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Nonlinear Analysis, Geometry and Applications - Diaraf Seck - 2020-11-20
This book gathers nineteen papers presented at the first NLAGA-BIRS Symposium, which was held at the Cheikh Anta Diop University in Dakar, Senegal, on June 24–28, 2019. The four-day symposium brought together African experts on nonlinear analysis and geometry and their applications, as well as their international partners, to present and discuss mathematical results in various areas. The main goal of the NLAGA project is to advance and consolidate the
development of these mathematical fields in West and Central Africa with a focus on solving real-world problems such as coastal erosion, pollution, and urban network and population dynamics problems. The book addresses a range of topics related to partial differential equations, geometrical analysis of optimal shapes, geometric structures, optimization and optimal transportation, control theory, and mathematical modeling.

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**Geometric Function Theory and Non-linear Analysis** - Tadeusz Iwaniec - 2001
This unique book explores the connections between the geometry of mappings and many important areas of modern mathematics such as Harmonic and non-linear Analysis, the theory of Partial Differential Equations, Conformal Geometry and Topology. Much of the book is new. It aims to provide students and researchers in many areas with a comprehensive and up to date account and an overview of the subject as a whole.
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Investigations in modern nonlinear analysis rely on ideas, methods and problems from various fields of mathematics, mechanics, physics and other applied sciences. In the second half of the twentieth century many prominent, exemplary problems in nonlinear analysis were subject to ideas and methods of differential geometry, topology, differential equations and functional analysis as well as other areas of research in mathematics were successfully applied towards the complete solution of complex problems in nonlinear analysis. It is not possible to encompass in the scope of one book all concepts, ideas, methods and results related to nonlinear analysis. Therefore, we shall restrict ourselves in this monograph to nonlinear elliptic boundary value problems as well as global geometric problems. In order that we may examine these problems, we are provided with a fundamental vehicle: The theory of convex bodies and hypersurfaces. In this book we systematically present a series of centrally significant results obtained in the second half of the twentieth century up to the present time. Particular attention is given to profound interconnections between various divisions in nonlinear analysis. The theory of convex functions and bodies plays a
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differential equations in modern geometrical

Geometric Analysis of Nonlinear Partial Differential Equations - Valentin Lychagin - 2021-09-03
This book contains a collection of twelve papers that reflect the state of the art of nonlinear differential equations in modern geometrical theory. It comprises miscellaneous topics of the local and nonlocal geometry of differential equations and the applications of the corresponding methods in hydrodynamics, symplectic geometry, optimal investment theory, etc. The contents will be useful for all the readers whose professional interests are related to nonlinear PDEs and differential geometry, both in theoretical and applied aspects.

Analysis of Geometrically Nonlinear Structures - Robert Levy - 2013-03-14
The availability of computers has, in real terms, moved forward the practice of structural engineering. Where it was once enough to have any analysis given a complex configuration, the profession today is much more demanding. How engineers should be more demanding is the subject of this book. In terms of the theory of structures, the importance of geometric nonlinearities is explained by the theorem which states that "In the presence of prestress,
engineering. Where it was once enough to have magnitude as linear elastic effects in structures. This theorem implies that in most cases (in all cases of incremental analysis) geometric nonlinearities should be considered. And it is well known that problems of buckling, cable nets, fabric structures, REQUIRE the inclusion of geometric nonlinearities. What is offered in the book which follows is a unified approach (for both discrete and continuous systems) to geometric nonlinearities which incidentally does not require a discussion of large strain. What makes this all work is perturbation theory. Let the equations of equilibrium for a system be written as where $P$ represents the applied loads, $F$ represents the member forces or stresses, and $N$ represents the operator which describes system equilibrium.

