### Cracks in composite materials

G.C. Sih and E.P. Chen

A compilation of stress solutions for composite systems with cracks

> edited by George C. Sih

Mechanics of fracture

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BEREZHNITSKIY, I. I. TRUSH, NATIONAL
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ADMINISTRATION WASHINGTON D.C.

Cracks in composite materials George C. Sih, E.P. Chen, 2012-12-06 Composites offer great promise as light weight and strong materials for high performance structures One of the major advantages of these materials as compared with metals is the basic way in which heterogeneity resist crack extension In a fiber matrix composite system the fibers tend to cause cracks to form at closer spacing and delay the formation of a large crack The enhancement of local failure such as fiber breaking matrix cracking and interface debonding further reduces the energy level which might have otherwise reached the point of catastrophic failure Even though substantial tests have been made on composite materials little has been gained in the understanding and development of a predic tive procedure for composite failure There are fundamental difficulties associated with incorporating the nonhomogeneous and anisotropic properties of the composite into the continuum mechanics analysis Additional uncertainties arise from voids and defects that are introduced in the composite during manufacturing Even a small quantity of mechanical imperfections can cause a marked influence on the composite strength Moreover the interface properties between the fibers and matrix or bonded laminae can also affect the load transmission characteristics significantly It would be impossible to establish predictive procedures for composite failure unless realistic guidelines could be developed to control the manufacturing quality of composite systems **Fracture Mechanics of Composites** G. P. Sendeckyj, 1975 Stiffness Changes in Unidirectional Composites Caused by Crack Systems N. Laws, George J. Dvorak, M. Hejazi, Cranfield Institute of Technology. College of Aeronautics, 1983 Interface Fracture and Delaminations in Composite Materials Leslie Banks-Sills, 2017-07-05 Part I of this SpringerBrief presents the problem of a crack between two dissimilar isotropic materials and describes the mathematical background A fracture criterion is discussed and Methods for calculating fracture parameters such as stress intensity factors using the finite element method and three post processors are considered Actual test data and both deterministic and statistical failure curves are presented In Part II of the book similar descriptions are given for delaminations in composite laminates. The mathematical treatment of this type of damage including the first term of the asymptotic expansion of the stress and displacement fields is considered Numerical post processors for determining stress intensity factors for these cases are reviewed Two examples of specific laminates are presented one with a failure curve and the other with a failure surface Finally beam specimens used for testing such failures are discussed Fracture and Damage of Composites M. H. Aliabadi, M. Guagliano, 2006 Covering various aspects of dynamic fractures this book contains state of the art contributions from leading scientists in the field of crack Propagation of Cracks in Composite Materials V. V. PANASYUK, L. T. BEREZHNITSKIY, I. I. TRUSH, NATIONAL dvnamics AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON D C.,1971 **Failure Study of Composite Materials by** the Yeh-Stratton Criterion Hsien-Yang Yeh, 1997 Analysis of Cracks Emanating from a Circular Hole in Unidirectional Fiber Reinforced Composites, Part 2,1981 **Numerical Assessments of Cracks in Elastic-Plastic** 

Materials Huang Yuan, 2013-11-11 In this book a systematic discussion of crack problems in elastic plastic materials is presented The state of the art in fracture mechanics research and assessment of cracks is documented with the help of analytic asymptotic methods as well as finite element computations After a brief introduction to fracture mechanics the two parameter concept for stationary cracks is studied in addition to the issues in three dimensional crack fields under coupling with strong out of plane effects Cracks along interfaces and crack growth problems under mixed mode conditions are also treated A systematic study of stress singularities for different notches is accompanied by detailed finite element Damage and Fracture of Composite Materials and Structures Mohd Nasir Tamin, 2012-01-05 This monograph presents recent research findings on fracture properties and behavior of the composites and their damage and cracking process under both quasi static and impact loading conditions Theoretical treatment experimental investigation and numerical simulation aspects of the mechanics of composites including sandwich structures are included Fracture Mechanics to Composite Materials K. Friedrich, 2012-12-02 This multiauthor volume provides a useful summary of current knowledge on the application of fracture mechanics to composite materials It has been written to fill the gap between the literature on fundamental principles of fracture mechanics and the special publications on the fracture properties of conventional materials such as metals polymers and ceramics The data are represented in the form of about 420 figures including diagrams schematics and photographs and 80 tables The author index covers more than 500 references and the subject index more than 1000 key words Srength of Composite Materials with Small Cracks in the Matrix Henrik Stang, 1985 Composite Materials T. Kevin O'Brien, 1991 The Virtual Crack Closure Technique: History, **Approach and Applications** Ronald Krueger, 2002 An overview of the virtual crack closure technique is presented The approach used is discussed the history summarized and insight into its applications provided Equations for two dimensional quadrilateral elements with linear and quadratic shape functions are given Formula for applying the technique in conjuction with three dimensional solid elements as well as plate shell elements are also provided Necessary modifications for the use of the method with geometrically nonlinear finite element analysis and corrections required for elements at the crack tip with different lengths and widths are discussed The problems associated with cracks or delaminations propagating between different materials are mentioned briefly as well as a strategy to minimize these problems Due to an increased interest in using a fracture mechanics based approach to assess the damage tolerance of composite structures in the design phase and during certification the engineering problems selected as examples and given as references focus on the application of the technique to components made of composite materials **Composite Materials** Erian A. Armanios, 1997 Damage in Composite Materials K. L. Reifsnider, 1982 The contents of this book should serve a variety of technical people in a variety of ways Engineers who only want to consider damage mechanisms and damage development to the extent that they can use those concepts in design will find that several papers deal specifically with relationships between damage development and

If Mechanics for the Growth of Bridged Cracks in Composite Materials L. N. McCartney, National Physical Lab., Teddington (GB). Div. of Materials Metrology, National Physical Laboratory (Great Britain). Division of Materials Metrology, 1991 Mechanics for the Growth of Bridged Cracks in Composite Materials LN. McCartney, 1992 A fracture mechanics analysis valid for long cracks is applied to three crack bridging problems that arise in the composites area namely 1 matrix cracking in perfectly bonded unidirectional composites 2 transverse cracking in perfectly bonded cross ply laminates and 3 matrix cracking in unidirectional composites in which frictional slip occurs at fiber matrix interfaces governed by the constant shear stress shear lag model of stress transfer Fracture of Composites Erian A. Armanios, 1996-05-06 The potential of composites cannot be fully realized unless their fracture modes and failure mechanisms are fully understood and appropriate design tools for failure prediction are developed and verified

Interlaminar Fracture of Composites E.A. Armanios,1989-01-01 I INTERLAMINAR FRACTURE MODELING ANALYSIS II EXPERIMENTAL EVALUATION CHARACTERIZATION III INFLUENCE OF MATRIX MATERIAL AND ENVIRONMENTAL EFFECTS IV DELAMINATION BUCKLING V DELAMINATION RESISTANCE CONCEPTS

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