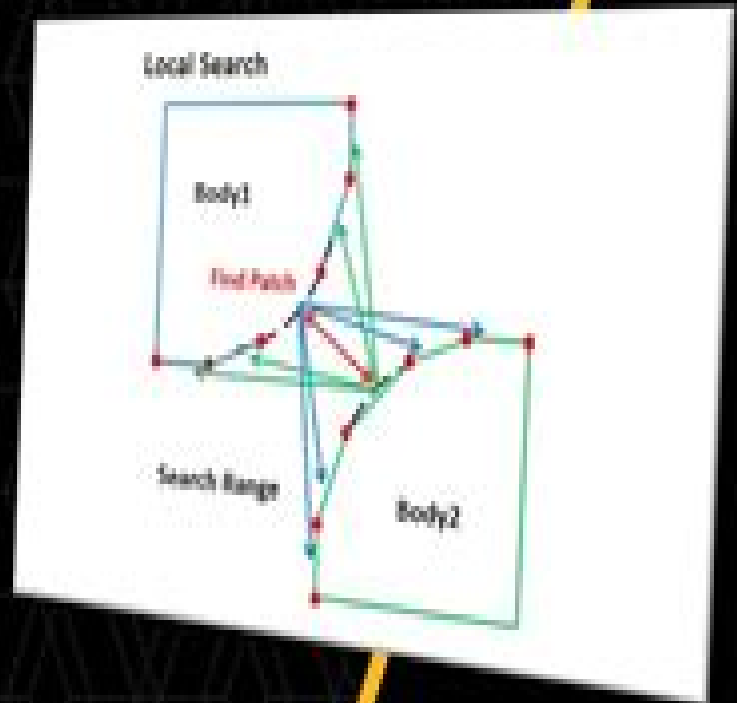


MULTIBODY DYNAMICS THEORY

CONTACT MECHANICS

FOR MULTIBODY

DYNAMICS



Contact Mechanics

**Irina Goryacheva, Marco Paggi, Valentin
L. Popov**



Contact Mechanics:

Contact Mechanics K. L. Johnson, 1987-08-28 This treatise is concerned with the stresses and deformation of solid bodies in contact with each other along curved surfaces which touch initially at a point or along a line Examples are a railway wheel and rail or a pair of gear wheel teeth Professor Johnson first reviews the development of the theory of contact stresses since the problem was originally addressed by H Hertz in 1882 Next he discusses the influence of friction and the topographical roughness of surfaces and this is incorporated into the theory of contact mechanics An important feature is the treatment of bodies which deform plastically or viscoelastically In addition to stationary contact an appreciable section of the book is concerned with bodies which are in sliding or rolling contact or which collide *New Solutions in Contact Mechanics*

Juergen Jaeger, 2005 The result of around 20 years of research by the author this book features some previously unpublished solutions that will be useful for scientific investigation and mechanical design A boundary element algorithm for contact with friction is discussed and a demonstration version with 800 contact points is included on an accompanying CD ROM All of the chapters are more or less self contained while the derivations used are suitable for undergraduate students Readers will also find new information such as the correspondence between friction and normal contact conditions which may aid further developments in this field **BOOK JACKET** **Introduction to Contact Mechanics** Anthony C. Fischer-Cripps, 2006-04-06

Mechanical engineering an engineering discipline forged and shaped by the needs of the industrial revolution is once again asked to do its substantial share in the call for industrial renewal The general call is urgent as we face profound issues of productivity and competitiveness that require engineering solutions The Mechanical Engineering Series features graduate texts and research monographs intended to address the need for information in contemporary areas of mechanical engineering The series is conceived as a comprehensive one that covers a broad range of concentrations important to mechanical engineering graduate education and research We are fortunate to have a distinguished roster of consulting editors on the advisory board each an expert in one of the areas of concentration The names of the consulting editors are listed on the facing page of this volume The areas of concentration are applied mechanics biomechanics computational mechanics dynamic systems and control energetics mechanics of materials pressing production systems thermal science and tribology Professor Finnie the consulting editor for mechanics of materials and I are pleased to present *Introduction to Contact Mechanics* by Anthony C Fischer Cripps *Handbook of Plane Contact Mechanics* Valentin L. Popov, Markus Heß, Emanuel

