## COMPUTATIONAL METHODS FOR PLASTICITY

THEORY AND APPLICATIONS

EA de Souza Neto D Perić DRJ Owen



# **Computational Methods For Plasticity Theory And Applications**

**Andreas Öchsner** 

#### **Computational Methods For Plasticity Theory And Applications:**

Computational Methods for Plasticity Eduardo A. de Souza Neto, Djordje Peric, David R. J. Owen, 2008-12-22 The subject of computational plasticity encapsulates the numerical methods used for the finite element simulation of the behaviour of a wide range of engineering materials considered to be plastic i e those that undergo a permanent change of shape in response to an applied force Computational Methods for Plasticity Theory and Applications describes the theory of the associated numerical methods for the simulation of a wide range of plastic engineering materials from the simplest infinitesimal plasticity theory to more complex damage mechanics and finite strain crystal plasticity models It is split into three parts basic concepts small strains and large strains Beginning with elementary theory and progressing to advanced complex theory and computer implementation it is suitable for use at both introductory and advanced levels The book Offers a self contained text that allows the reader to learn computational plasticity theory and its implementation from one volume Includes many numerical examples that illustrate the application of the methodologies described Provides introductory material on related disciplines and procedures such as tensor analysis continuum mechanics and finite elements for non linear solid mechanics Is accompanied by purpose developed finite element software that illustrates many of the techniques discussed in the text downloadable from the book s companion website This comprehensive text will appeal to postgraduate and graduate students of civil mechanical aerospace and materials engineering as well as applied mathematics and courses with computational mechanics components It will also be of interest to research engineers scientists and software developers working in the field of computational solid mechanics Computational Methods for Plasticity Eduardo A. de Souza Neto, Djordje Peric, David R. J. Owen, 2011-09-21 The subject of computational plasticity encapsulates the numerical methods used for the finite element simulation of the behaviour of a wide range of engineering materials considered to be plastic i e those that undergo a permanent change of shape in response to an applied force Computational Methods for Plasticity Theory and Applications describes the theory of the associated numerical methods for the simulation of a wide range of plastic engineering materials from the simplest infinitesimal plasticity theory to more complex damage mechanics and finite strain crystal plasticity models It is split into three parts basic concepts small strains and large strains Beginning with elementary theory and progressing to advanced complex theory and computer implementation it is suitable for use at both introductory and advanced levels The book Offers a self contained text that allows the reader to learn computational plasticity theory and its implementation from one volume Includes many numerical examples that illustrate the application of the methodologies described Provides introductory material on related disciplines and procedures such as tensor analysis continuum mechanics and finite elements for non linear solid mechanics Is accompanied by purpose developed finite element software that illustrates many of the techniques discussed in the text downloadable from the book s companion website This comprehensive text will appeal to postgraduate and graduate students of civil mechanical aerospace and materials

engineering as well as applied mathematics and courses with computational mechanics components It will also be of interest to research engineers scientists and software developers working in the field of computational solid mechanics

Computational Methods in Elasticity and Plasticity A. Anandarajah, 2011-01-04 Computational Methods in Elasticity and Plasticity Solids and Porous Media presents the latest developments in the area of elastic and elasto plastic finite element modeling of solids porous media and pressure dependent materials and structures The book covers the following topics in depth the mathematical foundations of solid mechanics the finite element method for solids and porous media the theory of plasticity and the finite element implementation of elasto plastic constitutive models The book also includes A detailed coverage of elasticity for isotropic and anisotropic solids A detailed treatment of nonlinear iterative methods that could be used for nonlinear elastic and elasto plastic analyses A detailed treatment of a kinematic hardening von Mises model that could be used to simulate cyclic behavior of solids Discussion of recent advances in the analysis of porous media and pressure dependent materials in more detail than other books currently available Computational Methods in Elasticity and Plasticity Solids and Porous Media also contains problem sets worked examples and a solutions manual for instructors

