

T.A. Laursen

Computational Contact and Impact Mechanics

Fundamentals of Modeling
Interfacial Phenomena in
Nonlinear Finite Element Analysis



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Computational Contact And Impact Mechanics

**Meir Shillor, Mircea Sofonea, Józef
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Analysis and Simulation of Contact Problems Peter Wriggers, Udo

Nackenhorst, 2006-08-15 Contact mechanics was and is an important branch in mechanics which covers a broad field of theoretical numerical and experimental investigations. In this carefully edited book the reader will obtain a state of the art overview on formulation mathematical analysis and numerical solution procedures of contact problems. The contributions collected in this volume summarize the lectures presented during the 4th Contact Mechanics International symposium CMIS held in Hannover Germany 2005 by leading scientists in the area of contact mechanics.

Advances In Computational Coupling And Contact Mechanics Luis Rodriguez-tembleque, M H Ferri Aliabadi, 2018-04-20

This book presents recent advances in the field of computational coupling and contact mechanics with particular emphasis on numerical formulations and methodologies necessary to solve advanced engineering applications. Featuring contributions from leading experts and active researchers in these fields who provide a detailed overview of different modern numerical schemes that can be considered by main numerical methodologies to simulate interaction problems in continuum mechanics. A number of topics are addressed including formulations based on the finite element method FEM and their variants e.g. isogeometric analysis or standard and generalized high order FEM hp FEM and GFEM respectively the boundary element method BEM the material point method MPM or the recently proposed finite block method FBM among many more. Written with PhD students in mind. Advances in Computational Coupling and Contact Mechanics also includes the most recent numerical techniques which could

be served as reference material for researchers and practicing engineers All chapters are self contained and can be read independently with numerical formulations accompanied by practical engineering applications Related Link s

Computational Contact Mechanics Alexander Konyukhov, Karl Schweizerhof, 2012-08-14 This book contains a systematical analysis of geometrical situations leading to contact pairs point to surface surface to surface point to curve curve to curve and curve to surface Each contact pair is inherited with a special coordinate system based on its geometrical properties such as a Gaussian surface coordinate system or a Serret Frenet curve coordinate system The formulation in a covariant form allows in a straightforward fashion to consider various constitutive relations for a certain pair such as anisotropy for both frictional and structural parts Then standard methods well known in computational contact mechanics such as penalty Lagrange multiplier methods combination of both and others are formulated in these coordinate systems Such formulations require then the powerful apparatus of differential geometry of surfaces and curves as well as of convex analysis The final goals of such transformations are then ready for implementation numerical algorithms within the finite element method including any arbitrary discretization techniques such as high order and isogeometric finite elements which are most convenient for the considered geometrical situation The book proposes a consistent study of geometry and kinematics variational formulations constitutive relations for surfaces and discretization techniques for all considered geometrical pairs and contains the associated numerical analysis as well as some new analytical results in contact mechanics

Contact Dynamics Nikolay Goloshchapov, 2019-02-08 This volume describes the application of the method of the differential specific forces MDSF By using this new method the solutions to the problems of a dissipative viscoelastic and elastic plastic contacts between curvilinear surfaces of two solid bodies can be found The novelty is that the forces of viscosity and the forces of elasticity can be found by an integration of the differential specific forces acting inside an elementary volume of the contact zone This volume shows that this method allows finding the viscoelastic forces for any theoretical or experimental dependencies between the distance of mutual approach of two curvilinear surfaces and the radiuses of the contact area Also the derivation of the integral equations of the viscoelastic forces has been given and the equations for the contact pressure have been obtained The viscoelastic and elastic plastic contacts at impact between two spherical bodies have been examined The equations for work and energy in the phases of compression and restitution and at the rolling shear have been obtained Approximate solutions for the differential equations of movement displacement by using the method of equivalent work have been calculated This new method of differential specific viscoelastic forces allows us to find the equations for all viscoelastic forces It is principally different from other methods that use Hertz's theory the classical theory of elasticity and the tensor algebra This method will be useful in research of contact dynamics of any shape of contacting surfaces It also can be used for determination of the dynamic mechanical properties of materials and in the design of wear resistant elements and coverings for components of machines and equipment that are in harsh conditions where they

are subjected to the action of flow or jet abrasive particles This volume will be useful for professional designers of machines and mechanisms as well as for the design and development of new advanced materials such as wear resistant elastic coatings and elements for pneumatic and hydraulic systems stop valves fans centrifugal pumps injectors valves gate valves and in other installations