Willert, 2025-02-18 The book contains a structured collection of complete solutions to all relevant plane contact problems Classic profiles such as the cylinder the wedge or the rectangular flat punch are considered under centric and eccentric loading but also a variety of other technically relevant shapes such as the flat punch with rounded edges the wedge with rounded tip or wavy surfaces With regard to the load configuration adhesive and non adhesive normal contacts tangential contacts and rolling contacts are considered The materials considered are elastic isotropic transversally isotropic viscoelastic

and functionally graded media The solutions given are derived in the simplest way available and in addition to the macroscopic relationships between load and contact configuration include the stress fields in the surface and where applicable within the contacting bodies

Contact Mechanics J.R. Barber, 2018-02-09 This book describes the solution of contact problems with an emphasis on idealized mainly linear elastic problems that can be treated with elementary analytical methods General physical and mathematical features of these solutions are highlighted Topics covered include the contact of rough surfaces and problems involving adhesive e.g. van der Waals forces The author is a well known researcher in the subject with hands on experience of the topics covered and a reputation for lucid explanations The target readership for the book includes researchers who encounter contact problems but whose primary focus is not contact mechanics Coverage is also suitable for a graduate course in contact mechanics and end of chapter problems are included

Contact Mechanics and Friction Valentin L. Popov, 2010-03-10 The English edition of *Contact Mechanics and Friction* lying before you is for the most part the text of the 1st German edition Springer Publishing 2009 The book was expanded by the addition of a chapter on frictional problems in earthquake research Additionally Chapter 15 was supplemented by a section on elastohydrodynamics The problem sections of several chapters were enriched by the addition of new examples This book would not have been possible without the active support of J Gray who translated it from the German edition I would like to thank Prof G G Charyan and Prof S Sobolev for discussions and critical comments on the chapter over earthquake dynamics Dr R Heise made significant contributions to the development and correction of new problems I would like to convey my affectionate thanks to Dr J Starcevic for her complete support during the composition of this book I want to thank Ms Ch Koll for her patience in creating figures and Dr R Heise M Popov M He S Krscher and B Grzemba for their help in proofreading Berlin November 2009 V L Popov Preface to the German Edition

Introduction to Contact Mechanics Anthony C. Fischer-Cripps, 2007-04-08 This book deals with the mechanics of solid bodies in contact a subject intimately connected with such topics as fracture hardness and elasticity Coverage begins with an introduction to the mechanical properties of materials general fracture mechanics and the fracture of brittle solids It then provides a detailed description of indentation stress fields for both elastic and elastic plastic contact In addition the book discusses the formation of Hertzian cone cracks in brittle materials subsurface damage in ductile materials and the meaning of hardness Coverage concludes with an overview of practical methods of indentation testing

Contact Mechanics J.A.C. Martins, Manuel D.P. Monteiro Marques, 2013-06-29 This volume contains 44 papers presented at the Third Contact Mechanics International Symposium CMIS 2001 held in Praia da Consolação Peniche Portugal June 17-21 2001 This Symposium was the direct continuation of the first two CMIS held in Lausanne 1992 and in Carry Le Rouet 1994 Other related meetings in what concerns scientific topics and participants took place in the nineties at La Grande Motte 1990 Vadstena 1996 Ferrara 1997 Munich 1998 and Grenoble 1999 The Symposium aimed at gathering researchers with interests in a wide range of topics in theoretical computational and experimental

contact mechanics The call for papers mentioned topics in tribology mathematical formulations and analysis numerical methods in non smooth mechanics impact problems instabilities and technological problems The total number of participants was 102 from Universities and Research Institutes of 19 countries The Scientific Committee reviewed 102 submitted abstracts and the final program consisted of 6 main lectures 43 oral communications and 36 poster presentations see Appendix A The papers in this book correspond to almost all the main lectures and oral communications and they are assembled in 5 chapters Dynamics and Impact Instabilities Oscillations and Waves Contact Models Results and Applications Mathematical Analysis Numerical Methods We thank all the authors for their valuable contributions to this volume We are indebted to the members of the Scientific Committee for their help in refereeing the submitted abstracts and manuscripts We also thank the Series editor Prof Graham Gladwell for his assistance in the revision process

Contact Mechanics K. L. Johnson, 1987-08-28 This treatise is concerned with the stresses and deformation of solid bodies in contact with each other along curved surfaces which touch initially at a point or along a line Examples are a railway wheel and rail or a pair of gear wheel teeth Professor Johnson first reviews the development of the theory of contact stresses since the problem was originally addressed by H Hertz in 1882 Next he discusses the influence of friction and the topographical roughness of surfaces and this is incorporated into the theory of contact mechanics An important feature is the treatment of bodies which deform plastically or viscoelastically In addition to stationary contact an appreciable section of the book is concerned with bodies which are in sliding or rolling contact or which collide

