

Understanding The Discrete Element Method Simulation Of Non Spherical Particles For Granular And Multi Body Systems

Thank you for downloading **Understanding The Discrete Element Method Simulation Of Non Spherical Particles For Granular And Multi Body Systems** . As you may know, people have look numerous times for their chosen novels like this Understanding The Discrete Element Method Simulation Of Non Spherical Particles For Granular And Multi Body Systems , but end up in malicious downloads. Rather than enjoying a good book with a cup of tea in the afternoon, instead they juggled with some malicious bugs inside their desktop computer.

Understanding The Discrete Element Method Simulation Of Non Spherical Particles For Granular And Multi Body Systems is available in our digital library an online access to it is set as public so you can download it instantly.

Our book servers saves in multiple countries, allowing you to get the most less latency time to download any of our books like this one.

Merely said, the Understanding The Discrete Element Method Simulation Of Non Spherical Particles For Granular And Multi Body Systems is universally compatible with any devices to read

Discrete Element Modelling of Particulate Media - Chuan-Yu Wu 2012

Discrete Element Methods (DEM) is a numerical technique for analysing the mechanics and physics of particulate systems. Originated in the late seventies for analysing geotechnical problems, it has seen significant development and is now employed extensively across disciplines. Produced in celebration of the 70th Birthday of Colin Thornton, this book contains a selection of papers concerning advances in discrete element modelling which were presented at the International Symposium on Discrete Element Modelling of Particulate Media held at Birmingham, UK on 28-30th March, 2012. The book showcases the wide application of discrete element modelling in gas-solid fluidisation, particulate flows, liquid-solid systems and quasi-static behaviour. It also reports the recent advancement in coupled DEM with computational fluid dynamics, Lattice Boltzmann Methods for multiphase systems and the novel application of DEM in contact electrification and fracture of granular systems. Aimed at research communities dealing with this technique in the powder handling and formulation industries, this will be a welcomed addition to the literature in this area.

Discrete-element Modeling of Granular Materials - Farang Radjai 2011-05-03

This book brings together in a single volume various methods and skills for particle-scale or discrete-element numerical simulation of granular media. It covers a broad range of topics from basic concepts and methods towards more advanced aspects and technical details applicable to the current research on granular materials. Discrete-element simulations of granular materials are based on four basic models (molecular dynamics, contact dynamics, quasi-static and event driven) dealing with frictional contact interactions and integration schemes for the equations of dynamics. These models are presented in the first chapters of the book, followed by various methods for sample preparation and monitoring of boundary conditions, as well as dimensionless control parameters. Granular materials encountered in real life involve a variety of compositions (particle shapes and size distributions) and interactions (cohesive, hydrodynamic, thermal) that have been extensively covered by several chapters. The book ends with two applications in the field of geo-materials.

Numerical Simulation of Selected Geologic Processes Based on Discrete Element Method - Liu Yuan 2018

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.

Handbook of Discrete Element Method for Dense Granular Solids - Bruno Chareyre 2016-08

This book provides scientists and engineers with solutions to the basic problems of DEM modeling of granular solids, both conceptual and practical. To help new users, the book carefully follows important steps, from conceptual model, to the numerical simulation of dense granular materials. This includes contact models, numerical schemes, simulation setup and post-processing. The authors present many examples, including the complete code which assists the reader in reproducing the simulations with open-source code-Yade-DEM-that was developed by the author and his colleagues at the University of Grenoble. Presents the basics, along with effective usage of DEM code Details state-of-the-art, practical implementation for research and numerical methods Provides examples with scripts, linking the book to online content and freely available software (yade-dem.org)

Discrete Element Method in the Design of Transport Systems - Daniel Gelnar 2019-01-02

This book deals with the design and optimization of the bucket elevator using the discrete element method (DEM). It describes the underlying scientific basis for the design of transport equipment using computer simulations and is focused on issues relevant to the industrial sector, mechanical engineering; and the transport, treatment, measurement, and storage of bulk materials. It presents solutions for mitigating bulk material supply chain interruptions due to process malfunctions and failures, utilizing research on monitoring and evaluating of the dynamic processes of particulate matter. The aim of the book is to help readers new to the field with the design of innovative devices. Imparting practical information aimed at saving time and money in project design, the book is ideal for engineers, designers, and researchers concerned with all aspects of bulk materials. Introduces and explains fully the Discrete Element Method

using measured values as inputs for the method; Shows whether calculated simulations and real measured values models can be used for design; Illustrates how to validate, calibrate, and optimize the dynamic processes of bulk elevators; Explains how to test transport and storage equipment before it is produced using dynamic simulation of material flow on transport lines, saving time and money.