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**Geometric Nonlinear Functional Analysis** - Yoav Benyamini - 2000
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**Nonlinear Analysis on Manifolds. Monge-Ampère Equations** - Thierry Aubin - 2012-12-06
This volume is intended to allow mathematicians and physicists, especially analysts, to learn about nonlinear problems which arise in Riemannian Geometry. Analysis on Riemannian manifolds is a field currently undergoing great development. More and more, analysis proves to be a very powerful means for solving geometrical problems. Conversely, geometry may help us to solve certain problems in analysis. There are several reasons why the topic is difficult and interesting. It is very large and almost unexplored. On the other hand, geometric problems often lead to limiting cases of known
and physicists, especially analysts, to learn about more than one approach, and the already existing theoretical studies are inadequate to solve them. Each problem has its own particular difficulties. Nevertheless there exist some standard methods which are useful and which we must know to apply them. One should not forget that our problems are motivated by geometry, and that a geometrical argument may simplify the problem under investigation. Examples of this kind are still too rare. This work is neither a systematic study of a mathematical field nor the presentation of a lot of theoretical knowledge. On the contrary, I do my best to limit the text to the essential knowledge. I define as few concepts as possible and give only basic theorems which are useful for our topic. But I hope that the reader will find this sufficient to solve other geometrical problems by analysis.

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Nonlinear Analysis in Geometry and Applied Mathematics - Lydia Bieri - 2017
During the 2015-2016 year at Harvard University's Center of Mathematical Sciences and Applications (CMSA), several researchers working in mathematical general relativity presented lectures on modern topics of research in the field of "Non-linear Equations." This volume presents articles--by those researchers and their co-authors--drawn from their CMSA lectures. Specific topics include the Cauchy problem for the Einstein equations in cosmological and non-cosmological settings; (black holes) of classes of spacetimes; initial data engineering; gravitational radiation; and asymptotics of spacetimes, quasi-local energies, and their limits. The content of this volume reflects some of the activities at the Harvard CMSA during the 2015-2016 program, and provides insights into active areas of research in mathematical general relativity that can benefit scholars working in PDEs, geometric analysis, and general relativity.

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**Geometry and Analysis in Nonlinear Dynamics** - Hendrik Wolter Broer - 1992
Based on lectures that took place in Groningen University from 13-17th March 1989, this book looks at geometry and analysis in nonlinear dynamics. Aspects covered range from bifurcational aspects of parametric resonance to subharmonic branching in reversible systems.
problems which can be easily understood, but subharmonic branching in reversible systems.

**Geometric Analysis and Nonlinear Partial Differential Equations** - Stefan Hildebrandt - 2012-12-06

This book is not a textbook, but rather a coherent collection of papers from the field of partial differential equations. Nevertheless we believe that it may very well serve as a good introduction into some topics of this classical field of analysis which, despite of its long history, is highly modem and well prospering. Richard Courant wrote in 1950: "It has always been a temptation for mathematicians to present the crystallized product of their thought as a deductive general theory and to relegate the individual mathematical phenomenon into the role of an example. The reader who submits to the dogmatic form will be easily indoctrinated. Enlightenment, however, must come from an understanding of motives; live mathematical development springs from specific natural

whose solutions are difficult and demand new methods or more general significance. " We think that many, if not all, papers of this book are written in this spirit and will give the reader access to an important branch of analysis by exhibiting interest ing problems worth to be studied. Most of the collected articles have an extensive introductory part describing the history of the presented problems as well as the state of the art and offer a well chosen guide to the literature. This way the papers became lengthier than customary these days, but the level of presentation is such that an advanced graduate student should find the various articles both readable and stimulating.

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Lobachevsky Geometry and Modern Nonlinear Problems - Andrey Popov - 2014-08-06
This monograph presents the basic concepts of hyperbolic Lobachevsky geometry and their possible applications to modern nonlinear applied problems in mathematics and physics, summarizing the findings of roughly the last hundred years. The central sections cover the classical building blocks of hyperbolic Lobachevsky geometry, pseudo spherical surfaces theory, net geometrical investigative techniques of nonlinear differential equations in partial derivatives, and their applications to the
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**Methods in Nonlinear Analysis** - Kung-Ching Chang - 2006-03-30

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**Nonlinear Analysis in Geometry** - Shing Tung Yau - 1986

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Some Nonlinear Problems in Riemannian Geometry - Thierry Aubin - 2013-03-09
This book deals with such important subjects as variational methods, the continuity method, parabolic equations on fiber bundles, ideas concerning points of concentration, blowing-up technique, geometric and topological methods. It explores important geometric problems that are of interest to many mathematicians and scientists but have only recently been partially solved.