Handbook of Contact Mechanics Valentin L. Popov, Markus Heß, Emanuel Willert, 2019-04-26 This open access book contains a structured collection of the complete solutions of all essential axisymmetric contact problems Based on a systematic distinction regarding the type of contact the regime of friction and the contact geometry a multitude of technically relevant contact problems from mechanical engineering the automotive industry and medical engineering are discussed In addition to contact problems between isotropic elastic and viscoelastic media contact problems between transversal isotropic elastic materials and functionally graded materials are addressed too The optimization of the latter is a focus of current research especially in the fields of actuator technology and biomechanics The book takes into account adhesive effects which allow access to contact mechanical questions about micro and nano electromechanical systems Solutions of the contact problems include both the relationships between the macroscopic force displacement and contact length as well as the stress and displacement fields at the surface and if appropriate within the half space medium Solutions are always obtained with the simplest available method usually with the method of dimensionality reduction MDR or approaches which use the solution of the non adhesive normal contact problem to solve the respective contact problem

Contact Mechanics M. Jean, J.J. Moreau, M. Raous, 2012-12-06 This proceedings volume contains 66 papers presented at the second Contact Mechanics International Symposium held in Carry Le Rouet France from September 19th to 23rd 1994 attended by 110 participants from 17 countries

This symposium was the continuation of the first CMIS held in 1992 in Lausanne of the Symposium Euromech 273 Unilateral Contact and Dry Friction held in 1990 in La Grande Motte France and of the series of Meetings on Unilateral Problems in Structural Analysis organized in Italy every other year during the eighties. The primary purpose of the symposium was to bring specialists of contact mechanics together in order to draw a representative picture of the state of the art and to identify new trends and new features in the field. In view of the contributions made one may assert that the mechanics of contact and friction has now reached a stage where the foundations are clear both from the mathematical and from the computational standpoints. Some of the difficulties met may be identified by saying that frictional contact is governed by resistance laws that are non smooth and whose flow rule is not associated with the yield criterion through the traditional normality property.

Contact mechanics perspective of tribology Irina Goryacheva, Marco Paggi, Valentin L. Popov, 2021-06-04 *Method of Dimensionality Reduction in Contact Mechanics* Valentin L. Popov, Markus Hess, Emanuel Willert, 2018-08-08. The present book is a collection of open access papers describing the foundations and applications of the Method of Dimensionality Reduction (MDR) first published in the Journal Facta Universitatis Series Mechanical Engineering in the years 2014-2018. The Method of Dimensionality Reduction (MDR) is a method of calculation and simulation of contacts of elastic and viscoelastic bodies. It consists essentially of two simple steps: a substitution of the three dimensional continuum by a uniquely defined one dimensional linearly elastic or viscoelastic foundation (Winkler foundation) and b) transformation of the three dimensional profile of the contacting bodies by means of the MDR transformation. As soon as these two steps are done the contact problem can be considered to be solved. For axial symmetric contacts only a small calculation by hand is required which does not exceed elementary calculus and will not be a barrier for any practically oriented engineer. Alternatively the MDR can be implemented numerically which is almost trivial due to the independence of the foundation elements. In spite of its simplicity all results are exact. The present book brings together papers covering the most important aspects of the MDR and providing a practical guide for its use. *Recent Advances in Contact Mechanics* Georgios E. Stavroulakis, 2012-10-19. Contact mechanics is an active research area with deep theoretical and numerical roots. The links between nonsmooth analysis and optimization with mechanics have been investigated intensively during the last decades especially in Europe. The study of complementarity problems, variational, quasivariational and hemivariational inequalities arising in contact mechanics and beyond is a hot topic for interdisciplinary research and cooperation. The needs of industry for robust solution algorithms suitable for large scale applications and the regular updates of the respective elements in major commercial computational mechanics codes demonstrate that this interaction is not restricted to the academic environment. The contributions of this book have been selected from the participants of the CMIS 2009 international conference which took place in Crete and continued a successful series of specialized contact mechanics conferences. **Surface Effects and Contact Mechanics X** J. T. M. De Hosson, C. A. Brebbia, 2011. Contact mechanics and surface effects as well as their interaction are important in

modern engineering The life and performance of structural components is affected by surface conditions such as wear corrosion and high cycle fatigue Surface treatments that address contact conditions can reduce costs by extending the life of components These are the subjects of a biennial conference first held in 1993 the papers from the latest of which are collected in this volume The book discusses Computer simulation Surface modification Surface treatments Surface problems in contact mechanics Contact mechanics Applications and case studies Indentation and hardness Thick and thin coatings Corrosion problems Nano characterisation Test methodology Multiscale experiments and modelling and Fracture fatigue and mechanics

