

T.A. Laursen

Computational Contact and Impact Mechanics

Fundamentals of Modeling
Interfacial Phenomena in
Nonlinear Finite Element Analysis



Springer

Computational Contact And Impact Mechanics

Hans-Georg Matuttis, Jian Chen



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Laursen, 2013-03-14 Many physical systems require the description of mechanical interaction across interfaces if they are to be successfully analyzed. Examples in the engineered world range from the design of prosthetics in biomedical engineering e.g. hip replacements to characterization of the response and durability of head disk interfaces in computer magnetic storage devices to development of pneumatic tires with better handling characteristics and increased longevity in automotive engineering to description of the adhesion and/or relative slip between concrete and reinforcing steel in structural engineering. Such mechanical interactions often called contact impact interactions usually necessitate at minimum the determination of areas over which compressive pressures must act to prevent interpenetration of the mechanical entities involved. Depending on the application frictional behavior transient interaction of interfaces with their surroundings e.g. in intermittent stick slip thermo mechanical coupling interaction with an intervening lubricant and/or fluid layer and damage of the interface i.e. wear may also be featured. When taken together or even separately these features have the effect of making the equations of mechanical evolution not only highly nonlinear but highly nonsmooth as well. While many modern engineering simulation packages possess impressive capabilities in the general area of nonlinear mechanics it can be contended that methodologies typically utilized for contact interactions are relatively immature in comparison to other components of a nonlinear finite element package such as large deformation kinematics inelastic material modeling nonlinear equation solving or linear solver technology.

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.

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 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 Handbook of Software Solutions for ICME Georg J. Schmitz,Ulrich

Prahl,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 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

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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 investigati

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

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