**Plasticity Theory** Andreas Öchsner, 2024-05-30 This book provides a comprehensive exploration of the fundamentals experimental techniques and simulation methodologies related to advanced engineering materials It addresses the challenges posed by these materials introduces the concept of stress invariants and demonstrates their implementation in finite element programs for accurate simulations The book serves as a valuable resource for researchers engineers and students interested in the cutting edge developments in materials science and engineering **Elements of Classical** <u>Plasticity Theory</u> Andreas Öchsner, 2022-11-08 This monograph provides a compact introduction into the classical i e rate independent plasticity theory Starting from the engineering stress strain diagram the concept of elastic and elasto plastic material behavior is introduced as well as the concept of uniaxial and multiaxial stress states Continuum mechanical modeling in the elasto plastic range requires in regards to the constitutive equation in addition to the elastic law e g Hooke s law a yield condition a flow rule and a hardening rule These basic equations are thoroughly introduced and explained for one dimensional stress states Considering three dimensional plasticity different sets of stress invariants to characterize the stress matrix and the decomposition of the stress matrix in its hydrostatic and deviatoric part are introduced Furthermore the concept of the yield condition flow rule and hardening rule is generalized for multiaxial stress states Some typical yield conditions are introduced and their graphical representation in different stress spaces is discussed in detail The book concludes with an introduction in the elasto plastic finite element simulation of mechanical structures In the context of numerical approximation methods the so called predictor corrector methods are used to integrate the constitutive equations This is again introduced in detail based on one dimensional stress states and afterwards generalized to the three dimensional case Test your knowledge with questions and answers about the book in the Springer Nature Flashcards app Engineering Design Applications II Andreas Öchsner, Holm Altenbach, 2019-06-27 This book offers an update on recent developments in modern engineering design Different engineering disciplines such as mechanical materials computer and process engineering provide the foundation for the design and development of improved structures materials and processes The modern design cycle is characterized by the interaction between various disciplines and a strong shift to computer based approaches where only a few experiments are conducted for verification purposes A major driver for this development is the increased demand for cost reduction which is also linked to environmental demands In the transportation industry e.g. automotive or aerospace the demand for higher fuel efficiency is related to reduced operational costs and less environmental damage One way to fulfil such requirements is lighter structures and or improved processes for energy conversion Another emerging area is the interaction of classical engineering with the health and medical sector Plasticity Weimin Han, B. Daya Reddy, 2012-11-19 This book focuses on the theoretical aspects of small strain theory of elastoplasticity with hardening assumptions It provides a comprehensive and unified treatment of the mathematical theory and numerical analysis It is divided into three parts with the first part providing a detailed introduction to plasticity the second part covering the mathematical analysis of the elasticity problem and the third part devoted to error analysis of various semi discrete and fully discrete approximations for variational formulations of the elastoplasticity This revised and expanded edition includes material on single crystal and strain gradient plasticity In addition the entire book has been revised to make it more accessible to readers who are actively involved in computations but less so in numerical analysis Reviews of earlier edition The authors have written an excellent book which can be recommended for specialists in plasticity who wish to know more about the mathematical theory as well as those with a background in the mathematical sciences who seek a self contained account of the mechanics and mathematics of plasticity theory ZAMM 2002 In summary the book represents an impressive comprehensive overview of the mathematical approach to the theory and numerics of plasticity Scientists as well as lecturers and graduate students will find the book very useful as a reference for research or for preparing courses in this field Technische Mechanik The book is professionally written and will be a useful reference to researchers and students interested in mathematical and numerical problems of plasticity It represents a major contribution in the area of continuum mechanics and numerical analysis Math Reviews The Catalogue of Computational Material Models Paul Steinmann, Kenneth Runesson, 2021-02-16 This book gives a comprehensive account of the formulation and computational treatment of basic geometrically linear models in 1D To set the stage it assembles some preliminaries regarding necessary modelling computational and mathematical tools Thereafter the remaining parts are concerned with the actual catalogue of computational material models To this end after starting out with elasticity as a reference further 15 different basic variants of material models 5 x each of visco elasticity plasticity visco plasticity respectively are systematically explored The presentation for each of these basic material models is a stand alone account and follows in each case the same structure On

the one hand this allows in the true sense of a catalogue to consult each of the basic material models separately without the need to refer to other basic material models On the other hand even though this somewhat repetitious concept may seem tedious it allows to compare the formulation and resulting algorithmic setting of the various basic material models and thereby to uncover in detail similarities and differences In particular the response of each basic material model is analysed for the identical histories Ziq Zaq Sine Ramp of prescribed strain and stress so as to clearly showcase and to contrast to each other the characteristics of the various modelling options Numerical Methods in Geotechnical Engineering IX António Cardoso, José Borges, Pedro Costa, António Gomes, José Marques, Castorina Vieira, 2018-06-19 Numerical Methods in Geotechnical Engineering IX contains 204 technical and scientific papers presented at the 9th European Conference on Numerical Methods in Geotechnical Engineering NUMGE2018 Porto Portugal 25 27 June 2018 The papers cover a wide range of topics in the field of computational geotechnics providing an overview of recent developments on scientific achievements innovations and engineering applications related to or employing numerical methods. They deal with subjects from emerging research to engineering practice and are grouped under the following themes Constitutive modelling and numerical implementation Finite element discrete element and other numerical methods Coupling of diverse methods Reliability and probability analysis Large deformation large strain analysis Artificial intelligence and neural networks Ground flow thermal and coupled analysis Earthquake engineering soil dynamics and soil structure interactions Rock mechanics Application of numerical methods in the context of the Eurocodes Shallow and deep foundations Slopes and cuts Supported excavations and retaining walls Embankments and dams Tunnels and caverns and pipelines Ground improvement and reinforcement Offshore geotechnical engineering Propagation of vibrations Following the objectives of previous eight thematic conferences 1986 Stuttgart Germany 1990 Santander Spain 1994 Manchester United Kingdom 1998 Udine Italy 2002 Paris France 2006 Graz Austria 2010 Trondheim Norway 2014 Delft The Netherlands Numerical Methods in Geotechnical Engineering IX updates the state of the art regarding the application of numerical methods in geotechnics both in a scientific perspective and in what concerns its application for solving practical boundary value problems The book will be much of interest to engineers academics and professionals involved or interested in Geotechnical Engineering

Automation of Finite Element Methods Jože Korelc, Peter Wriggers, 2016-06-08 New finite elements are needed as well in research as in industry environments for the development of virtual prediction techniques. The design and implementation of novel finite elements for specific purposes is a tedious and time consuming task especially for nonlinear formulations. The automation of this process can help to speed up this process considerably since the generation of the final computer code can be accelerated by order of several magnitudes. This book provides the reader with the required knowledge needed to employ modernautomatic tools like AceGen within solid mechanics in a successful way. It covers the range from the theoretical background algorithmic treatments to many different applications. The book is written for advanced students in the

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