Matrix Discrete Element Analysis of Geological and Geotechnical Engineering - Chun Liu 2021-01-23

This book introduces the basic structure, modeling methods, numerical calculation processes, post-processing, and system functions of MatDEM, which applies the basic principles and algorithm of the discrete element method. The discrete element method can effectively simulate the discontinuity, inhomogeneity, and large deformation damage of rock and soil. It is widely used in both research and industry. Based on the innovative matrix discrete element computing method, the author developed the high-performance discrete element software MatDEM from scratch, which can handle millions of elements in discrete element numerical simulations. This book also presents several examples of applications in geological and geotechnical engineering, including basic geotechnical engineering problems, discrete element tests, three dimensional landslides, and dynamic and multi-field coupling functions. Teaching videos and the relevant software can be accessed on the MATDEM website (<http://matdem.com>). The book serves as a useful reference for research and engineering staff, undergraduates, and postgraduates who work in the fields of geology, geotechnical, water conservancy, civil engineering, mining, and physics.

Computational Mechanics of Discontinua - Antonio A. Munjiza 2011-10-13

Mechanics of Discontinua is the first book to comprehensively tackle both the theory of this rapidly developing topic and the applications that span a broad field of scientific and engineering disciplines, from traditional engineering to physics of particulates, nano-technology and micro-flows. Authored by a leading researcher who has been at the cutting edge of discontinua simulation developments over the last 15 years, the book is organized into four parts: introductory knowledge, solvers, methods and applications. In the first chapter a short revision of Continuum Mechanics together with tensorial calculus is introduced. Also, a short introduction to the finite element method is given. The second part of the book introduces key aspects of the subject. These include a diverse field of applications, together with fundamental theoretical and algorithmic aspects common to all methods of Mechanics of Discontinua. The third part of the book proceeds with the most important computational and simulation methods including Discrete Element Methods, the Combined Finite-Discrete Element Method, Molecular Dynamics Methods, Fracture and Fragmentation solvers and Fluid Coupling. After these the reader is introduced to applications stretching from traditional engineering and industry (such as mining, oil industry, powders) to nanotechnology, medical and science.

Computational Science - ICCS 2020 - Valeria V. Krzhizhanovskaya 2020-06-19

The seven-volume set LNCS 12137, 12138, 12139, 12140, 12141, 12142, and 12143 constitutes the proceedings of the 20th International Conference on Computational Science, ICCS 2020, held in Amsterdam, The Netherlands, in June 2020.* The total of 101 papers and 248 workshop papers presented in this book set were carefully reviewed and selected from 719 submissions (230 submissions to the main track and 489 submissions to the workshops). The papers were organized in topical sections named: Part I: ICCS Main Track Part II: ICCS Main Track Part III: Advances in High-Performance Computational Earth Sciences: Applications and Frameworks; Agent-Based Simulations, Adaptive Algorithms and Solvers; Applications of Computational Methods in Artificial Intelligence and Machine Learning; Biomedical and Bioinformatics Challenges for Computer Science Part IV: Classifier Learning from Difficult Data; Complex Social Systems through the Lens of Computational Science; Computational Health; Computational Methods for Emerging Problems in (Dis-)Information Analysis Part V: Computational Optimization, Modelling and Simulation; Computational Science in IoT and Smart Systems; Computer Graphics, Image Processing and Artificial Intelligence Part VI: Data Driven Computational Sciences; Machine Learning and Data Assimilation for Dynamical Systems; Meshfree Methods in Computational Sciences; Multiscale Modelling and Simulation; Quantum Computing Workshop Part VII: Simulations of Flow and Transport: Modeling, Algorithms and Computation; Smart Systems: Bringing Together Computer Vision, Sensor Networks and Machine Learning; Software Engineering for Computational Science; Solving Problems with Uncertainties; Teaching Computational Science; UNcErtainty QUantificatiOn for ComputatiOnAl modeLs *The conference

was canceled due to the COVID-19 pandemic. Chapter 'APE: A Command-Line Tool and API for Automated Workflow Composition' is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

