties of all these objects form the basis for the study of several themes concerning linear quadratic control problems including the linear regulator property the Kalman Bucy filter the infinite horizon optimization problem the nonautonomous version of the Yakubovich Frequency Theorem and dissipativity in the Willems sense The book will be useful for graduate students and researchers interested in nonautonomous differential equations dynamical systems and ergodic theory spectral theory of differential operators and control theory Symplectic Difference Systems: Oscillation and Spectral Theory Ondřej Došlý,Julia Elyseeva,Roman Šimon Hilscher,2019-09-06 This monograph is devoted to covering the main results in the qualitative theory of symplectic difference systems including linear Hamiltonian difference systems and Sturm Liouville difference equations with the emphasis on the oscillation and spectral theory As a pioneer monograph in this field it contains nowadays standard theory of symplectic systems as well as the most current results in this field which are based on the recently developed central object the comparative index The book contains numerous results and citations which were till now scattered only in journal papers The book also provides new applications of the theory of matrices in this field in particular of the Moore Penrose pseudoinverse matrices orthogonal projectors and symplectic matrix factorizations Thus it brings this topic to the attention of researchers and students in pure as well as applied mathematics *Physics Briefs* ,1993 **Mathematical Reviews** ,2004 **Spectral Theory of Nonautonomous Dynamical Systems and Applications** Thai Son Doan,2024-12-27 The main challenge in the study of nonautonomous phenomena is to understand the very complicated dynamical behaviour both as a scientific and mathematical problem The theory of nonautonomous dynamical systems has experienced a renewed and steadily growing interest in the last twenty years stimulated also by synergetic effects of disciplines which have developed relatively independent for some

time such as topological skew product random dynamical systems finite time dynamics and control systems The book provides new insights in many aspects of the qualitative theory of nonautonomous dynamical systems including the spectral theory the linearization theory the bifurcation theory The book first introduces several important spectral theorem for nonautonomous differential equations including the Lyapunov spectrum Sacker Sell spectrum and finite time spectrum The author also establishes the smooth linearization and partial linearization for nonautonomous differential equations in application part Then the second part recalls the multiplicative ergodic theorem for random dynamical systems and discusses several explicit formulas in computing the Lyapunov spectrum for random dynamical systems generated by linear stochastic differential equations and random difference equations with random delay In the end the Pitchfork bifurcation and Hopf bifurcation with additive noise are investigated in terms of change of the sign of Lyapunov exponents and loss of topological equivalence This book might be appealing to researchers and graduate students in the field of dynamical systems stochastic differential equations ergodic theory **Index of Mathematical Papers** ,1985 **International Aerospace Abstracts** ,1992 *Integrable Hamiltonian systems and spectral theory* Jürgen Moser,1983-10-01 These notes are based on six Fermi Lectures held at the Scuola Normale Superiore in Pisa in March and April 1981 The topics treated depend on basic concepts of classical mechanics elementary geometry complex analysis as well as spectral theory and are meant for mathematicians and theoretical physicists alike These lectures weave together a number of threads from various fields of mathematics impinging on the subject of inverse spectral theory I did not try to give an overview over this fast moving subject but rather tie various aspects together by one guiding theme the construction of all potentials for the one dimensional Schr dinger equation which gives rise to finite band potentials which is done by reducing it to solving a system of differential equations In fact we will see that the problem of finding all almost periodic potentials having finitely many intervals as its spectrum is equivalent to the study of the geodesics on an ellipsoid To make this connection clear we have carried together several facts from classical mechanics and from spectral theory and we give a self contained exposition of the construction of these finite band potentials **Integrable Hamiltonian Systems & Spectral Theory** Jurgen Moser,2003-12-30 *Nonlinear Dynamical Systems Of Mathematical Physics: Spectral And Symplectic Integrability Analysis* Denis Blackmore,Anatoliy Karl Prykarpatsky,Valeriy Hr Samoylenko,2011-03-04 This distinctive volume presents a clear rigorous grounding in modern nonlinear integrable dynamics theory and applications in mathematical physics and an introduction to timely leading edge developments in the field including some innovations by the authors themselves that have not appeared in any other book The exposition begins with an introduction to modern integrable dynamical systems theory treating such topics as Liouville Arnold and Mischenko Fomenko integrability This sets the stage for such topics as new formulations of the gradient holonomic algorithm for Lax integrability novel treatments of classical integration by quadratures Lie algebraic characterizations of integrability and recent results on tensor Poisson structures Of particular note is the development via

