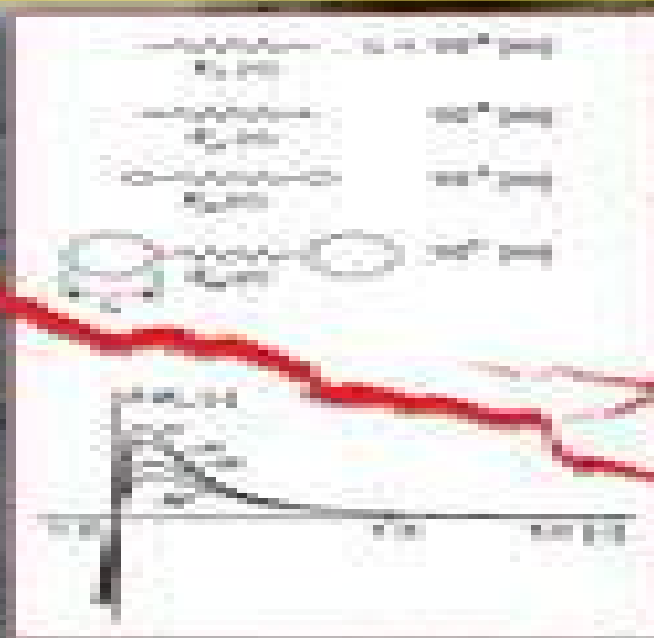


Concrete Fracture

A Multiscale Approach



Jan G.M. van Mier



Concrete Fracture A Multiscale Approach

Jacek Tejchman, Jerzy Bobiński



Concrete Fracture A Multiscale Approach:

Concrete Fracture Jan G.M. van Mier, 2012-10-25 The study of fracture mechanics of concrete has developed in recent years to the point where it can be used for assessing the durability of concrete structures and for the development of new concrete materials The last decade has seen a gradual shift of interest toward fracture studies at increasingly smaller sizes and scales Concrete Fracture A

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Concrete Fracture Models and Applications Shailendra Kumar, Sudhirkumar V Barai, 2011-02-08 Cementitious materials rocks and fibre reinforced composites commonly termed as quasibrittle need a different fracture mechanics approach to model the crack propagation study because of the presence of significant size of fracture process zone ahead of the crack tip Recent studies show that concrete structures manifest three important stages in fracture process crack initiation stable crack propagation and unstable fracture or failure Fracture Mechanics concept can better explain the above various stages including the concepts of ductility size effect strain softening and post cracking behavior of concrete and concrete structures The book presents a basic introduction on the various nonlinear concrete fracture models considering the respective fracture parameters To this end a thorough state of the art review on various aspects of the material behavior and development of different concrete fracture models is presented The development of cohesive crack model for standard test geometries using commonly used softening functions is shown and extensive studies on the behavior of cohesive crack fracture parameters are also carried out The subsequent chapter contains the extensive study on the double K and double G fracture parameters in which some recent developments on the related fracture parameters are illustrated including introduction of weight function method to Double K Fracture Model and formulation of size effect behavior of the double K fracture parameters The application of weight function approach for determining of the KR curve associated with cohesive stress distribution in the fracture process zone is also presented Available test data are used to validate the new approach Further effect of specimen geometry loading condition size effect and softening function on various fracture parameters is investigated Towards the end a comparative study between different fracture parameters obtained from various models is presented

Non-Destructive Testing of Structures Magdalena Rucka, 2021-02-16 The Special Issue Non Destructive Testing of Structures has been proposed to present the recent developments in the field of the diagnostics of structural materials and components in civil and mechanical engineering The papers highlighted in this editorial concern various aspects of non invasive diagnostics including such topics as the condition assessments of civil and mechanical structures and the connections of structural elements the inspection of cultural heritage monuments the testing of structural materials structural health monitoring systems the

integration of non destructive testing methods advanced signal processing for the non destructive testing of structures NDT damage detection and damage imaging as well as modeling and numerical analyses for supporting structural health monitoring SHM systems *Recent Advances in Structural Health Monitoring and Engineering Structures* Ravipudi Venkata Rao, Samir Khatir, Thanh Cuong-Le, 2022-12-16 This book presents the select proceedings of the 2nd International Conference on Structural Health Monitoring Engineering Structures SHM ES 2021 held at the University of Transport and Communications Hanoi Vietnam during 13 14 December 2021 It covers the recent advances in the fields related to structural health monitoring damage detection and assessment non destructive testing inverse problems optimization artificial neural networks and evaluation This book will be useful for researchers and professionals working in the field of health monitoring of engineering structures **Continuous and Discontinuous Modelling of Fracture in Concrete Using FEM** Jacek Tejchman, Jerzy Bobiński, 2012-07-28 The book analyzes a quasi static fracture process in concrete and reinforced concrete by means of constitutive models formulated within continuum mechanics A continuous and discontinuous modelling approach was used Using a continuous approach numerical analyses were performed using a finite element method and four different enhanced continuum models isotropic elasto plastic isotropic damage and anisotropic smeared crack one The models were equipped with a characteristic length of micro structure by means of a non local and a second gradient theory So they could properly describe the formation of localized zones with a certain thickness and spacing and a related deterministic size effect Using a discontinuous FE approach numerical results of cracks using a cohesive crack model and XFEM were presented which were also properly regularized Finite element analyses were performed with concrete elements under monotonic uniaxial compression uniaxial tension bending and shear extension Concrete beams under cyclic loading were also simulated using a coupled elasto plastic damage approach Numerical simulations were performed at macro and meso level of concrete A stochastic and deterministic size effect was carefully investigated In the case of reinforced concrete specimens FE calculations were carried out with bars slender and short beams columns corbels and tanks Tensile and shear failure mechanisms were studied Numerical results were compared with results from corresponding own and known in the scientific literature laboratory and full scale tests *Multiscale and Multiphysics Modelling for Advanced and Sustainable Materials* Patrizia Trovalusci, Tomasz Sadowski, Adnan Ibrahimbegovic, 2025-06-25 This book offers the proceedings of Euromech colloquium 642 which wanted to provide a forum to present and debate several advanced computational experimental and analytical methods for studying the behaviour of complex materials and structures The goal was to gather researchers engineers physicists and mathematicians specialized in multiscale material modelling for simulating the mechanics of solids and the physics of matter with the final aim of bridging the gap between solids and structural mechanics and material science in the modelling of complex materials Both computational and experimental aspects play a central role and talks have also focused on a broad range of aspects either related to the material modelling or the structural one Various types of