Mathematics - Shing-Tung Yau - 2018

Nonlinear Analysis in Geometry and Applied Mathematics - Shing-Tung Yau - 2018

Linear and Nonlinear Functional Analysis with Applications - Philippe G. Ciarlet - 2013-10-10
This single-volume textbook covers the fundamentals of linear and nonlinear functional analysis, illustrating most of the basic theorems with numerous applications to linear and nonlinear partial differential equations and to selected topics from numerical analysis and optimization theory. This book has pedagogical appeal because it features self-contained and complete proofs of most of the theorems, some of which are not always easy to locate in the literature or are difficult to reconstitute. It also offers 401 problems and 52 figures, plus historical notes and many original references that provide an idea of the genesis of the
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Elliptic curves and Weierstrass functions, the algebra of differential operators, Lax Pairs and their use in discovering other soliton equations, wedge products and decomposability, the KP Equation and Sato's theory relating the Bilinear KP Equation to the geometry of Grassmannians. Notable features of the book include: careful selection of topics and detailed explanations to make this advanced subject accessible to any undergraduate math major, numerous worked examples and thought-provoking but not overly-difficult exercises, footnotes and lists of suggested readings to guide the interested reader to more information, and use of the software package Mathematica® to facilitate computation and to animate the solutions under study. This book provides the reader with a unique glimpse of the unity of mathematics and could form the basis for a self-study, one-semester special topics, or "capstone" course.


Session of the American Mathematical Society Meeting held in 1990 at the University of North Texas, Denton - discussing and developing research on boundary value problems for nonlinear partial differential equations and related problems.;Written by more than 15 authorities in the field, Geometric Analysis and Nonlinear Partial Differential Equations: presents methods and results of the convex bodies and geometric inequalities theory and its applications to differential equations, geometry, and mathematical physics; details recent studies on Monge-Ampere equations, emphasizing geometric inequalities governing a priori estimates of solutions and existence theorems of the Dirichlet problem for convex generalized solutions and showing the proofs of all theorems; examines the generalization of the isoperimetric inequality for two-dimensional general convex surfaces whose integral Gaussian curvature is less than 2 π; and contains open problems on the
Monge-Ampere equations, emphasizing curvature.;Geometric Analysis and Nonlinear Partial Differential Equations is for mathematical analysts, geometers, pure and applied mathematicians, physicists, engineers, computer scientists, and upper-level undergraduate and graduate students in these disciplines.

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**Nonlinear Poisson Brackets** - Mihail Vladimirovi_ Karasev - 2012-06-06
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Nonlinear Analysis, Differential Equations, and Applications - Themistocles M. Rassias - 2021
This contributed volume showcases research and survey papers devoted to a broad range of topics on functional equations, ordinary differential
strongly generalized convex functions, stochastic differential equations, optimization theory, network games, generalized Nash equilibria, critical point theory, calculus of variations, nonlinear functional analysis, convex analysis, variational inequalities, topology, global differential geometry, curvature flows, perturbation theory, numerical analysis, mathematical finance and a variety of applications in interdisciplinary topics. Chapters in this volume investigate compound superquadratic functions, the Hyers-Ulam Stability of functional equations, edge degenerate pseudo-hyperbolic equations, Kirchhoff wave equation, BMO norms of operators on differential forms, equilibrium points of the perturbed R3BP, complex zeros of solutions to second order differential equations, a higher-order Ginzburg-Landau-type equation, multi-symplectic numerical schemes for differential equations, the Erdős-Rényi network model, strongly m-convex functions, higher order factorization and solution of second order differential equations, generalized topologically open sets in relator spaces, graphical mean curvature flow, critical point theory in infinite dimensional spaces using the Leray-Schauder index, non-radial solutions of a supercritical equation in expanding domains, the semi-discrete method for the approximation of the solution of stochastic differential equations, homotopic metric-interval L-contractions in gauge spaces, Rhoades contractions theory, network centrality measures, the Radon transform in three space dimensions via plane integration and applications in positron emission tomography boundary perturbations on medical monitoring and imaging techniques, the KdV-B equation and biomedical applications.

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Lecture Notes in Mathematics - - 1964
Nonlinear Analysis in Geometry - Shing-Tung Yau (Mathématicien) - 1986

Variational Principles in Mathematical Physics, Geometry, and Economics - Alexandru Kristály - 2010-08-19
A comprehensive introduction to modern applied functional analysis. Assumes only basic notions of calculus, real analysis, geometry, and differential equations.