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

Surface Effects and Contact Mechanics including Tribology XII J.Th.M. De Hosson, M. Hadfield, C.A. Brebbia, 2015-04-21 The book contains papers from the twelfth in a series of biennial conferences first held in 1993 on the topics of contact mechanics and surface effects and their interaction In general structural components fail by wear corrosion and fatigue that is to say affected and initiated by surface conditions Consequently it is often appropriate to modify the surface layer of a base material or coat it so as to provide an enhanced performance or longer life However in many cases it is the combined effect of wear and corrosion that is damaging contributing to complexity in determining the proper approach The surface treatment chosen should be suitably related to the problem to be solved The necessary thickness of the coating depends largely on the applied loading and environmental conditions The papers in the book address novel protective layers for advances in sliding wear and low friction The contents cover topics such as Experimental and Measurement Tests Surface Modification Surface Problems in Contact Mechanics Thick and Thin Coatings Tribomechanics Computer Simulation

Method of Dimensionality Reduction in Contact Mechanics and Friction Valentin L. Popov, Markus Heß, 2014-08-19 This book describes for the first time a simulation method for the fast calculation of contact properties and friction between rough surfaces in a complete form In contrast to existing simulation methods the method of dimensionality reduction MDR is based on the exact mapping of various types of three dimensional contact problems onto contacts of one dimensional foundations Within the confines of MDR not only are three dimensional systems reduced to one dimensional but also the resulting

degrees of freedom are independent from another Therefore MDR results in an enormous reduction of the development time for the numerical implementation of contact problems as well as the direct computation time and can ultimately assume a similar role in tribology as FEM has in structure mechanics or CFD methods in hydrodynamics Furthermore it substantially simplifies analytical calculation and presents a sort of pocket book edition of the entirety contact mechanics Measurements of the rheology of bodies in contact as well as their surface topography and adhesive properties are the inputs of the calculations In particular it is possible to capture the entire dynamics of a system beginning with the macroscopic dynamic contact calculation all the way down to the influence of roughness in a single numerical simulation model Accordingly MDR allows for the unification of the methods of solving contact problems on different scales The goals of this book are on the one hand to prove the applicability and reliability of the method and on the other hand to explain its extremely simple application to those interested

Surface Effects and Contact Mechanics XI J. Th. M. De Hosson, C. A. Brebbia, 2013 Containing the papers from the eleventh biennial conference on the topic first held in 1993 this book covers contact mechanics and surface effects and their interaction so important in modern engineering The life and performance of structural components is affected by surface conditions such as wear corrosion and high cycle fatigue Surface treatments that address contact conditions can reduce costs by extending the life of components Hence the importance of the conference discussions The book's papers cover such matters as Experimental and measurement tests Fracture fatigue and mechanics Surface modification Surface problems in contact mechanics Thick and thin coatings Heat transfers Multiscale experiments and modelling Computer simulation Biocompatible materials Vacuum technologies Residual stress problems Tribomechanics Case studies

Granular Dynamics, Contact Mechanics and Particle System Simulations Colin Thornton, 2015-09-03 This book is devoted to the Discrete Element Method DEM technique a discontinuum modelling approach that takes into account the fact that granular materials are composed of discrete particles which interact with each other at the microscale level This numerical simulation technique can be used both for dispersed systems in which the particle particle interactions are collisional and compact systems of particles with multiple enduring contacts The book provides an extensive and detailed explanation of the theoretical background of DEM Contact mechanics theories for elastic elastic plastic adhesive elastic and adhesive elastic plastic particle particle interactions are presented Other contact force models are also discussed including corrections to some of these models as described in the literature and important areas of further research are identified A key issue in DEM simulations is whether or not a code can reliably simulate the simplest of systems namely the single particle oblique impact with a wall This is discussed using the output obtained from the contact force models described earlier which are compared for elastic and inelastic collisions In addition further insight is provided for the impact of adhesive particles The author then moves on to provide the results of selected DEM applications to agglomerate impacts fluidised beds and quasi static deformation demonstrating that the DEM technique can be used i to mimic experiments ii

explore parameter sweeps including limiting values or iii identify new previously unknown phenomena at the microscale In the DEM applications the emphasis is on discovering new information that enhances our rational understanding of particle systems which may be more significant than developing a new continuum model that encompasses all microstructural aspects which would most likely prove too complicated for practical implementation The book will be of interest to academic and industrial researchers working in particle technology process engineering and geomechanics both experimentalists and theoreticians

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