

fracture mechanics

by

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Preface to the Second Edition

In 1991, the fifth reprint of the first edition of the textbook “Fracture Mechanics”, by H.L. Ewalds and R.J.H. Wanhill, was published. Obviously the field of fracture mechanics has developed further since that time. A new edition was needed. The task fell mainly to the new authors, M. Janssen and J. Zuidema, both engaged at the Department of Materials Science at Delft University of Technology, with assistance by R.J.H. Wanhill, engaged at National Aerospace Laboratory NLR. The original first author, H.L. Ewalds, indicated that he no longer wished to be involved with this textbook. We respect his decision, and thank him for his major contribution to the First Edition, which has been very successful.

This second edition is the result of numerous revisions, updates and additions. These were driven by the ongoing development of fracture mechanics, but also by teaching the course on fracture mechanics at Delft University of Technology. The fracture mechanics parameters K , G and J are now treated in a more basic manner. Test methods for J_{Ic} and for crack arrest toughness are updated. The development of failure assessment based on elastic-plastic fracture mechanics is reflected in a comprehensive treatment. On the subject of subcritical crack growth more attention is paid to the important topic of the initiation and growth of short fatigue cracks.

We would like to acknowledge the assistance of colleagues in preparing this second edition. With critical reading and profound discussions A.R. Wachters helped considerably in drawing up the part on the J integral. G. Pape did the preparatory work necessary for updating the chapter on dynamic fracture. A. Bakker contributed to the treatment of the R6 failure assessment procedure. Finally, A.H.M. Krom provided useful comments and suggestions on various subjects.

The authors wish to thank J.E. Schievink of the VSSD for his stimulation and co-operation in creating this new edition.

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Preface to the First Edition

While teaching a course on fracture mechanics at Delft University of Technology we discovered that although there are a few excellent textbooks, their subject matter covers developments only up to the early 1970s. Consequently there was no systematic treatment of the concepts of elastic-plastic fracture mechanics. Also the description of fracture mechanics characterisation of crack growth needed updating, especially for sustained load fracture and unstable dynamic crack growth.

In the present textbook we have attempted to cover the basic concepts of fracture mechanics for both the linear elastic and elastic-plastic regimes, and three chapters are devoted to the fracture mechanics characterisation of crack growth (fatigue crack growth, sustained load fracture and dynamic crack growth).

There are also two chapters concerning mechanisms of fracture and the ways in which actual material behaviour influences the fracture mechanics characterisation of crack growth. The reader will find that this last topic is treated to some way beyond that of a basic course. This is because to our knowledge there is no reference work that systematically covers it. A consequence for instructors is that they must be selective here. However, any inconvenience thereby entailed is, we feel, outweighed by the importance of the subject matter.

This textbook is intended primarily for engineering students. We hope it will be useful to practising engineers as well, since it provides the background to several new design methods, criteria for material selection and guidelines for acceptance of weld defects.

Many people helped us during preparation of the manuscript. We wish to thank particularly J. Zuidema, who made vital contributions to uniform treatment of the energy balance approach for both the linear elastic and elastic-plastic regimes; R.A.H. Edwards, who assisted with the chapter on sustained load fracture; A.C.F. Hagedorn, who drew the figures for the first seven chapters; and the team of the VSSD, our publisher, whose patience was sorely tried but who remained unbelievably co-operative.

Finally, we wish to thank the National Aerospace Laboratory NLR and the Boiler and Pressure Vessel Authority 'Dienst voor het Stoomwezen' for providing us the opportunity to finish this book, which was begun at the Delft University of Technology.