Tribology Across Scales: Theory, Simulation and Experiment Jasminka Starčević, Markus Heß, 2025-05-01 This book is dedicated to Prof Dr rer nat Valentin L Popov who has become an internationally recognized leading figure in the field of tribology within the past 35 years He has collaborated with numerous scientists and researchers all over the world His countless publications cover not only research contributions to classical tribology in mechanical engineering but also to more modern fields such as nanotribology or biotribology They include experimental investigations theoretical approaches and numerical simulations from the nanoscale to the macroscale In tribute to the outstanding work of Prof Popov this book brings together advanced contributions in the field of tribology written by more than 40 distinguished scientists and researchers MP4 File via app download the SN More Media app for free scan a link with play button and access MP4 File directly on your smartphone or tablet

Models and Analysis of Quasistatic Contact Meir Shillor, Mircea Sofonea, Józef Joachim Telega, 2004-09-16 The mathematical theory of contact mechanics is a growing field in engineering and scientific computing This book is intended as a unified and readily accessible source for mathematicians applied mathematicians mechanicians engineers and scientists as well as advanced students The first part describes models of the processes involved like friction heat generation and thermal effects wear adhesion and damage The second part presents many mathematical models of practical interest and demonstrates the close interaction and cross fertilization between contact mechanics and the theory of variational inequalities The last part reviews further results gives many references to current research and discusses open problems and future developments The book can be read by mechanical engineers interested in applications In addition some theorems and their proofs are given as examples for the mathematical tools used in the models

Understanding the Discrete Element Method Hans-Georg Matuttis, Jian Chen, 2014-05-12 Gives readers a more thorough understanding of DEM and equips researchers for independent work and an ability to judge methods related to simulation of polygonal particles Introduces DEM from the fundamental concepts theoretical mechanics and solidstate physics with 2D and 3D simulation methods for polygonal particles Provides the fundamentals of coding discrete element method DEM requiring little advance knowledge of granular matter or numerical simulation Highlights the numerical tricks and pitfalls that are usually only realized after years of experience with relevant simple experiments as applications Presents a logical approach starting with the mechanical and physical bases followed by a description of the techniques and finally their applications Written by a key author presenting ideas on how to model the dynamics of angular particles using polygons and polyhedral Accompanying website includes MATLAB Programs providing the simulation code for two dimensional polygons Recommended for researchers and graduate students who deal with particle models in areas such

as fluid dynamics multi body engineering finite element methods the geosciences and multi scale physics **IUTAM Symposium on Multiscale Problems in Multibody System Contacts** Peter Eberhard,2007-05-26 The investigation of multiscale problems in multibody system contacts is an interesting and timely topic which has been the subject of intensive research This IUTAM Symposium facilitated discussions between researchers active in the field This proceedings volume summarizes contributions of many authors active in the field and gives insight in very different areas of this fascinating research It reviews the state of the art and identifies future hot topics **Nonlinear Solid Mechanics** Adnan Ibrahimbegovic,2009-06-02 This book offers a recipe for constructing the numerical models for representing the complex nonlinear behavior of structures and their components represented as deformable solid bodies Its appeal extends to those interested in linear problems of mechanics **Nonlinear Dynamics, Volume 1** Gan Kerschen,2015-08-07 Nonlinear Dynamics Volume 1 Proceedings of the 33rd IMAC A Conference and Exposition on Balancing Simulation and Testing 2015 the first volume of ten from the Conference brings together contributions to this important area of research and engineering The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics including papers on Nonlinear Oscillations Nonlinear Simulation Using Harmonic Balance Nonlinear Modal Analysis Nonlinear System Identification Nonlinear Modeling Simulation Nonlinearity in Practice Nonlinear Systems Round Robin on Nonlinear System Identification **Nonlinear Dynamics, Volume 1** Gaëtan Kerschen,2015-08-14 Nonlinear Dynamics Volume 1 Proceedings of the 33rd IMAC A Conference and Exposition on Balancing Simulation and Testing 2015 the first volume of ten from the Conference brings together contributions to this important area of research and engineering The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics including papers on Nonlinear Oscillations Nonlinear Simulation Using Harmonic Balance Nonlinear Modal Analysis Nonlinear System Identification Nonlinear Modeling Simulation Nonlinearity in Practice Nonlinear Systems Round Robin on Nonlinear System Identification **Elastomere Friction** Dieter Besdo,Bodo Heimann,Manfred Klüppel,Matthias Kröger,Peter Wriggers,Udo Nackenhorst,2010-03-18 Understanding elastomer friction is essential for the development of tyres but also for sealings and other components Thus it is of great technical importance There are many aspects to modelling frictional processes in which an elastomer is interacting with a rough surface ranging from theoretical formulations leading to reduced and complex models via numerical simulation techniques to experimental investigations and validations **Handbook of Software Solutions for ICME** Georg J. Schmitz,Ulrich Prah,2016-12-19 As one of the results of an ambitious project this handbook provides a well structured directory of globally available software tools in the area of Integrated Computational Materials Engineering ICME The compilation covers models software tools and numerical methods allowing describing electronic atomistic and mesoscopic phenomena which in their combination determine the microstructure and the properties of materials It reaches out to simulations of component manufacture comprising primary shaping forming joining coating heat