spectral reduction of a generalized de Rham Hodge theory related to Delsarte Lions operators leading to new Chern type classes useful for integrability analysis Also included are elements of quantum mathematics along with applications to Whitham systems gauge theories hadronic string models and a supplement on fundamental differential geometric concepts making this volume essentially self contained This book is ideal as a reference and guide to new directions in research for advanced students and researchers interested in the modern theory and applications of integrable especially infinite dimensional dynamical systems Contributions to the Theory of Nonlinear Oscillations, Volume V Lamberto Cesari,J. LaSalle,Solomon Lefschetz,2016-03-02 Classic contributions to the theory of nonlinear oscillations from the acclaimed Annals of Mathematics Studies series Princeton University Press is proud to have published the Annals of Mathematics Studies since 1940 One of the oldest and most respected series in science publishing it has included many of the most important and influential mathematical works of the twentieth century The series continues this tradition as Princeton University Press publishes the major works of the twenty first century To mark the continued success of the series all books are available in paperback and as ebooks **Hamiltonian Methods in the Theory of Solitons** Ludwig Faddeev,Leon Takhtajan,2007-08-10 This book presents the foundations of the inverse scattering method and its applications to the theory of solitons in such a form as we understand it in Leningrad The concept of solitonwas introduced by Kruskal and Zabusky in 1965 A soliton a solitary wave is a localized particle like solution of a nonlinear equation which describes excitations of finite energy and exhibits several characteristic features propagation does not destroy the profile of a solitary wave the interaction of several solitary waves amounts to their elastic scat tering so that their total number and shape are preserved Occasionally the concept of the soliton is treated in a more general sense as a localized solu tion of finite energy At present this concept is widely spread due to its universality and the abundance of applications in the analysis of various processes in nonlinear media The inverse scattering method which is the mathematical basis of soliton theory has developed into a powerful tool of mathematical physics for studying nonlinear partial differential equations almost as vigoraus as the Fourier transform The book is based on the Hamiltonian interpretation of the method hence the title Methods of differential geometry and Hamiltonian formal ism in particular are very popular in modern mathematical physics It is precisely the general Hamiltonian formalism that presents the inverse scat tering method in its most elegant form Moreover the Hamiltonian formal ism provides a link between classical and quantum mechanics **Oscillations and Waves** M.I Rabinovich,D.I. Trubetskov,1989-11-30 Et mai si j avait su comment en revenir One service mathematics has rendered the je n y semis point aUe human race It has put common sense back Jules Verne where it belongs on the topmost sheJf next to the dusty canister Iabclled discarded non The series is divergent therefore we may be sense Eric T Bell able to do something with it O Heaviside Mathematics is a tool for thought A highly necessary tool in a world where both feedback and non linearities abound Similarly all kinds of parts of mathematics serve as tools for other parts and for other sciences Applying a simple rewriting

rule to the quote on the right above one finds such statements as One service topology has rendered mathematical physics One service logic has rendered com puter science One service category theory has rendered mathematics All arguably true And all statements obtainable this way form part of the raison d etre of this series *Hamiltonian Systems with Three or More Degrees of Freedom* Carles Simó,2012-12-06 A survey of current knowledge about Hamiltonian systems with three or more degrees of freedom and related topics The Hamiltonian systems appearing in most of the applications are non integrable Hence methods to prove non integrability results are presented and the different meaning attributed to non integrability are discussed For systems near an integrable one it can be shown that under suitable conditions some parts of the integrable structure most of the invariant tori survive Many of the papers discuss near integrable systems From a topological point of view some singularities must appear in different problems either caustics geodesics moving wavefronts etc This is also related to singularities in the projections of invariant objects and can be used as a signature of these objects Hyperbolic dynamics appear as a source on unpredictable behaviour and several mechanisms of hyperbolicity are presented The destruction of tori leads to Aubrey Mather objects and this is touched on for a related class of systems Examples without periodic orbits are constructed against a classical conjecture Other topics concern higher dimensional systems either finite networks and localised vibrations on them or infinite like the quasiperiodic Schr dinger operator or nonlinear hyperbolic PDE displaying quasiperiodic solutions Most of the applications presented concern celestial mechanics problems like the asteroid problem the design of spacecraft orbits and methods to compute periodic solutions *Complex Hamiltonian Dynamics* Tassos Bountis,Haris Skokos,2012-04-03 This book explores modern developments in Hamiltonian dynamical systems focusing on high degree of freedom systems and the transitional regimes between regular and chaotic motion Includes end of chapter exercises and challenging problems **Hamiltonian Systems and Their Integrability** Mich'le Audin,2008 Hamiltonian systems began as a mathematical approach to the study of mechanical systems As the theory developed it became clear that the systems that had a sufficient number of conserved quantities enjoyed certain remarkable properties These are the completely integrable systems In time a rich interplay arose between integrable systems and other areas of mathematics particularly topology geometry and group theory This book presents some modern techniques in the theory of integrable systems viewed as variations on the theme of action angle coordinates These techniques include analytical methods coming from the Galois theory of differential equations as well as more classical algebro geometric methods related to Lax equations Audin has included many examples and exercises Most of the exercises build on the material in the text None of the important proofs have been relegated to the exercises Many of the examples are classical rather than abstract This book would be suitable for a graduate course in Hamiltonian systems *Contributions to the Theory of Nonlinear Oscillations* Solomon Lefschetz,1958-09-21 The description for this book Contributions to the Theory of Nonlinear Oscillations AM 41 Volume IV will be forthcoming **Notes on Hamiltonian Dynamical Systems** Antonio

Giorgilli,2022-05-05 Starting with the basics of Hamiltonian dynamics and canonical transformations this text follows the historical development of the theory culminating in recent results the Kolmogorov Arnold Moser theorem Nekhoroshev s theorem and superexponential stability Its analytic approach allows students to learn about perturbation methods leading to advanced results Key topics covered include Liouville s theorem the proof of Poincar s non integrability theorem and the nonlinear dynamics in the neighbourhood of equilibria The theorem of Kolmogorov on persistence of invariant tori and the theory of exponential stability of Nekhoroshev are proved via constructive algorithms based on the Lie series method A final chapter is devoted to the discovery of chaos by Poincar and its relations with integrability also including recent results on superexponential stability Written in an accessible self contained way with few prerequisites this book can serve as an introductory text for senior undergraduate and graduate students **Contributions to the Theory of Nonlinear Oscillations** Solomon Lefschetz,1953-01-20 These two new collections numbers 28 and 29 respectively in the Annals of Mathematics Studies continue the high standard set by the earlier Annals Studies 20 and 24 by bringing together important contributions to the theories of games and of nonlinear differential equations **Hamiltonian Systems** Alfredo M. Ozorio de Almeida,1988 Hamiltonian Systems outlines the main results in the field and considers the implications for quantum mechanics

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