Riemannian Geometric Statistics in Medical Image Analysis - Xavier Pennec - 2019-09-02
Over the past 15 years, there has been a growing need in the medical image computing community for principled methods to process nonlinear geometric data. Riemannian geometry has emerged as one of the most powerful mathematical and computational frameworks for analyzing such data. Riemannian Geometric Statistics in Medical Image Analysis is a complete reference on statistics on Riemannian manifolds and more general nonlinear spaces with applications in medical image analysis. It provides an introduction to the core methodology followed by a presentation of state-of-the-art methods. Beyond medical image computing, the methods described in this book may also apply to other domains such as signal processing, computer vision, geometric deep learning, and other domains where statistics on geometric features appear. As such, the presented core methodology takes its place in the field of...
geometric statistics, the statistical analysis of data being elements of nonlinear geometric spaces. The foundational material and the advanced techniques presented in the later parts of the book can be useful in domains outside medical imaging and present important applications of geometric statistics methodology. Content includes: The foundations of Riemannian geometric methods for statistics on manifolds with emphasis on concepts rather than on proofs. Applications of statistics on manifolds and shape spaces in medical image computing. Diffeomorphic deformations and their applications. As the methods described apply to domains such as signal processing (radar signal processing and brain computer interaction), computer vision (object and face recognition), and other domains where statistics of geometric features appear, this book is suitable for researchers and graduate students in medical imaging, engineering and computer science. A complete reference covering both the

Riemannian Geometric Statistics in Medical Image Analysis - Xavier Pennec - 2019-09-02

Over the past 15 years, there has been a growing need in the medical image computing community for principled methods to process nonlinear geometric data. Riemannian geometry has emerged as one of the most powerful mathematical and computational frameworks for analyzing such data. Riemannian Geometric Statistics in Medical Image Analysis is a complete reference on statistics on Riemannian manifolds and more general nonlinear spaces with applications in medical image analysis. It provides an introduction to the core methodology followed by a presentation of state-of-the-art methods. Beyond medical image computing, the methods described in this book may also apply to
features appear, this book is suitable for researchers and graduate students in medical imaging, engineering and computer science. A complete reference covering both the foundations and state-of-the-art methods Edited and authored by leading researchers in the field Contains theory, examples, applications, and algorithms Gives an overview of current research challenges and future applications

**Nonlinear Analysis on Manifolds** - Emmanuel Hebey - 2000-10-27
This volume offers an expanded version of lectures given at the Courant Institute on the theory of Sobolev spaces on Riemannian manifolds. "Several surprising phenomena appear when studying Sobolev spaces on manifolds," according to the author. "Questions that are elementary for Euclidean space become challenging and give rise to sophisticated mathematics, where the geometry of the manifold plays a central role." The volume is
contained. No familiarity is assumed with brief introduction to differential and Riemannian geometry. Chapter 2 deals with the general theory of Sobolev spaces for compact manifolds. Chapter 3 presents the general theory of Sobolev spaces for complete, noncompact manifolds. Best constants problems for compact manifolds are discussed in Chapters 4 and 5. Chapter 6 presents special types of Sobolev inequalities under constraints. Best constants problems for complete noncompact manifolds are discussed in Chapter 7. Chapter 8 deals with Euclidean-type Sobolev inequalities. And Chapter 9 discusses the influence of symmetries on Sobolev embeddings. An appendix offers brief notes on the case of manifolds with boundaries. This topic is a field undergoing great development at this time. However, several important questions remain open. So a substantial part of the book is devoted to the concept of best constants, which appeared to be crucial for solving limiting cases of some classes of PDEs. The volume is highly self-differentiable manifolds and Riemannian geometry, making the book accessible to a broad audience of readers, including graduate students and researchers.

