

Christoph Glocker

Set-Valued Force Laws

Dynamics of Non-Smooth Systems



Springer

Setvalued Force Laws Dynamics Of Nonsmooth Systems

Holm Altenbach, Michael

Beitelschmidt, Markus

Kästner, Konstantin

Naumenko, Thomas Wallmersperger

Setvalued Force Laws Dynamics Of Nonsmooth Systems:

Set-Valued Force Laws Christoph Glocker, 2013-11-11 As one of the oldest natural sciences mechanics occupies a certain pioneering role in determining the development of exact sciences through its interaction with mathematics As a matter of fact there is hardly an area in mathematics that hasn't found an application of some form in mechanics It is thus almost inevitable that theoretical methods in mechanics are highly developed and laid out on different levels of abstraction With the spread of digital processors this goes as far as the implementation in commercial computer codes where the user is merely confronted on the surface with the processes that run in the background i.e. mechanics as such in teaching and research as well as in the context of industry mechanics is much more and must remain much more than the mere production of data with the help of a processor Mechanics as it is talked about here traditionally includes a wide spectrum ranging from applied mechanics analytical and technical mechanics to modeling and experimental mechanics as well as technical realization It also includes the subdisciplines of rigid body mechanics continuum mechanics or fluid mechanics to mention only a few One of the fundamental and most important concepts used by nearly all natural sciences is the concept of linearization which assumes the differentiability of mappings As a matter of fact all of classical mechanics is based on the availability of this quality

Dynamics and Bifurcations of Non-Smooth Mechanical Systems Remco I. Leine, Henk Nijmeijer, 2013-03-19 This monograph combines the knowledge of both the field of nonlinear dynamics and non-smooth mechanics presenting a framework for a class of non-smooth mechanical systems using techniques from both fields The book reviews recent developments and opens the field to the nonlinear dynamics community This book addresses researchers and graduate students in engineering and mathematics interested in the modelling simulation and dynamics of non-smooth systems and nonlinear dynamics

Advanced Topics in Nonsmooth Dynamics Remco Leine, Vincent Acary, Olivier Brüls, 2018-06-07 This book discusses emerging topics in the area of nonsmooth dynamics research such as numerical methods for nonsmooth systems impact laws for multi collisions nonlinear vibrations and control of nonsmooth systems It documents original work of researchers at the European Network for NonSmooth Dynamics ENNSD which provides a cooperation platform for researchers in the field and promotes research focused on nonsmooth dynamics and its applications Since the establishment of the network in 2012 six ENNSD symposia have been organized at different European locations The network brings together 40 specialists from 9 different countries in and outside Europe and a wealth of scientific knowledge has been gathered and developed by this group of experts in recent years The book is of interest to both new and experienced researchers in the field of nonsmooth dynamics Each chapter is written in such a way as to provide an introduction to the topic for researchers from other fields

Multibody Dynamics Krzysztof Arczewski, Wojciech Blajer, Janusz Fraczek, Marek Wojtyra, 2010-11-08 The ECCOMAS Thematic Conference Multibody Dynamics 2009 was held in Warsaw representing the fourth edition of a series which began in Lisbon 2003 and was then continued in Madrid 2005 and

Milan 2007 held under the auspices of the European Community on Computational Methods in Applied Sciences ECCOMAS The conference provided a forum for exchanging ideas and results of several topics related to computational methods and applications in multibody dynamics through the participation of 219 scientists from 27 countries mostly from Europe but also from America and Asia This book contains the revised and extended versions of invited conference papers reporting on the state of the art in the advances of computational multibody models from the theoretical developments to practical engineering applications By providing a helpful overview of the most active areas and the recent efforts of many prominent research groups in the field of multibody dynamics this book can be highly valuable for both experienced researches who want to keep updated with the latest developments in this field and researches approaching the field for the first time

Nonsmooth Mechanics Bernard Brogliato, 2016-02-29 Now in its third edition this standard reference is a comprehensive treatment of nonsmooth mechanical systems refocused to give more prominence to issues connected with control and modelling It covers Lagrangian and Newton Euler systems detailing mathematical tools such as convex analysis and complementarity theory The ways in which nonsmooth mechanics influence and are influenced by well posedness analysis numerical analysis and simulation modelling and control are explained Contact impact laws stability theory and trajectory tracking control are given detailed exposition connected by a mathematical framework formed from complementarity systems and measure differential inclusions Links are established with electrical circuits with set valued nonsmooth elements as well as with other nonsmooth dynamical systems like impulsive and piecewise linear systems Nonsmooth Mechanics third edition retains the topical structure familiar from its predecessors but has been substantially rewritten edited and updated to account for the significant body of results that have emerged in the twenty first century including developments in the existence and uniqueness of solutions impact models extension of the Lagrange Dirichlet theorem and trajectory tracking and well posedness of contact complementarity problems with and without friction Many figures both new and redrawn to improve the clarity of the presentation and examples are used to illustrate the theoretical developments Material introducing the mathematics of nonsmooth mechanics has been improved to reflect the broad range of applications interest that has developed since publication of the second edition The detail of some mathematical essentials is provided in four appendices With its improved bibliography of over 1 300 references and wide ranging coverage Nonsmooth Mechanics third edition is sure to be an invaluable resource for researchers and postgraduates studying the control of mechanical systems robotics granular matter and relevant fields of applied mathematics The book s two best features in my view are its detailed survey of the literature and its detailed presentation of many examples illustrating both the techniques and their limitations For readers interested in the field this book will serve as an excellent introductory survey Andrew Lewis in Automatica It is written with clarity contains the latest research results in the area of impact problems for rigid bodies and is recommended for both applied mathematicians and engineers Panagiotis D Panagiotopoulos in