H.L. Ewalds
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Contents

| | |
|--|------------|
| Preface to the Second Edition | v |
| Preface to the First Edition | vii |
| Contents | ix |

Part I Introduction

| | |
|---|----------|
| 1 An Overview | 3 |
| 1.1 About this Course | 3 |
| 1.2 Historical Review | 3 |
| 1.3 The Significance of Fracture Mechanics | 5 |
| 1.4 The Griffith Energy Balance Approach | 8 |
| 1.5 Irwin's Modification to the Griffith Theory | 11 |
| 1.6 The Stress Intensity Approach | 12 |
| 1.7 Crack Tip Plasticity | 14 |
| 1.8 Fracture Toughness | 15 |
| 1.9 Elastic-Plastic Fracture Mechanics | 16 |
| 1.10 Subcritical Crack Growth | 18 |
| 1.11 Influence of Material Behaviour | 20 |

Part II Linear Elastic Fracture Mechanics

| | |
|---|-----------|
| 2 The Elastic Stress Field Approach | 25 |
| 2.1 Introduction | 25 |
| 2.2 Derivation of the Mode I Elastic Stress Field Equations | 26 |
| 2.3 Useful Expressions | 37 |
| 2.4 Finite Specimen Width | 41 |
| 2.5 Two Additional Important Solutions for Practical Use | 44 |
| 2.6 Superposition of Stress Intensity Factors | 48 |
| 2.7 Some Remarks Concerning Stress Intensity Factor Determinations | 50 |
| 2.8 A Compendium of Well-Known Stress Intensity Factor Solutions | 52 |
| 2.9 Bibliography | 59 |
| 3 Crack Tip Plasticity | 61 |
| 3.1 Introduction | 61 |
| 3.2 The Plastic Zone Size According to Irwin | 62 |
| 3.3 The Plastic Zone Size According to Dugdale: The Strip Yield Model | 65 |
| 3.4 First Order Approximations of Plastic Zone Shapes | 71 |
| 3.5 The State of Stress in the Crack Tip Region | 73 |

| | | |
|--|--|------------|
| 3.6 | Stress State Influences on Fracture Behaviour | 76 |
| 3.7 | Some Additional Remarks on Plastic Zone Size and Shape Determination | 80 |
| 3.8 | Bibliography | 82 |
| 4 | The Energy Balance Approach | 83 |
| 4.1 | Introduction | 83 |
| 4.2 | The Energy Balance Approach | 83 |
| 4.3 | Relations for Practical Use | 90 |
| 4.4 | Determination of Stress Intensity Factors from Compliance | 93 |
| 4.5 | The Energy Balance for More Ductile Materials | 96 |
| 4.6 | Slow Stable Crack Growth and the <i>R</i> -Curve Concept | 97 |
| 4.7 | A Possible Explanation for the Rising <i>R</i> -Curve | 99 |
| 4.8 | Crack Resistance: a Complete Description | 101 |
| 4.9 | Bibliography | 105 |
| 5 | LEFM Testing | 107 |
| 5.1 | Introduction | 107 |
| 5.2 | Plane Strain Fracture Toughness (K_{Ic}) Testing | 108 |
| 5.3 | Plane Stress Fracture Toughness (K_C) Testing: the Feddersen Approach | 115 |
| 5.4 | The Determination of <i>R</i> -Curves | 120 |
| 5.5 | An Engineering Approximation to Account for the Effects of Yield Strength and Specimen Thickness on Fracture Toughness: Anderson's Model | 125 |
| 5.6 | Practical Use of K_{Ic} , K_C and <i>R</i> -Curve Data | 127 |
| 5.7 | Bibliography | 129 |
| Part III Elastic-Plastic Fracture Mechanics | | |
| 6 | Basic Aspects of Elastic-Plastic Fracture Mechanics | 133 |
| 6.1 | Introduction | 133 |
| 6.2 | Development of Elastic-Plastic Fracture Mechanics | 135 |
| 6.3 | The <i>J</i> Integral | 136 |
| 6.4 | Remarks Concerning the <i>J</i> Integral Concept | 147 |
| 6.5 | <i>J</i> as a Stress Intensity Parameter | 148 |
| 6.6 | The Crack Opening Displacement (COD) Approach | 149 |
| 6.7 | Remarks on the COD Approach | 151 |
| 6.8 | Relation Between <i>J</i> and CTOD | 151 |
| 6.9 | Bibliography | 154 |
| 7 | EPFM Testing | 155 |
| 7.1 | Introduction | 155 |
| 7.2 | The Original J_{Ic} Test Method | 155 |
| 7.3 | Alternative Methods and Expressions for <i>J</i> | 157 |
| 7.4 | The Standard J_{Ic} Test | 163 |
| 7.5 | The K_{Ic} Specimen Size Requirement | 171 |
| 7.6 | The Standard $\delta_{t_{crit}}$ Test | 173 |