3D Discrete Element Workbench for Highly Dynamic Thermo-mechanical Analysis - Damien Andre 2015-10-26

Complex behavior models (plasticity, cracks, visco elasticity) face some theoretical difficulties for the determination of the behavior law at the continuous scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a meso scale in order to simulate directly a set of discrete properties that are responsible of the macroscopic behavior. The discrete element model has been developed for granular material. The proposed set shows how this method is capable to solve the problem of complex behavior that are linked to discrete meso scale effects. The first book solves the local problem, the second one presents a coupling approach to link the structural effects to the local ones, this third book presents the software workbench that includes all the theoretical developments.

Granular Dynamics, Contact Mechanics and Particle System Simulations - Colin Thornton 2015-09-15

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.

Coupled CFD-DEM Modeling - Hamid Reza Norouzi 2016-10-17

Discusses the CFD-DEM method of modeling which combines both the Discrete Element Method and Computational Fluid Dynamics to simulate fluid-particle interactions. Deals with both theoretical and practical concepts of CFD-DEM, its numerical implementation accompanied by a hands-on numerical code in FORTRAN Gives examples of industrial applications

Coupled CFD-DEM Modeling - Hamid Reza Norouzi 2016-10-21

Discusses the CFD-DEM method of modeling which combines both the Discrete Element Method and Computational Fluid Dynamics to simulate fluid-particle interactions. Deals with both theoretical and practical concepts of CFD-DEM, its numerical implementation accompanied by a hands-on numerical code in FORTRAN Gives examples of industrial applications

Particle Technology and Engineering - Jonathan P.K. Seville 2016-05-20

Particle Technology and Engineering presents the basic knowledge and fundamental concepts that are needed by engineers dealing with particles and powders. The book provides a comprehensive reference and introduction to the topic, ranging from single particle characterization to bulk powder properties, from particle-particle interaction to particle-fluid interaction, from fundamental mechanics to advanced computational mechanics for particle and powder systems. The content focuses on fundamental concepts,

mechanistic analysis and computational approaches. The first six chapters present basic information on properties of single particles and powder systems and their characterisation (covering the fundamental characteristics of bulk solids (powders) and building an understanding of density, surface area, porosity, and flow), as well as particle-fluid interactions, gas-solid and liquid-solid systems, with applications in fluidization and pneumatic conveying. The last four chapters have an emphasis on the mechanics of particle and powder systems, including the mechanical behaviour of powder systems during storage and flow, contact mechanics of particles, discrete element methods for modelling particle systems, and finite element methods for analysing powder systems. This thorough guide is beneficial to undergraduates in chemical and other types of engineering, to chemical and process engineers in industry, and early stage researchers. It also provides a reference to experienced researchers on mathematical and mechanistic analysis of particulate systems, and on advanced computational methods. Provides a simple introduction to core topics in particle technology: characterisation of particles and powders: interaction between particles, gases and liquids; and some useful examples of gas-solid and liquid-solid systems Introduces the principles and applications of two useful computational approaches: discrete element modelling and finite element modelling Enables engineers to build their knowledge and skills and to enhance their mechanistic understanding of particulate systems

IUTAM Symposium on Multiscale Problems in Multibody System Contacts - Peter Eberhard 2007-04-12

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.

