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

Discrete Element Method in the Design of Transport Systems
The Finite Element Method in Electromagnetics
Finite Element Analysis for Biomedical Engineering Applications
The Combined Finite-Discrete Element Method
Processes in GeoMedia—Volume I
Discrete-element Modeling of Granular Materials
Discrete Choice Methods with Simulation
Contact Modeling for Solids and Particles
Proceedings of the 7th International Conference on Discrete Element Methods
Engineering Applications of Discrete Element Method
Discrete Element Method to Model 3D Continuous Materials
Understanding the Discrete Element Method
Discontinuous Deformation Analysis in Rock Mechanics Practice
The Cell Method
Fundamentals of Discrete Element Methods for Rock Engineering: Theory and Applications
3D Discrete Element Workbench for Highly Dynamic Thermo-mechanical Analysis
Discrete Element Analysis Methods of Generic Differential Quadratures
Computational Mechanics of Discontinua
Coupled DEM-CFD Analyses of Landslide-Induced Debris Flows
Coupled CFD-DEM Modeling
Discrete Element Modelling of Particulate Media
Notes on Numerical Modeling in Geomechanics
Introduction to Numerical Methods for Variational Problems
Particle-Based Methods
Analysis and Improvement of the Time Driven Discrete Element Method
The Finite Element Method for Elliptic Problems
The Discrete Element Method for Granular Solids
Granular Gases
Granular Dynamics, Contact Mechanics and Particle System Simulations
Discrete Element Methods
Finite Element Analysis in Geotechnical Engineering
The Combined Finite-Discrete Element Method
Particulate Discrete Element Modelling
An Introduction to the Finite Element Method for Differential Equations

The Finite Element Method
Crystal Plasticity Finite Element Methods
Discrete Element Modelling of Particulate Media
TEXTBOOK OF FINITE ELEMENT ANALYSIS
Computational Modeling of Masonry Structures Using the Discrete Element Method
Modeling and Simulation of Functionalized Materials for Additive Manufacturing and 3D Printing: Continuous and Discrete Media

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Discrete Element Method in the Design of Transport Systems Springer Science & Business Media
"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.
The Finite Element Method in Electromagnetics John Wiley & Sons
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 withthe 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.
Finite Element Analysis for Biomedical Engineering Applications John Wiley & Sons
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.

The Combined Finite-Discrete Element Method John Wiley & Sons

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.

Processes in GeoMedia—Volume I Royal Society of Chemistry

The numerical, discrete element, Discontinuous Deformation Analysis (DDA) method was developed by Dr. Gen-hua Shi while he was working at the University of California, Berkeley, under the supervision of Prof. Richard E. Goodman in the late 1980s. Two-dimensional DDA was published in 1993 and three-dimensional DDA in 2001. Since its publication DDA has been verified, validated and applied in numerous studies worldwide and is now considered a powerful and robust method to address both static and dynamic engineering problems in discontinuous rock masses. In this book Yossef H. Hatzor and Guowei Ma, co-chairs of the International Society for Rock Mechanics (ISRM) Commission on DDA, join Dr. Shi in authoring a monograph that presents the state of the art in DDA research. A comprehensive discussion of DDA development since its publication is provided in Chapter 1, followed by concise reviews of 2D and 3D DDA in chapters 2 and 3. Procedures to select geological and numerical input parameters for DDA are discussed in Chapter 4, and DDA validation and verification is presented in Chapter 5. Applications of DDA in underground and rock slope engineering projects are discussed in chapters 6 and 7. In

Chapter 8 the novel contact theory recently developed by Dr. Shi is published in its complete form, for the first time. This book is published within the framework of the ISRM Book Series and is the contribution of the ISRM DDA Commission to the international rock mechanics community.
Discrete-element Modeling of Granular Materials John Wiley & Sons
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.
Discrete Choice Methods with Simulation John Wiley & Sons
The book conveys modern techniques and the latest state-of-the-art with regard to the most fundamental aspects of computational contact mechanics. However, since contact can readily be interpreted as a special type of interface problem, it seems advisable not to isolate contact mechanics, but rather to address it in the context of a broader class of problems denoted as computational interface mechanics. The book gives a clear understanding of the underlying physics of interfaces, and a comprehensive insight into the current state-of-the-art and selected cutting-edge research directions in the computational treatment of interface effects. It focuses on the modeling of friction, wear, lubrication, cohesive interfaces, grain boundaries, phase boundaries, fracture, thermo-mechanics and particulate contact (e.g. granular media). Also the most important computational aspects are addressed, including discretization techniques for finite deformations, solution algorithms for single- and multi-processor computing environments, multi-scale approaches, discrete element models and multi-physics problems including contact and interface constraints. Among the computational techniques covered in this book are finite element (FEM) and boundary element (BEM) methods, atomistic models, molecular dynamics (MD), discrete element methods (DEM), coupling

approaches for multi-scale simulations, and tools for an efficient automated FEM code generation.