| | | |
|---|---|------------|
| 7.7 | Bibliography | 177 |
| 8 | Failure Assessment Using EPFM | 179 |
| 8.1 | Introduction | 179 |
| 8.2 | The COD Design Curve | 179 |
| 8.3 | Stable Crack Growth and Ductile Instability described by J | 184 |
| 8.4 | The Failure Assessment Diagram: CEGB R6 Procedure | 191 |
| 8.5 | Bibliography | 203 |
| | | |
| Part IV Fracture Mechanics Concepts for Crack Growth | | |
| 9 | Fatigue Crack Growth..... | 207 |
| 9.1 | Introduction | 207 |
| 9.2 | Description of Fatigue Crack Growth Using the Stress Intensity Factor | 209 |
| 9.3 | The Effects of Stress Ratio and Crack Tip Plasticity: Crack Closure | 213 |
| 9.4 | Environmental Effects | 222 |
| 9.5 | Prediction of Fatigue Crack Growth Under Constant Amplitude Loading | 225 |
| 9.6 | Fatigue Crack Growth Under Variable Amplitude Loading | 226 |
| 9.7 | Prediction of Fatigue Crack Growth Under Variable Amplitude Loading | 230 |
| 9.8 | Fatigue Crack Initiation | 234 |
| 9.9 | Bibliography | 242 |
| 10 | Sustained Load Fracture | 245 |
| 10.1 | Introduction | 245 |
| 10.2 | Time-To-Failure (TTF) Tests | 246 |
| 10.3 | Crack Growth Rate Testing | 248 |
| 10.4 | Experimental Problems | 251 |
| 10.5 | Method of Predicting Failure of a Structural Component | 253 |
| 10.6 | Practical Significance of Sustained Load Fracture Testing | 254 |
| 10.7 | Bibliography | 258 |
| 11 | Dynamic Crack Growth and Arrest..... | 259 |
| 11.1 | Introduction | 259 |
| 11.2 | Basic Aspects of Dynamic Crack Growth | 259 |
| 11.3 | Basic Principles of Crack Arrest | 263 |
| 11.4 | Fracture Mechanics Analysis of Fast Fracture and Crack Arrest | 267 |
| 11.5 | Determination of the Crack-Arrest Toughness | 272 |
| 11.6 | Determination of Dynamic Stress Intensity Factors | 275 |
| 11.7 | Approaches in Elastic-Plastic Dynamic Fracture Mechanics | 278 |
| 11.8 | Bibliography | 280 |
| | | |
| Part V Mechanisms of Fracture in Actual Materials | | |
| 12 | Mechanisms of Fracture in Metallic Materials | 285 |
| 12.1 | Introduction | 285 |

| | | |
|--------------|---|------------|
| 12.2 | The Study of Fracture Surfaces | 286 |
| 12.3 | Slip, Plastic Deformation and Dislocations | 291 |
| 12.4 | Ductile Transgranular Fracture by Microvoid Coalescence | 294 |
| 12.5 | Brittle Transgranular Fracture (Cleavage) | 298 |
| 12.6 | Transgranular Fracture by Fatigue | 301 |
| 12.7 | Intergranular Fracture | 306 |
| 12.8 | Types of Sustained Load Fracture | 308 |
| 12.9 | Bibliography | 314 |
| 13 | The Influence of Material Behaviour on Fracture Mechanics Properties | 317 |
| 13.1 | Introduction | 317 |
| 13.2 | The Effects of Crack Tip Geometry | 318 |
| 13.3 | The Effects of Fracture Path and Microstructure | 324 |
| 13.4 | Fracture Mechanics and the Mechanisms of Fracture | 329 |
| 13.5 | Bibliography | 357 |
| Index | | 361 |