Investigation of Form Effect on Ballast Mechanical Behavior Based on Discrete Element Modeling - Bo Wang 2019-08-27

As an essential component of the ballast track, the ballast layer provides functional-ties such as drainage, load distribution, as well as strength and stability for the rail-way track. The mechanical behaviors of ballast track such as its permanent settle-ment, breakage, force propagation and void ratio are in a great extent influenced by the form distribution of ballast stones. Its reasonable design will greatly improve the mechanical behaviors, and thus prolong the maintenance cycle of ballast track, or reduce the number of ballast stones needed for construction. This dissertation focuses on proposing optimized ballast stones in the ballast aggregate in regard to their geometrical forms. As the first step, a ballast random form generator, which is designed to generate ballast form databases with different form distributions, is proposed. 15 databases are created for further usage. Afterwards, Discrete Element Method (DEM) based simulations are performed to investigate the mechanical behaviors of ballast aggregates. The simulation model is established based on a box test, whose result is presented firstly. Establishment and calibration process of the model are expatiated afterwards. A parameter study regarding to crucial modeling parameters is also performed. Using the validated parameters and the 15 generated form databases, DEM simulation models with different form distributions of ballast stones in the ballast aggregate are proposed. Simulative methods to quantify the mechanical behaviors are elaborated. Based on the obtained results, the interrelation between mechanical behaviors of ballast aggregate and the form effect on mechanical behavior of the ballast aggregates are studied. The optimized ballast aggregate is proposed based on the findings stated above. The proposed optimized ballast aggregate is expected to be a reference for construction of ballast track in real world. The modeling technic and the calibrated modeling parameters can be used for optimization for different railway operating programs.

Computational Seismology - Heiner Igel 2017

An introductory text to a range of numerical methods used today to simulate time-dependent processes in Earth science, physics, engineering and many other fields. It looks under the hood of current simulation technology and provides guidelines on what to look out for when carrying out sophisticated simulation tasks.

Finite Element Analysis Concepts - J. E. Akin 2010

Young engineers are often required to utilize commercial finite element software without having had a

course on finite element theory. That can lead to computer-aided design errors. This book outlines the basic theory, with a minimum of mathematics, and how its phases are structured within a typical software. The importance of estimating a solution, or verifying the results, by other means is emphasized and illustrated. The book also demonstrates the common processes for utilizing the typical graphical icon interfaces in commercial codes. In particular, the book uses and covers the widely utilized SolidWorks solid modeling and simulation system to demonstrate applications in heat transfer, stress analysis, vibrations, buckling, and other fields. The book, with its detailed applications, will appeal to upper-level undergraduates as well as engineers new to industry.

Computational Modeling of Masonry Structures Using the Discrete Element Method - Sarhosis, Vasilis 2016-06-09

The Discrete Element Method (DEM) has emerged as a solution to predicting load capacities of masonry structures. As one of many numerical methods and computational solutions being applied to evaluate masonry structures, further research on DEM tools and methodologies is essential for further advancement. Computational Modeling of Masonry Structures Using the Discrete Element Method explores the latest digital solutions for the analysis and modeling of brick, stone, concrete, granite, limestone, and glass block structures. Focusing on critical research on mathematical and computational methods for masonry analysis, this publication is a pivotal reference source for scholars, engineers, consultants, and graduate-level engineering students.

Proceedings of the First International Conference on Theoretical, Applied and Experimental Mechanics - Emmanuel E. Gdoutos 2018-05-26

ICTAEM_1 treated all aspects of theoretical, applied and experimental mechanics including biomechanics, composite materials, computational mechanics, constitutive modeling of materials, dynamics, elasticity, experimental mechanics, fracture, mechanical properties of materials, micromechanics, nanomechanics, plasticity, stress analysis, structures, wave propagation. During the conference special symposia covering major areas of research activity organized by members of the Scientific Advisory Board took place.

ICTAEM_1 brought together the most outstanding world leaders and gave attendees the opportunity to get acquainted with the latest developments in the area of mechanics. ICTAEM_1 is a forum of university, industry and government interaction and serves in the exchange of ideas in an area of utmost scientific and technological importance.

The Finite Element Method for Elliptic Problems - P.G. Ciarlet 1978-01-01

The objective of this book is to analyze within reasonable limits (it is not a treatise) the basic mathematical aspects of the finite element method. The book should also serve as an introduction to current research on this subject. On the one hand, it is also intended to be a working textbook for advanced courses in Numerical Analysis, as typically taught in graduate courses in American and French universities. For example, it is the author's experience that a one-semester course (on a three-hour per week basis) can be taught from Chapters 1, 2 and 3 (with the exception of Section 3.3), while another one-semester course can be taught from Chapters 4 and 6. On the other hand, it is hoped that this book will prove to be useful for researchers interested in advanced aspects of the numerical analysis of the finite element method. In this respect, Section 3.3, Chapters 5, 7 and 8, and the sections on "Additional Bibliography and Comments" should provide many suggestions for conducting seminars.

