

Exterior Differential Systems and the Calculus of Variations

P.A. GRIFFITHS

XXV

Exterior Differential Systems And The Calculus Of Variations

Thi Kim Thoan Do



Exterior Differential Systems And The Calculus Of Variations:

Exterior Differential Systems and the Calculus of Variations P.A. Griffiths, 2013-06-29 15 0 PRELIMINARIES a Notations from Manifold Theory b The Language of Jet Manifolds c Frame Manifolds d Differential Ideals e Exterior Differential Systems EULER LAGRANGE EQUATIONS FOR DIFFERENTIAL SYSTEMS WITH ONE INDEPENDENT VARIABLE a Setting up the Problem Classical Examples b Variational Equations for Integral Manifolds of Differential Systems c Differential Systems in Good Form the Derived Flag Cauchy Characteristics and Prolongation of Exterior Differential Systems d Derivation of the Euler Lagrange Equations Examples e The Euler Lagrange Differential System Non Degenerate Variational Problems Examples FIRST INTEGRALS OF THE EULER LAGRANGE SYSTEM NOETHER'S II THEOREM AND EXAMPLES a First Integrals and Noether's Theorem Some Classical Examples Variational Problems Algebraically Integrable by Quadratures b Investigation of the Euler Lagrange System for Some Differential Geometric Variational Problems 2 i Kds for Plane Curves i i Affine Arclength 2 iii f Kds for Space Curves and iv Delauney Problem II I EULER EQUATIONS FOR VARIATIONAL PROBLEMS IN HOMOGENEOUS SPACES 161 a Derivation of the Equations i Motivation i i Review of the Classical Case iii the General 1 Euler Equations 2 K 2 ds b Examples i the Euler Equations Associated to f for lEn but for Curves in i i Some Problems as in i sn Non Curves in iii Euler Equations Associated to degenerate Ruled Surfaces IV **Exterior Differential Systems** Robert L. Bryant, S.S. Chern, Robert B. Gardner, Hubert L. Goldschmidt, P.A. Griffiths, 2013-06-29 This book gives a treatment of exterior differential systems It will include both the general theory and various applications An exterior differential system is a system of equations on a manifold defined by equating to zero a number of exterior differential forms When all the forms are linear it is called a pfaffian system Our object is to study its integral manifolds i e submanifolds satisfying all the equations of the system A fundamental fact is that every equation implies the one obtained by exterior differentiation so that the complete set of equations associated to an exterior differential system constitutes a differential ideal in the algebra of all smooth forms Thus the theory is coordinate free and computations typically have an algebraic character however even when coordinates are used in intermediate steps the use of exterior algebra helps to efficiently guide the computations and as a consequence the treatment adapts well to geometrical and physical problems A system of partial differential equations with any number of independent and dependent variables and involving partial derivatives of any order can be written as an exterior differential system In this case we are interested in integral manifolds on which certain coordinates remain independent The corresponding notion in exterior differential systems is the independence condition certain pfaffian forms remain linearly independent Partial differential equations and exterior differential systems with an independence condition are essentially the same object **Exterior Differential Systems** Robert L. Bryant, 1991-01

The Inverse Problem in the Calculus of Variations Via Exterior Differential Systems Thi Kim Thoan Do, 2016 *The Inverse Problem of the Calculus of Variations for Ordinary Differential Equations* Ian Anderson, Gerard Thompson, 1992 This

monograph explores various aspects of the inverse problem of the calculus of variations for systems of ordinary differential equations The main problem centres on determining the existence and degree of generality of Lagrangians whose system of Euler Lagrange equations coincides with a given system of ordinary differential equations The authors rederive the basic necessary and sufficient conditions of Douglas for second order equations and extend them to equations of higher order using methods of the variational bicomplex of Tulczyjew Vinogradov and Tsujishita The authors present an algorithm based upon exterior differential systems techniques for solving the inverse problem for second order equations a number of new examples illustrate the effectiveness of this approach

Proceedings of the Sixth International Colloquium on Differential Equations Dimităr Bañnov, 1996-01-01 The Sixth International Colloquium on Differential Equations was organized by the Institute for Basic Science of Inha University the International Federation of Nonlinear Analysts the Mathematical Society of Japan the Pharmaceutical Faculty of the Medical University of Sofia the University of Catania and UNESCO with the cooperation of a number of international mathematical organizations and was held at the Technical University of Plovdiv Bulgaria from 18 to 23 August 1995 This proceedings volume contains selected talks which deal with various aspects of differential and partial differential equations