complex materials made of very different constituents are used nowadays in engineering practice particle or fibrous composites laminates green composites with natural fillers and industrial or urban recyclable materials nanomaterials architecture material in general complex multiphase materials with a complex internal structure including porosity reinforcement in the form of short fibres and particles of various properties shapes and sizes filled in different media It is widely recognized that important macroscopic properties such as the macroscopic stiffness and strength are governed by multiphysics processes e g damage due to heat transfer or fluid penetration crack propagation under thermal shock in ceramic metallic matrix composites etc which occur at one to several scales below the level of observation A thorough understanding of how these processes influence the reduction of stiffness and strength is a key to the analysis of existing and the design of improved complex materials The colloquium was centred on Multiscale and Multiphysics Modeling of Complex Materials with attention to the constitutive aspects concerning complex materials so defined for the presence of internal structure at different scales nano micro meso and nonlinear constitutive behaviour plasticity damage fracture etc

Strain-Hardening Cement-Based Composites Viktor Mechtcherine, Volker Slowik, Petr Kabele, 2017-09-04 This is the proceedings of the 4th International Conference on Strain Hardening Cement Based Composites SHCC4 that was held at the Technische Universität Dresden Germany from 18 to 20 September 2017 The conference focused on advanced fiber reinforced concrete materials such as strain hardening cement based composites SHCC textile reinforced concrete TRC and high performance fiber reinforced cement based composites HPFRCC All these new materials exhibit pseudo ductile behavior resulting from the formation of multiple fine cracks when subject to tensile loading The use of such types of fiber reinforced concrete could revolutionize the planning development dimensioning structural and architectural design construction of new and strengthening and repair of existing buildings and structures in many areas of application The SHCC4 Conference was the follow up of three previous successful international events in Stellenbosch South Africa in 2009 Rio de Janeiro Brazil in 2011 and Dordrecht The Netherlands in 2014

Fracture Phenomena in Nature and Technology Davide Bigoni, Angelo Carini, Massimiliano Gei, Alberto Salvadori, 2014-04-29 This book contains contributions presented at the IUTAM Symposium Fracture Phenomena in Nature and Technology held in Brescia Italy 1-5 July 2012 The objective of the Symposium was fracture research interpreted broadly to include new engineering and structural mechanics treatments of damage development and crack growth and also large scale failure processes as exemplified by earthquake or landslide failures ice shelf break up and hydraulic fracturing natural or for resource extraction or CO₂ sequestration as well as small scale rupture phenomena in materials physics including e g inception of shear banding void growth adhesion and decohesion in contact and friction crystal dislocation processes and atomic electronic scale treatment of brittle crack tips and fundamental cohesive properties Special emphasis was given to multiscale fracture description and new scale bridging formulations capable to substantiate recent experiments and tailored to become the basis for innovative computational algorithms

Small Scale

Deformation using Advanced Nanoindentation Techniques Ting Tsui, Alex A. Volinsky, 2019-06-11 Small scale mechanical deformations have gained a significant interest over the past few decades driven by the advances in integrated circuits and microelectromechanical systems One of the most powerful and versatile characterization methods is the nanoindentation technique The capabilities of these depth sensing instruments have been improved considerably They can perform experiments in vacuum and at high temperatures such as in situ SEM and TEM nanoindenters This allows researchers to visualize mechanical deformations and dislocations motion in real time Time dependent behavior of soft materials has also been studied in recent research works This Special Issue on Small Scale Deformation using Advanced Nanoindentation Techniques will provide a forum for researchers from the academic and industrial communities to present advances in the field of small scale contact mechanics Materials of interest include metals glass and ceramics Manuscripts related to deformations of biomaterials and biological related specimens are also welcome Topics of interest include but are not limited to Small scale fracture Nanoscale plasticity and creep Size dependent deformation phenomena Deformation of biological cells Mechanical properties of cellular and sub cellular components Novel mechanical properties characterization techniques New modeling methods Environmentally controlled nanoindentation In situ SEM and TEM indentation

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