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Geometric Properties of Banach Spaces and constants problems for compact manifolds are discussed in Chapters 4 and 5. Chapter 6 presents special types of Sobolev inequalities under constraints. Best constants problems for complete noncompact manifolds are discussed in Chapter 7. Chapter 8 deals with Euclidean-type Sobolev inequalities. And Chapter 9 discusses the influence of symmetries on Sobolev embeddings. An appendix offers brief notes on the case of manifolds with boundaries. This topic is a field undergoing great development at this time. However, several important questions remain open. So a substantial part of the book is devoted to the concept of best constants, which appeared to be crucial for solving limiting cases of some classes of PDEs. The volume is highly self-contained. No familiarity is assumed with differentiable manifolds and Riemannian geometry, making the book accessible to a broad audience of readers, including graduate students and researchers.

Nonlinear Iterations - Charles Chidume - 2009-03-27
The contents of this monograph fall within the general area of nonlinear functional analysis and applications. We focus on an important topic within this area: geometric properties of Banach spaces and nonlinear iterations, a topic of intensive research e?orts, especially within the past 30 years, or so. In this theory, some geometric properties of Banach spaces play a crucial role. In the rst part of the monograph, we expose these geometric properties most of which are well known. As is well known, among all in?nite dimensional Banach spaces, Hilbert spaces have the nicest geometric properties. The availability of the inner product, the fact that the proximity map or nearest point map of a real Hilbert space H onto a closed convex subset K of H is Lipschitzian with constant 1, and the following two identities 2 2 2 ||x+y|| =||x|| +2 x,y +||y|| , (?) 2 2 2 2 ||?x+(1??)y|| = ?||x|| +(1??)||y||.
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Nonlinear Iterations** - Charles Chidume -
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\[
2 \|x+y\| = \|x\| + 2 x, y + \|y\| ,
\]

\[
2 \|\lambda x + (1-\lambda)y\| = \|x\| + (1-\lambda)\|y\|
\]

\[
??(1-\lambda)\|x-y\| ,
\]

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Contact Geometry and Nonlinear Differential Equations - Alexei Kushner - 2007
Shows novel and modern ways of solving differential equations using methods from contact and symplectic geometry.

A Primer of Nonlinear Analysis - Antonio Ambrosetti - 1995-03-09
This is an elementary and self-contained introduction to nonlinear functional analysis and its applications, especially in bifurcation theory.

An Introduction to Nonlinear Analysis: Theory is an overview of some basic, important aspects of Nonlinear Analysis, with an emphasis on those not included in the classical treatment of the field. Today Nonlinear Analysis is a very prolific part of modern mathematical analysis, with fascinating theory and many different applications ranging from mathematical physics and engineering to social sciences and economics. Topics covered in this book include the necessary background material from topology, measure theory and functional analysis (Banach space theory). The text also deals with multivalued analysis and basic features of nonsmooth analysis, providing a solid
the necessary background material from material of the book An Introduction to Nonlinear Analysis: Applications by the same authors. The book is self-contained and accessible to the newcomer, complete with numerous examples, exercises and solutions. It is a valuable tool, not only for specialists in the field interested in technical details, but also for scientists entering Nonlinear Analysis in search of promising directions for research.

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Nonlinear Analysis in Geometry and Topology - Themistocles M. Rassias - 2000

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Nonlinear Problems of Analysis in Geometry
This book covers different, current research directions in the context of variational methods for non-linear geometric data. Each chapter is authored by leading experts in the respective discipline and provides an introduction, an overview and a description of the current state of the art. Non-linear geometric data arises in various applications in science and engineering. Examples of nonlinear data spaces are diverse and include, for instance, nonlinear spaces of matrices, spaces of curves, shapes as well as manifolds of probability measures. Applications can be found in biology, medicine, product engineering, geography and computer vision for instance. Variational methods on the other hand have evolved to being amongst the most powerful tools for applied mathematics. They involve techniques from various branches of mathematics such as statistics, modeling, optimization, numerical mathematics and analysis. The vast majority of research on
collaborations. Chapter 9 of this book is available in linear spaces. Variational methods for non-linear data is currently an emerging research topic. As a result, and since such methods involve various branches of mathematics, there is a plethora of different, recent approaches dealing with different aspects of variational methods for nonlinear geometric data. Research results are rather scattered and appear in journals of different mathematical communities. The main purpose of the book is to account for that by providing, for the first time, a comprehensive collection of different research directions and existing approaches in this context. It is organized in a way that leading researchers from the different fields provide an introductory overview of recent research directions in their respective discipline. As such, the book is a unique reference work for both newcomers in the field of variational methods for non-linear geometric data, as well as for established experts that aim at to exploit new research directions or open access under a CC BY 4.0 license at link.springer.com.

