

Zengtao Chen
Cliff Butcher

Micromechanics Modelling of Ductile Fracture



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André Pineau, André Zaoui



Micromechanics Modelling Of Ductile Fracture Micromechanics Modelling Of Ductile Fracture:

Micromechanics Modelling of Ductile Fracture Zengtao Chen,Cliff Butcher,2013-04-05 This book summarizes research advances in micromechanics modeling of ductile fractures made in the past two decades The ultimate goal of this book is to reach manufacturing frontline designers and materials engineers by providing a user oriented theoretical background of micromechanics modeling Accordingly the book is organized in a unique way first presenting a vigorous damage percolation model developed by the authors over the last ten years This model overcomes almost all difficulties of the existing models and can be used to completely accommodate ductile damage developments within a single measure microstructure frame Related void damage criteria including nucleation growth and coalescence are then discussed in detail how they are improved when and where they are used in the model and how the model performs in comparison with the existing models Sample forming simulations are provided to illustrate the model s performance *Micromechanics*

Modelling of Ductile Fracture Zengtao Chen,Cliff Butcher,2013-04-02 This book summarizes research advances in micromechanics modeling of ductile fractures made in the past two decades The ultimate goal of this book is to reach manufacturing frontline designers and materials engineers by providing a user oriented theoretical background of micromechanics modeling Accordingly the book is organized in a unique way first presenting a vigorous damage percolation model developed by the authors over the last ten years This model overcomes almost all difficulties of the existing models and can be used to completely accommodate ductile damage developments within a single measure microstructure frame Related void damage criteria including nucleation growth and coalescence are then discussed in detail how they are improved when and where they are used in the model and how the model performs in comparison with the existing models Sample forming simulations are provided to illustrate the model s performance *Modeling of the Damage Mechanisms in*

AlMgSi Alloys Denis Lassance,2006 With the growth in importance of the aluminium industry has come increased demand to invest into the quality improvement of the different aluminium based hot extruded products One of the main mechanisms which can influence deformation at high temperature within the 6xxx aluminium is linked to the presence of the AlFeSi intermetallic phases These phases severely restrict hot workability when present as hard and brittle plate like precipitates b AlFeSi Damage initiation occurs in these alloys by decohesion or fracture of these intermetallic inclusions The understanding and modeling of the deformation and fracture behavior of aluminium alloys at room and at hot working temperature is very important for optimizing manufacturing processes such as extrusion The ductility of 6xxx aluminium alloys can be directly related to chemical composition and to the microstructural evolution occurring during the heat treatment procedures preceding extrusion if proper physics based deformation and fracture models are used In this thesis room temperature and hot tensile tests are adopted to address the problem xperimentally The damage evolution mechanisms is defined at various temperatures and a micromechanics based model of the Gurson type considering several populations of cavities nucleated by

different second phase particles groups is developed on the basis of the experimental observations This model allows relating quantitatively microstructure and ductility at various temperatures strain rates and stress triaxialities Finite element simulations based on an enhanced micromechanics based model are used to validate the model Finally the effect of some key factors that determine the extrudability of aluminium is also discussed and a correlation between the ductility calculations in uniaxial tension and the maximum extrusion speed is developed for one defined profile

Micromechanics and Nanosimulation of Metals and Composites Siegfried Schmauder, Leon Mishnaevsky, 2008-10-20 The strength of metallic materials determines the usability and reliability of all the machines tools and equipment around us Yet the question about which mechanisms control the strength and damage resistance of materials and how they can be optimised remains largely unanswered How do real heterogeneous materials deform and fail Why can a small modification of the microstructure increase the strength and damage resistance of materials manifold How can the strength of heterogeneous materials be predicted The purpose of this book is to present different experimental and computational analysis methods of micromechanics of damage and strength of materials and to demonstrate their applications to various micromechanical problems This book summarizes at a glance some of the publications of the Computational Mechanics Group at the IMWF MPA Stuttgart dealing with atomistic micro and meso mechanical modelling and experimental analysis of strength and damage of metallic materials In chapter 1 the micromechanisms of damage and fracture in different groups of materials are investigated experimentally using direct observations and inverse analysis The interaction of microstructural elements with the evolving damage is studied in these experiments Chapter 2 presents different approaches to the micromechanical simulation of composite materials embedded unit cells multiphase finite elements and multiparticle unit cells Examples of the application of these models to the analysis of deformation and damage in different materials are given Chapter 3 deals with the methods of numerical modelling of damage evolution and crack growth in heterogeneous materials

Recent Trends in Fracture and Damage Mechanics Geralf Hütter, Lutz Zymbell, 2015-09-01 This book covers a wide range of topics in fracture and damage mechanics It presents historical perspectives as well as recent innovative developments presented by peer reviewed contributions from internationally acknowledged authors The volume deals with the modeling of fracture and damage in smart materials current industrial applications of fracture mechanics and it explores advances in fracture testing methods In addition readers will discover trends in the field of local approach to fracture and approaches using analytical mechanics Scholars in the fields of materials science engineering and computational science will value this volume which is dedicated to Meinhard Kuna on the occasion of his 65th birthday in 2015 This book incorporates the proceedings of an international symposium that was organized to honor Meinhard Kuna's contributions to the field of theoretical and applied fracture and damage mechanics

IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase Materials André Pineau, André Zaoui, 2012-12-06 The IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase

Materials was held in Sevres Paris France 29 August 1 September 1995 The Symposium was attended by 83 persons from 18 countries In addition 17 young French students attended the meeting During the 4 day meeting a total of 55 papers were presented including 24 papers in the poster sessions The meeting was divided into 7 oral and 3 poster sessions The 7 oral sessions were the following Plasticity and Viscoplasticity I and II Phase transformations Damage I and II Statistical and geometrical aspects Cracks and interfaces Each poster session was introduced by a Rapporteur as follows Session I Plasticity and Viscoplasticity G Cailletaud Session 2 Damage D Franc ois Session 3 Phase transformation statistical and geometrical aspects D Jeulin The main purpose of the Symposium was the discussion of the state of the art in the development of micromechanical models used to predict the macroscopic mechanical behaviour of mUltiphase solid materials These materials consist of at least two chemically different phases present either initially or formed during plastic deformation when a strain induced phase transformation takes place One session was devoted to the latter case Continuously strengthened composite materials containing long fibers were out of the scope of the Symposium

Micromechanical Analysis and Multi-Scale Modeling Using the Voronoi Cell Finite Element Method Somnath Ghosh,2011-06-23 As multi phase metal alloy systems and polymer ceramic or metal matrix composite materials are increasingly being used in industry the science and technology for these heterogeneous materials has advanced rapidly By extending analytical and numerical models engineers can analyze failure characteristics of the materials before they are integrat

Fracture Mechanics Fazil Erdogan,1995 *Advances in Fracture Research* Alberto Carpinteri,Yiu-Wing Mai,Robert O. Ritchie,2007-01-30 This book is a spin off from the International Journal of Fracture and collects lectures and papers presented at the 11th International Conference on Fracture ICF11 March 20 25 2005 Included in this volume are introductory addresses as well as remarks on the presentation of honorary degrees A collection of papers follows including presentations by such eminent scientists as B B Mandelbrot G I Barenblatt and numerous others reviewing advanced research in fracture *Applied Mechanics Reviews* ,1978

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