treatment and machining processes Models and tools addressing the in service behavior like fatigue corrosion and eventually recycling complete the compilation An introductory overview is provided for each of these different modelling areas highlighting the relevant phenomena and also discussing the current state for the different simulation approaches A must have for researchers application engineers and simulation software providers seeking a holistic overview about the current state of the art in a huge variety of modelling topics This handbook equally serves as a reference manual for academic and commercial software developers and providers for industrial users of simulation software and for decision makers seeking to optimize their production by simulations In view of its sound introductions into the different fields of materials physics materials chemistry materials engineering and materials processing it also serves as a tutorial for students in the emerging discipline of ICME which requires a broad view on things and at least a basic education in adjacent fields

Geomechanics from Micro to Macro Kenichi Soga,Krishna Kumar,Giovanna Biscontin,Matthew Kuo,2014-08-26 Geomechanics from Micro to Macro contains 268 papers presented at the International Symposium on Geomechanics from Micro and Macro IS Cambridge UK 1 3 September 2014 The symposium created a forum for the dissemination of new advances in the micro macro relations of geomaterial behaviour and its modelling The papers on experimental investigation

Meshfree and Particle Methods Ted Belytschko,J. S. Chen,Michael Hillman,2023-12-13 Meshfree and Particle Methods Provides thorough coverage of essential concepts and state of the art developments in the field Meshfree and Particle Methods is the first book of its kind to combine comprehensive up to date information on the fundamental theories and applications of meshfree methods with systematic guidance on practical coding implementation Broad in scope and content this unique volume provides readers with the knowledge necessary to perform research and solve challenging problems in nearly all fields of science and engineering using meshfree computational techniques The authors provide detailed descriptions of essential issues in meshfree methods as well as specific techniques to address them while discussing a wide range of subjects and use cases Topics include approximations in meshfree methods nonlinear meshfree methods essential boundary condition enforcement quadrature in meshfree methods strong form collocation methods and more Throughout the book topics are integrated with descriptions of computer implementation and an open source code with a dedicated chapter for users to illustrate the connection between the formulations discussed in the text and their real world implementation and application This authoritative resource Explains the fundamentals of meshfree methods their constructions and their unique capabilities as compared to traditional methods Features an overview of the open source meshfree code RKPM2D including code and numerical examples Describes all the variational concepts required to solve scientific and engineering problems using meshfree methods such as Nitsche s method and the Lagrange multiplier method Includes comprehensive reviews of essential boundary condition enforcement quadrature in meshfree methods and nonlinear aspects of meshfree analysis Discusses other Galerkin meshfree methods strong form meshfree methods and their comparisons Meshfree and Particle

Methods Fundamentals and Applications is the perfect introduction to meshfree methods for upper level students in advanced numerical analysis courses and is an invaluable reference for professionals in mechanical aerospace civil and structural engineering and related fields who want to understand and apply these concepts directly or effectively use commercial and other production meshfree and particle codes in their work

Trends in Computational Contact Mechanics Giorgio Zavarise, Peter Wriggers, 2011-06-19 The subject of Computational Contact Mechanics has many facets Its main impact lies in the transfer of knowledge from theoretical research to applied sciences and from there to industry The application fields are literally countless ranging from classical engineering to biomechanics and nano sciences The remarkable increase of computer power in recent years has been instrumental in enabling the development of simulation based analysis in current design activity This still involves tremendous effort in research which focuses on for example multi field and multi scale problems algorithmic robustness and geometrical accuracy Moreover several aspects of Contact Mechanics Debonding and Fracture Mechanics have been combined to offer new enhanced possibilities to the computer simulation of complex phenomena With these contributions of prominent scientists this book offers a wide overview on the ongoing research at the highest level in the field

Dynamics of Coupled Structures, Volume 1 Matt Allen, Randy Mayes, Daniel Rixen, 2025-08-07 This first volume of eight from the IMAC XXXII Conference brings together contributions to this important area of research and engineering The collection presents early findings and case studies on fundamental and applied aspects of Structural Dynamics including papers on Linear Systems Substructure Modelling Adaptive Structures Experimental Techniques Analytical Methods Damage Detection Damping of Materials Members Modal Parameter Identification Modal Testing Methods System Identification Active Control Modal Parameter Estimation Processing Modal Data

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