Mathematical Reviews The presentation is excellent in combining rigorous mathematics with a great number of examples allowing the reader to understand the basic concepts Hans Troger in *Mathematical Abstracts* i *Numerics of Unilateral Contacts and Friction* Christian Studer, 2009-05-06 Mechanics provides the link between mathematics and practical engineering applications It is one of the oldest sciences and many famous scientists have left and will leave their mark in this fascinating field of research Perhaps one of the most prominent scientists in mechanics was Sir Isaac Newton who with his laws of motion initiated the description of mechanical systems by differential equations And still today more than 300 years after Newton this mathematical concept is more actual than ever The rising computer power and the development of numerical solvers for differential equations allowed engineers all over the world to predict the behavior of their physical systems fast and easy in an numerical way And the trend to computational simulation methods is still further increasing not only in mechanics but practically in all branches of science Numerical simulation will probably not solve the world's engineering problems but it will help for a better understanding of the mechanisms of our models

Nonsmooth Mechanics of Solids Jaroslav Haslinger, Georgios E. Stavroulakis, 2007-08-03 Mechanics have played an important role in mathematics from infinitesimal calculus calculus of variations partial differential equations and numerical methods finite elements Originally mechanics treated smooth objects Technological progress has evoked the necessity to model and solve more complicated problems like unilateral contact and friction plasticity delamination and adhesion advanced materials etc The new tools include convex analysis differential calculus for convex functions and subgradients of convex functions and extensions for nonconvex problems Nonsmooth mechanics is a relatively complex field and requires a good knowledge of mechanics and a good background in some parts of modern mathematics The present volume of lecture notes follows a very successful advanced school with the aim to cover as much as possible all these aspects Therefore the contributions cover mechanical aspects as well as the mathematical and numerical treatment

Material Modeling and Structural Mechanics Holm Altenbach, Michael Beitelschmidt, Markus Kästner, Konstantin Naumenko, Thomas Wallmersperger, 2022-03-30 This book presents various questions of continuum mechanical modeling in the context of experimental and numerical methods in particular multi field problems that go beyond the standard models of continuum mechanics In addition it discusses dynamic problems and practical solutions in the field of numerical methods It focuses on continuum mechanics which is often overlooked in the traditional division of mechanics into statics strength of materials and kinetics The book is dedicated to Prof Volker Ulbricht who passed away on April 9 2021

Nonsmooth Mechanics and Analysis Pierre Alart, Olivier Maisonneuve, R. Tyrrell Rockafellar, 2006-06-26 This book's title Nonsmooth Mechanics and Analysis refers to a major domain of mechanics particularly those initiated by the works of Jean Jacques Moreau Nonsmooth mechanics concerns mechanical situations with possible nondifferentiable relationships eventually discontinuous as unilateral contact dry friction collisions plasticity damage and phase transition The basis of the approach consists in dealing with such problems without resorting to any regularization

process Indeed the nonsmoothness is due to simplified mechanical modeling a more sophisticated model would require too large a number of variables and sometimes the mechanical information is not available via experimental investigations Therefore the mathematical formulation becomes nonsmooth regularizing would only be a trick of arithmetic without any physical justification Nonsmooth analysis was developed especially in Montpellier to provide specific theoretical and numerical tools to deal with nonsmoothness It is important not only in mechanics but also in physics robotics and economics Audience This book is intended for researchers in mathematics and mechanics Mechanical System Dynamics Friedrich Pfeiffer, 2008-09-27 Mechanics as a fundamental science in Physics and in Engineering deals with interactions of forces resulting in motion and deformation of material bodies Similar to other sciences Mechanics serves in the world of Physics and in that of Engineering in a different way in spite of many and increasing inter dependencies Machines and mechanisms are for physicists tools for cognition and research for engineers they are the objectives of research according to a famous statement of the Frankfurt physicist and biologist Friedrich Dessauer Physicists apply machines to support their questions to Nature with the goal of new insights into our physical world Engineers apply physical knowledge to support the realization process of their ideas and their intuition Physics is an analytical Science searching for answers to questions concerning the world around us Engineering is a synthetic Science where the physical and mathematical fundamentals play the role of a kind of reinsurance with respect to a really functioning and efficiently operating machine Engineering is also an iterative Science resulting in typical long time evolutions of their products but also in terms of the relatively short time developments of improving an existing product or in developing a new one Every physical or mathematical Science has to face these properties by developing on their side new methods new practice proved algorithms up to new fundamentals adaptable to new technological developments This is as a matter of fact also true for the field of Mechanics

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