Modeling and Simulation of Functionalized Materials for Additive Manufacturing and 3D Printing: Continuous and Discrete Media - Tarek I. Zohdi 2017-12-22

Within the last decade, several industrialized countries have stressed the importance of advanced manufacturing to their economies. Many of these plans have highlighted the development of additive manufacturing techniques, such as 3D printing which, as of 2018, are still in their infancy. The objective is to develop superior products, produced at lower overall operational costs. For these goals to be realized, a deep understanding of the essential ingredients comprising the materials involved in additive manufacturing is needed. The combination of rigorous material modeling theories, coupled with the dramatic increase of computational power can potentially play a significant role in the analysis, control, and design of many emerging additive manufacturing processes. Specialized materials and the precise design of their properties are key factors in the processes. Specifically, particle-functionalized materials play a

central role in this field, in three main regimes: (1) to enhance overall filament-based material properties, by embedding particles within a binder, which is then passed through a heating element and the deposited onto a surface, (2) to “functionalize” inks by adding particles to freely flowing solvents forming a mixture, which is then deposited onto a surface and (3) to directly deposit particles, as dry powders, onto surfaces and then to heat them with a laser, e-beam or other external source, in order to fuse them into place. The goal of these processes is primarily to build surface structures which are extremely difficult to construct using classical manufacturing methods. The objective of this monograph is introduce the readers to basic techniques which can allow them to rapidly develop and analyze particulate-based materials needed in such additive manufacturing processes. This monograph is broken into two main parts: “Continuum Method” (CM) approaches and “Discrete Element Method” (DEM) approaches. The materials associated with methods (1) and (2) are closely related types of continua (particles embedded in a continuous binder) and are treated using continuum approaches. The materials in method (3), which are of a discrete particulate character, are analyzed using discrete element methods.

Simulation of Bottle Conveyors - Opportunities of the Discrete Element Method (DEM) - Niels Dallinger 2017

Discrete-continuum Coupling Method to Simulate Highly Dynamic Multi-scale Problems - Mohamed Jebahi 2015-11-09

Complex behavior models (plasticity, crack, visco-elasticity) are facing several theoretical difficulties in determining the behavior law at the continuous (macroscopic) scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a mesoscale using the discrete element model (DEM) in order to directly simulate a set of discrete properties that are responsible for the macroscopic behavior. Originally, the discrete element model was developed for granular material. This book, the second in the Discrete Element Model and Simulation of Continuous Materials Behavior set of books, shows how to choose the adequate coupling parameters to avoid spurious wave reflection and to allow the passage of all the dynamic information both from the fine to the coarse model and vice versa. The authors demonstrate the coupling method to simulate a highly nonlinear dynamical problem: the laser shock processing of silica glass.

Particulate Discrete Element Modelling - Catherine O'Sullivan 2014-04-21

Particulate discrete element analysis is becoming increasingly popular for research in geomechanics as well as geology, chemical engineering, powder technology, petroleum engineering and in studying the physics of granular materials. With increased computing power, practising engineers are also becoming more interested in using this technology for analysis in industrial applications. This is the first single work on Discrete Element Modelling (DEM) providing the information to get started with this powerful numerical modelling approach. Written by an independent author with experience both in developing DEM codes and using commercial codes, this book provides the basic details of the numerical method and the approaches used to interpret the results of DEM simulations. Providing a basic overview of the numerical method, Particulate Discrete Element Modelling discusses issues related to time integration and numerical stability, particle types, contact modelling and boundary conditions. It summarizes approaches to interpret DEM data so that users can maximize their insight into the material response using DEM. The aim of this book is to provide both users and prospective users of DEM with a concise reference book that includes tips to optimize their usage. Particulate Discrete Element Modelling is suitable both for first time DEM analysts as well as more experienced users. It will be of use to professionals, researchers and higher level students, as it presents a theoretical overview of DEM as well as practical guidance on running DEM simulations and interpreting DEM simulation data.