Essays on Mathematical Robotics John Baillieul, Shankar S. Sastry, Hector J. Sussmann, 2012-12-06 The chapters in this book present an excellent exposition of recent developments in both robotics and nonlinear control centering around hyper redundancy highly oscillatory inputs optimal control exterior differential systems and the use of generic loops The principal topics covered in the book are adaptive control for a class of nonlinear systems event based motion planning nonlinear control synthesis and path planning in robotics with special emphasis on nonholonomic and hyper redundant robotic systems control design and stabilization of driftless affine control systems of the type arising in the kinematic control of nonholonomic robotic systems control design methods for Hamiltonian systems and exterior differential systems The chapter covering exterior differential systems contains a detailed introduction to the use of exterior differential methods including the Goursat and extended Goursat normal forms and their application to path planning for nonholonomic systems

Differential Systems and Isometric Embeddings.(AM-114), Volume 114 Phillip A. Griffiths, Gary R. Jensen, 2016-03-02 The theory of exterior differential systems provides a framework for systematically addressing the typically non linear and frequently overdetermined partial differential equations that arise in differential geometry Adaptation of the techniques of microlocalization to differential systems have led to recent activity on the foundations of the theory in particular the fundamental role of the characteristic variety in geometric problems is now clearly established In this book the general theory is explained in a relatively quick and concrete manner and then this general theory is applied to the recent developments in the classical problem of isometric embeddings of Riemannian manifolds

Stability Criteria for Fluid Flows Adelina Georgescu, Lidia Palese, 2010 1 Mathematical models governing fluid flows stability 1 1 General mathematical models of thermodynamics 1 2 Classical

mathematical models in thermodynamics of fluids 1 3 Classical mathematical models in thermodynamics 1 4 Classical perturbation models 1 5 Generalized incompressible Navier Stokes model 2 Incompressible Navier Stokes fluid 2 1 Back to integral setting involvement of dynamics and bifurcation 2 2 Stability in semidynamical systems 2 3 Perturbations asymptotic stability linear stability 2 4 Linear stability 2 5 Prodi s linearization principle 2 6 Estimates for the spectrum of 2 7 Universal stability criteria 3 Elements of calculus of variations 3 1 Generalities 3 2 Direct and inverse problems of calculus of variations 3 3 Symmetrization of some matricial ordinary differential operators 3 4 Variational principles for problems 3 3 1 3 3 7 3 5 Fourier series solutions for variational problems 4 Variants of the energy method for non stationary equations 4 1 Variant based on differentiation of parameters 4 2 Variant based on simplest symmetric part of operators 4 3 Variants based on energy splitting 5 Applications to linear B nard convections 5 1 Magnetic B nard convection in a partially ionized fluid 5 2 Magnetic B nard convection for a fully ionized fluid 5 3 Convection in a micro polar fluid bounded by rigid walls 5 4 Convections governed by ode s with variable coefficients 6 Variational methods applied to linear stability 6 1 Magnetic B nard problem with Hall effect 6 2 Lyapunov method applied to the anisotropic B nard problem 6 3 Stability criteria for a quasi geostrophic forced zonal flow 6 4 Variational principle for problem 5 3 1 5 3 2 6 5 Taylor Dean problem 7 Applications of the direct method to linear stability 7 1 Couette flow between two cylinders subject to a magnetic field 7 2 Soret Dufour driven convection 7 3 Magnetic Soret Dufour driven convection 7 4 Convection in a porous medium 7 5 Convection in the presence of a dielectrophoretic force 7 6 Convection in an anisotropic M H D thermodiffusive mixture 7 7 Inhibition of the thermal convection by a magnetic field 7 8 Microconvection in a binary layer subject to a strong Soret effect 7 9 Convection in the layer between the sea bed and the permafrost

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Congress, Library of Congress. Office for Subject Cataloging Policy, 2012

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Library of Congress. Cataloging Policy and Support Office, 2009

Mechanics, Analysis and Geometry: 200 Years after

Lagrange M. Francaviglia, 2012-12-02 Providing a logically balanced and authoritative account of the different branches and problems of mathematical physics that Lagrange studied and developed this volume presents up to date developments in differential geometry dynamical systems the calculus of variations and celestial and analytical mechanics

Library of Congress Subject Headings Library of Congress. Office for Subject Cataloging Policy, 1992 **A-E** Library of Congress. Office for Subject Cataloging Policy, 1990