Contact Modeling for Solids and Particles Springer Nature

This book is an introduction to numerical analysis in geomechanics and is intended for advanced undergraduate and beginning graduate study of the mechanics of porous, jointed rocks and soils. Although familiarity with the concepts of stress, strain and so on is assumed, a review of the fundamentals of solid mechanics including concepts of physical laws, kinematics and material laws is presented in an appendix. Emphasis is on the popular finite element method but brief explanations of the boundary element method, the distinct element method (also known as the discrete element method) and discontinuous deformation analysis are included. Familiarity with a computer programming language such as Fortran, C++ or Python is not required, although programming excerpts in Fortran are presented at the end of some chapters. This work begins with an intuitive approach to interpolation over a triangular element and thus avoids making the simple complex by not doing energy minimization via a calculus of variations approach so often found in reference books on the finite element method. The presentation then proceeds to a principal of virtual work via the well-known divergence theorem to obtain element equilibrium and then global equilibrium, both expressed as stiffness equations relating force to displacement. Solution methods for the finite element approach including elimination and iteration methods are discussed. Hydro-mechanical coupling is described and extension of the finite element method to accommodate fluid flow in porous geological media is made. Example problems illustrate important concepts throughout the text. Additional problems for a 15-week course of study are presented in an appendix; solutions are given in another appendix.

Proceedings of the 7th International Conference on Discrete Element Methods Elsevier

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

Engineering Applications of Discrete Element Method Cambridge University Press

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 stimulated likelihood, method of simulated moments, and method of simulated scores. Procedures for drawing from densities are described, including variance reduction techniques such as anithetics 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 Method to Model 3D Continuous Materials John Wiley & Sons

Master the finite element method with this masterful and practical volume An Introduction to the Finite Element Method (FEM) for Differential Equations provides readers with a practical and approachable examination of the use of the finite element method in mathematics. Author Mohammad Asadzadeh covers basic FEM theory, both in one-dimensional and higher dimensional cases. The book is filled with concrete strategies and useful methods to simplify its complex mathematical contents. Practically written and carefully detailed, An Introduction to the Finite Element Method covers topics including: An introduction to basic ordinary and partial differential equations The concept of fundamental solutions using Green's function approaches Polynomial approximations and interpolations, quadrature rules, and iterative numerical methods to solve linear systems of equations Higher-dimensional interpolation procedures Stability and convergence analysis of FEM for differential equations This book is ideal for upper-level undergraduate and graduate students in natural science and engineering. It belongs on the shelf of anyone seeking to improve their understanding of

differential equations.

Understanding the Discrete Element Method PHI Learning Pvt. Ltd.

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.

Discontinuous Deformation Analysis in Rock Mechanics Practice CRC Press

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.

The Cell Method Springer

The Discrete Element Method for Granular Solids 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)

Fundamentals of Discrete Element Methods for Rock Engineering: Theory and Applications John Wiley & Sons

The Special Publications series is a collection of books produced from the proceedings of international symposia.

3D Discrete Element Workbench for Highly Dynamic Thermo-mechanical Analysis Springer Science & Business Media

This book presents some fundamental concepts behind the basic theories and tools of discrete element methods (DEM), its historical development, and its wide scope of applications in geology, geophysics and rock engineering. Unlike almost all books available on the general subject of DEM, this book includes coverage of both explicit and implicit DEM approaches, namely the Distinct Element Methods and Discontinuous Deformation Analysis (DDA) for both rigid and deformable blocks and particle systems, and also the Discrete Fracture Network (DFN) approach for fluid flow and solute transport simulations. The latter is actually also a discrete approach of importance for rock mechanics and rock engineering. In addition, brief introductions to some alternative approaches are also provided, such as percolation theory and Cosserat micromechanics equivalence to particle systems, which often appear hand-in-hand with the DEM in the literature. Fundamentals of the particle mechanics approach using DEM for granular media is also presented. · Presents the fundamental concepts of the discrete models for fractured rocks, including constitutive models of rock fractures and rock masses for stress, deformation and fluid flow · Provides a comprehensive presentation on discrete element methods, including distinct elements, discontinuous deformation analysis, discrete fracture networks, particle mechanics and Cosserat representation of granular media · Features constitutive models of rock fractures and fracture system characterization methods detaiing their significant impacts on the performance and uncertainty of the DEM models

Discrete Element Analysis Methods of Generic Differential Quadratures Springer

Following the advance in computer technology, the numerical technique has made signi?cant progress in the past decades. Among the major techniques available for numerically analyzing continuum mechanics problems, ?nite d- ference method is most early developed. It is di?cult to deal with cont- uum mechanics problems showing complex curvilinear geometries by using this method. The other method that can consistently discretize continuum mechanics problems showing arbitrarily complex geometries is ?nite element method. In addition, boundary element method is also a useful numerical method. In the past decade, the di?erential quadrature and generic di?erential quadraturesbaseddiscrete elementanalysismethodsh avebeendevelopedand usedto solve various continuum mechanics problems. These methods have the same advantage as ?nite element method of consistently discretizing cont- uum mechanics problems

having arbitrarily complex geometries. This book includes my research results obtained in developing the related novel discrete element analysis methods using both of the extended di?erential quadrature based spacial and temporal elements. It is attempted to introduce the dev- oped numerical techniques as applied to the solution of various continuum mechanics problems, systematically.
Computational Mechanics of Discontinua IGI Global
This textbook teaches finite element methods from a computational point of view. It focuses on how to develop flexible computer programs with Python, a programming language in which a combination of symbolic and numerical tools is used to achieve an explicit and practical derivation of finite element algorithms. The finite element library FEniCS is used throughout the book, but the content is provided in sufficient detail to ensure that students with less mathematical background or mixed programming-language experience will equally benefit. All program examples are available on the Internet.
Coupled DEM-CFD Analyses of Landslide-Induced Debris Flows John Wiley & Sons
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.
Coupled CFD-DEM Modeling ISTE Press - Elsevier
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