Granular Gases - Thorsten Pöschel 2001-02-27

“Granular Gases” are diluted many-particle systems in which the mean free path of the particles is much larger than the typical particle size, and where particle collisions occur dissipatively. The dissipation of kinetic energy can lead to effects such as the formation of clusters, anomalous diffusion and characteristic shock waves to name but a few. The book is organized as follows: Part I comprises the rigorous theoretical results for the dilute limit. The detailed properties of binary collisions are described in Part II. Part III

contains experimental investigations of granular gases. Large-scale behaviour as found in astrophysical systems is discussed in Part IV. Part V, finally, deals with possible generalizations for dense granular systems.

Understanding the Discrete Element Method - Hans-Georg Matuttis 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.

Discrete Choice Methods with Simulation - Kenneth Train 2009-07-06

This book describes the new generation of discrete choice methods, focusing on the many advances that are made possible by simulation. Researchers use these statistical methods to examine the choices that consumers, households, firms, and other agents make. Each of the major models is covered: logit, generalized extreme value, or GEV (including nested and cross-nested logits), probit, and mixed logit, plus a variety of specifications that build on these basics. Simulation-assisted estimation procedures are investigated and compared, including maximum simulated likelihood, method of simulated moments, and method of simulated scores. Procedures for drawing from densities are described, including variance reduction techniques such as antithetics and Halton draws. Recent advances in Bayesian procedures are explored, including the use of the Metropolis-Hastings algorithm and its variant Gibbs sampling. The second edition adds chapters on endogeneity and expectation-maximization (EM) algorithms. No other book incorporates all these fields, which have arisen in the past 25 years. The procedures are applicable in many fields, including energy, transportation, environmental studies, health, labor, and marketing.

Discrete Element Methods - Benjamin K. Cook 2002

Proceedings of the Third International Conference on Discrete Element Methods, held in Santa Fe, New Mexico on September 23-25, 2002. This Geotechnical Special Publication contains 72 technical papers on discrete element methods (DEM), a suite of numerical techniques developed to model granular materials, rock, and other discontinua at the grain scale. Topics include: DEM formulation and implementation approaches, coupled methods, experimental validation, and techniques, including three-dimensional particle representations, efficient contact detection algorithms, particle packing schemes, and code design. Coupled methods include approaches to linking solid continuum and fluid models with DEM to simulate multiscale and multiphase phenomena. Applications include fundamental investigations of granular mechanics; micromechanical studies of powder, soil, and rock behavior; and large-scale modeling of geotechnical, material processing, mining, and petroleum engineering problems.

Finite Element Analysis for Biomedical Engineering Applications - Z. C. Yang 2019-03-14

Finite element analysis has been widely applied to study biomedical problems. This book aims to simulate some common medical problems using finite element advanced technologies, which establish a base for medical researchers to conduct further investigations. This book consists of four main parts: (1) bone, (2) soft tissues, (3) joints, and (4) implants. Each part starts with the structure and function of the biology and then follows the corresponding finite element advanced features, such as anisotropic nonlinear material, multidimensional interpolation, XFEM, fiber enhancement, UserHyper, porous media, wear, and crack growth fatigue analysis. The final section presents some specific biomedical problems, such as abdominal aortic aneurysm, intervertebral disc, head impact, knee contact, and SMA cardiovascular stent. All modeling files are attached in the appendixes of the book. This book will be helpful to graduate students and researchers in the biomedical field who engage in simulations of biomedical problems. The book also

provides all readers with a better understanding of current advanced finite element technologies. Details finite element modeling of bone, soft tissues, joints, and implants Presents advanced finite element technologies, such as fiber enhancement, porous media, wear, and crack growth fatigue analysis Discusses specific biomedical problems, such as abdominal aortic aneurysm, intervertebral disc, head impact, knee contact, and SMA cardiovascular stent Explains principles for modeling biology Provides various descriptive modeling files

Implicit and Explicit Algorithms in Discrete Element Method - Kasra Samiei 2014-04