**Handbook of Variational Methods for Nonlinear Geometric Data** - Philipp Grohs - 2020-04-03

This book covers different, current research directions in the context of variational methods for non-linear geometric data. Each chapter is authored by leading experts in the respective discipline and provides an introduction, an overview and a description of the current state of the art. Non-linear geometric data arises in various applications in science and engineering. Examples of nonlinear data spaces are diverse and include, for instance, nonlinear spaces of matrices, spaces of curves, shapes as well as manifolds of probability measures. Applications can be found in biology, medicine, product engineering, geography and computer vision for instance. Variational methods on the other hand have evolved to being amongst the most powerful
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Issues in Calculus, Mathematical Analysis, and Nonlinear Research: 2011 Edition

Issues in Calculus, Mathematical Analysis, and Nonlinear Research: 2011 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Calculus, Mathematical Analysis, and Nonlinear Research. The editors have built Issues in Calculus, Mathematical Analysis, and Nonlinear Research: 2011 Edition on the vast information databases of ScholarlyNews™. You can expect the information about Calculus, Mathematical Analysis, and Nonlinear Research
about Calculus, Mathematical Analysis, and access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Calculus, Mathematical Analysis, and Nonlinear Research: 2011 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

**Issues in Calculus, Mathematical Analysis, and Nonlinear Research: 2011 Edition**

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Geometrical (in particular, topological) methods in nonlinear analysis were originally invented by Banach, Birkhoff, Kellogg, Schauder, Leray, and others in existence proofs. Since about the fifties, these methods turned out to be essentially the sole approach to a variety of new problems: the investigation of iteration processes and other procedures in numerical analysis, in bifurcation problems and branching of solutions, estimates on the number of solutions and criteria for the existence of nonzero solutions, the analysis of the structure of the solution set, etc. These methods have been widely applied to the theory of forced vibrations and auto-oscillations, to various problems in the theory of elasticity and fluid mechanics, to control theory, theoretical physics, and various parts of mathematics. At present, nonlinear analysis along with its geometrical, topological, analytical, variational, and other methods is developing tremendously thanks to research work in many countries. Totally new ideas have been advanced, difficult problems have been solved, and new applications have been indicated. To enumerate the publications of the last few years one would need dozens of pages. On the other hand, many problems of nonlinear analysis are still far from a solution (problems arising from the internal development of mathematics and, in particular, problems arising in the process of interpreting new problems in the natural sciences). We hope that the English edition of our book will contribute to the further propagation of the ideas of nonlinear analysis.
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**Geometry and Nonlinear Analysis in Banach Spaces** - Kondagunta Sundaresan - 1985-06

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**Nonlinear Methods in Riemannian and Kählerian Geometry** - J. Jost - 2013-04-17

In this book, I present an expanded version of the contents of my lectures at a Seminar of the DMV (Deutsche Mathematiker Vereinigung) in Düsseldorf, June, 1986. The title "Nonlinear methods in complex geometry" already indicates a combination of techniques from nonlinear partial differential equations and geometric concepts. In older geometric investigations,
which are distinguished by geometric properties than the global ones as differential geometry in its foundations provides approximations of local phenomena through infinitesimal or differential constructions. Here, all equations are linear. If one wants to consider global aspects, however, usually the presence of curvature leads to a nonlinearity in the equations. The simplest case is the one of geodesics which are described by a system of second order nonlinear ODE; their linearizations are the Jacobi fields. More recently, nonlinear PDE played a more and more prominent role in geometry. Let us list some of the most important ones: - harmonic maps between Riemannian and Kahlerian manifolds - minimal surfaces in Riemannian manifolds - Monge-Ampere equations on Kahler manifolds - Yang-Mills equations in vector bundles over manifolds. While the solution of these equations usually is nontrivial, it can lead to very significant results in geometry, as solutions provide maps, submanifolds, metrics, or connections in a given context. All these equations are elliptic, but often parabolic equations are used as an auxiliary tool to solve the elliptic ones.

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