The Geometry of Ordinary Variational Equations Olga Krupkova, 2006-11-14

The book provides a comprehensive theory of ODE which come as Euler Lagrange equations from generally higher order Lagrangians Emphasis is laid on applying methods from differential geometry fibered manifolds and their jet prolongations and global analysis distributions and exterior differential systems Lagrangian and Hamiltonian dynamics Hamilton Jacobi theory etc for any Lagrangian system of any order are presented The key idea to build up these theories as related with the class of equivalent Lagrangians distinguishes this book from other texts on higher order mechanics The reader should be

familiar with elements of differential geometry global analysis and the calculus of variations Exterior Differential Systems and Equivalence Problems Kichoon Yang, 1992-03-31 This monograph presents a concise yet elementary account of exterior differential system theory so that it can be quickly applied to problems The first part of the monograph Chapters 1 5 deals with the general theory the Cartan Kaehler theorem is proved the notions of involution and prolongation are carefully laid out quasi linear differential systems are examined in detail and explicit examples of the Spencer cohomology groups and the characteristic variety are given The second part of the monograph Chapters 6 and 7 deals with applications to problems in differential geometry the isometric embedding theorem of Cartan Janet and its various geometric ramifications are discussed a proof of the Andreotti Hill theorem on the O_R embedding problem is given and embeddings of abstract projective structures are discussed For researchers and graduate students who would like a good introduction to exterior differential systems This volume will also be particularly useful to those whose work involves differential geometry and partial differential equations Clifford Algebras and their Applications in Mathematical Physics Rafał Abłamowicz, 2000 The first part of a two volume set concerning the field of Clifford geometric algebra this work consists of thematically organized chapters that provide a broad overview of cutting edge topics in mathematical physics and the physical applications of Clifford algebras algebras and their applications in physics Algebraic geometry cohomology non commutative spaces q deformations and the related quantum groups and projective geometry provide the basis for algebraic topics covered Physical applications and extensions of physical theories such as the theory of quaternionic spin a projective theory of hadron transformation laws and electron scattering are also presented showing the broad applicability of Clifford geometric algebras in solving physical problems Treatment of the structure theory of quantum Clifford algebras the connection to logic group representations and computational techniques including symbolic calculations and theorem proving rounds out the presentation Clifford Algebras and their Applications in Mathematical Physics Rafal Ablamowicz, Bertfried Fauser, 2012-12-06 The plausible relativistic physical variables describing a spinning charged and massive particle are besides the charge itself its Minkowski four position X its relativistic linear four momentum P and also its so called Lorentz four angular momentum E_0 the latter forming four translation invariant part of its total angular four momentum M Expressing these variables in terms of Poincare covariant real valued functions defined on an extended relativistic phase space 2×7 means that the mutual Poisson bracket relations among the total angular momentum functions M_{ab} and the linear momentum functions p_a have to represent the commutation relations of the Poincare algebra On any such an extended relativistic phase space as shown by Zakrzewski 2×7 the natural Poisson bracket relations 1×1 imply that for the splitting of the total angular momentum into its orbital and its spin part 1×2 one necessarily obtains 1×3 On the other hand it is always possible to shift translate the commuting see 1×1 four position x_a by a four vector X_a 1×4 so that the total angular four momentum splits instead into a new orbital and a new Pauli Lubanski spin part 1×5 in such a way that 1×6 However as proved

by Zakrzewski 2 7J the so defined new shifted four a position functions X must fulfill the following Poisson bracket relations 1

Some Variational Problems for Exterior Differential Systems Pedro Miguel Santos Goncalves Henriques, 1987

Mathematical Aspects of Classical Field Theory Mark J. Gotay, Jerrold E. Marsden, Vincent Moncrief, 1992 Classical field theory has undergone a renaissance in recent years Symplectic techniques have yielded deep insights into its foundations as has an improved understanding of the variational calculus Further impetus for the study of classical fields has come from other areas such as integrable systems Poisson geometry global analysis and quantum theory This book contains the proceedings of the AMS IMS SIAM Joint Summer Research Conference on Mathematical Aspects of Classical Field Theory held in July 1991 at the University of Washington at Seattle The conference brought together researchers in many of the main areas of classical field theory to present the latest ideas and results The volume contains thirty refereed papers both survey and research articles and is designed to reflect the state of the art as well as chart the future course of the subject The topics fall into four major categories global analysis and relativity cosmic censorship initial value problem quantum gravity geometric methods symplectic and Poisson structures momentum mappings Dirac constraint theory BRST theory and the calculus of variations the variational bicomplex higher order theories Also included are related topics with a classical basis such as geometric quantization integrable systems symmetries deformation theory and geometric mechanics

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