Granular materials are highly present in various industrial practices and as such their proper handling is of utmost economic importance. With the advancement of computers processing capacity, numerical simulation techniques are increasingly used to compute the dynamics of granular systems. Discrete Element Method (DEM) is widely used to predict the motion of the granular assembly by analyzing the forces on each individual grain/particle at each tiny time step. Such a detailed analysis, however, comes at the cost of huge computational time and power even with today's highly efficient supercomputers. The current book discusses alternative numerical integration algorithms with the focus on the comparison between implicit and explicit methods. Several test cases are presented. The analysis of forward and reverse acting grates is, in particular, elaborated and includes residence time distribution analysis and validation of the simulation results with experiments. The book is especially useful to academics who seek a deeper understanding than simple utilization of commercial DEM codes but also to any individual who is interested in research and development of current DEM algorithms.

Numerical Simulations of Coupled Problems in Engineering - Sergio R. Idelsohn 2014-05-09

This book presents and discusses mathematical models, numerical methods and computational techniques used for solving coupled problems in science and engineering. It takes a step forward in the formulation and solution of real-life problems with a multidisciplinary vision, accounting for all of the complex couplings involved in the physical description. Simulation of multifaceted physics problems is a common task in applied research and industry. Often a suitable solver is built by connecting together several single-aspect solvers into a network. In this book, research in various fields was selected for consideration: adaptive methodology for multi-physics solvers, multi-physics phenomena and coupled-field solutions, leading to computationally intensive structural analysis. The strategies which are used to keep these problems computationally affordable are of special interest, and make this an essential book.

Coupled DEM-CFD Analyses of Landslide-Induced Debris Flows - Tao Zhao 2017-05-22

This book reflects the latest research results in computer modelling of landslide-induced debris flows. The book establishes an understanding of the initiation and propagation mechanisms of landslides by means of numerical simulations, so that mitigation strategies to reduce the long-term losses from landslide hazards can be devised. In this context, the book employs the Discrete Element Method (DEM) and Computational Fluid Dynamics (CFD) to investigate the mechanical and hydraulic behaviour of granular materials involved in landslides – an approach that yields meaningful insights into the flow mechanisms, concerning e.g. the mobilization of sediments, the generation and dissipation of excess pore water pressures, and the evolution of effective stresses. As such, the book provides valuable information, useful methods and robust numerical tools that can be successfully applied in the field of debris flow research.

Modeling and Simulation of Functionalized Materials for Additive Manufacturing and 3D

Printing: Continuous and Discrete Media - Tarek I. Zohdi 2017-12-22

Within the last decade, several industrialized countries have stressed the importance of advanced manufacturing to their economies. Many of these plans have highlighted the development of additive manufacturing techniques, such as 3D printing which, as of 2018, are still in their infancy. The objective is to develop superior products, produced at lower overall operational costs. For these goals to be realized, a deep understanding of the essential ingredients comprising the materials involved in additive manufacturing is needed. The combination of rigorous material modeling theories, coupled with the dramatic increase of computational power can potentially play a significant role in the analysis, control, and design of many emerging additive manufacturing processes. Specialized materials and the precise design of their properties are key factors in the processes. Specifically, particle-functionalized materials play a central role in this field, in three main regimes: (1) to enhance overall filament-based material properties,

by embedding particles within a binder, which is then passed through a heating element and the deposited onto a surface, (2) to “functionalize” inks by adding particles to freely flowing solvents forming a mixture, which is then deposited onto a surface and (3) to directly deposit particles, as dry powders, onto surfaces and then to heat them with a laser, e-beam or other external source, in order to fuse them into place. The goal of these processes is primarily to build surface structures which are extremely difficult to construct using classical manufacturing methods. The objective of this monograph is introduce the readers to basic techniques which can allow them to rapidly develop and analyze particulate-based materials needed in such additive manufacturing processes. This monograph is broken into two main parts: “Continuum Method” (CM) approaches and “Discrete Element Method” (DEM) approaches. The materials associated with methods (1) and (2) are closely related types of continua (particles embedded in a continuous binder) and are treated using continuum approaches. The materials in method (3), which are of a discrete particulate character, are analyzed using discrete element methods.

Finite Element Analysis in Geotechnical Engineering - David M. Potts 2001

An insight into the use of the finite method in geotechnical engineering. The first volume covers the theory and the second volume covers the applications of the subject. The work examines popular constitutive models, numerical techniques and case studies.

The Combined Finite-Discrete Element Method - Antonio A. Munjiza 2004-04-21

The combined finite discrete element method is a relatively new computational tool aimed at problems involving static and / or dynamic behaviour of systems involving a large number of solid deformable bodies. Such problems include fragmentation using explosives (e.g rock blasting), impacts, demolition (collapsing buildings), blast loads, digging and loading processes, and powder technology. The combined finite-discrete element method - a natural extension of both discrete and finite element methods - allows researchers to model problems involving the deformability of either one solid body, a large number of bodies, or a solid body which fragments (e.g. in rock blasting applications a more or less intact rock mass is transformed into a pile of solid rock fragments of different sizes, which interact with each other). The topic is gaining in importance, and is at the forefront of some of the current efforts in computational modeling of the failure of solids. * Accompanying source codes plus input and output files available on the Internet * Important applications such as mining engineering, rock blasting and petroleum engineering * Includes practical examples of applications areas Essential reading for postgraduates, researchers and software engineers working in mechanical engineering.

3D Discrete Element Workbench for Highly Dynamic Thermo-mechanical Analysis - Damien Andre 2015-10-27

Complex behavior models (plasticity, cracks, visco elasticity) face some theoretical difficulties for the determination of the behavior law at the continuous scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a meso scale in order to simulate directly a set of discrete properties that are responsible of the macroscopic behavior. The discrete element model has been developed for granular material. The proposed set shows how this method is capable to solve the problem of complex behavior that are linked to discrete meso scale effects. The first book solves the local problem, the second one presents a coupling approach to link the structural effects to the local ones, this third book presents the software workbench that includes all the theoretical developments.

Engineering Applications of Discrete Element Method - Xuewen Wang 2020-09-10

This book introduces the engineering application of the discrete element method (DEM), especially the simulation analysis of the typical equipment (scraper conveyor, coal silos, subsoiler) in the coal and agricultural machinery. In this book, the DEM is applied to build rigid and loose coupling model, and the kinematic effect of the bulk materials, the mechanical effect of the interaction between the bulk materials, and the mechanical equipment in the operation process of the relevant equipment are studied. On this basis, the optimization design strategy of the relevant structure is proposed. This book effectively promotes the application of DEM in engineering, analyzes the operation state, failure mechanism, and operation effect of related equipment in operation, and provides theoretical basis for the optimal design of equipment. The book is intended for undergraduate and graduate students who are interested in mechanical engineering, researchers investigating coal and agricultural machinery, and engineers working on

designing related equipments.

Discrete Element Method to Model 3D Continuous Materials - Mohamed Jebahi 2015-02-26

Complex behavior models (plasticity, cracks, visco elasticity) face some theoretical difficulties for the determination of the behavior law at the continuous scale. When homogenization fails to give the right behavior law, a solution is to simulate the material at a meso scale in order to simulate directly a set of discrete properties that are responsible of the macroscopic behavior. The discrete element model has been developed for granular material. The proposed set shows how this method is capable to solve the problem of complex behavior that are linked to discrete meso scale effects.

The Cell Method - Elena Ferretti 2014-02-02

The Cell Method (CM) is a computational tool that maintains critical multidimensional attributes of physical phenomena in analysis. This information is neglected in the differential formulations of the classical

approaches of finite element, boundary element, finite volume, and finite difference analysis, often leading to numerical instabilities and spurious results. This book highlights the central theoretical concepts of the CM that preserve a more accurate and precise representation of the geometric and topological features of variables for practical problem solving. Important applications occur in fields such as electromagnetics, electrostatics, solid mechanics and fluids. CM addresses non-locality in continuum mechanics, an especially important circumstance in modeling heterogeneous materials. Professional engineers and scientists, as well as graduate students, are offered: • A general overview of physics and its mathematical descriptions; • Guidance on how to build direct, discrete formulations; • Coverage of the governing equations of the CM, including nonlocality; • Explanations of the use of Tonti diagrams; and • References for further reading.