

# ADVANCES IN ELASTO-PLASTIC FRACTURE MECHANICS

Edited by

L. H. LARSSON

*Commission of the European Communities, Joint Research Centre,  
Ispra Establishment, Italy*

M

Technische Hochschule Darmstadt  
Fachbereich Mechanik

Bibliothek

Inv.-Nr. BM 132/80



APPLIED SCIENCE PUBLISHERS LTD  
LONDON

# Contents

|  |     |
|--|-----|
| <i>Opening Address</i>   | vii |
| S. FINZI ( <i>Joint Research Centre, Ispra, Italy</i> )  |     |
| <i>Foreword</i>  | ix  |
| <br>   |     |
| <b>Session 1: Initiation of Crack Extension</b>  |     |
| Macroscopic aspects of crack extension   | 1   |
| J. F. KNOTT ( <i>University of Cambridge, UK</i> )   |     |
| Microscopic aspects of crack extension   | 21  |
| J. F. KNOTT ( <i>University of Cambridge, UK</i> )   |     |
| The one-parameter characterization viewpoint in fracture mechanics   | 43  |
| J. CARLSSON ( <i>Royal Institute of Technology, Stockholm, Sweden</i> )  |     |
| Experimental techniques for the determination of the initiation of failure   | 65  |
| J. G. BLAUDEL ( <i>Fraunhofer-Gesellschaft, Freiburg, FRG</i> )  |     |
| <br>   |     |
| <b>Session 2: Slow Stable Crack Growth and Instability</b>   |     |
| Slow stable crack growth and unstable fracture in the LEFM regime  | 91  |
| C. E. TURNER ( <i>Imperial College of Science and Technology, London, UK</i> )   |     |
| Determination of fracture toughness under plane stress conditions by the R-curve method  | 109 |
| B. MARANDET and G. SANZ ( <i>Institut de Recherches de la Sidérurgie Française (IRSID), St-Germain-en-Laye Cedex, France</i> ) |     |
| Application of J-R curves to slow stable crack growth and unstable tearing in the plastic regime                               | 139 |
| C. E. TURNER ( <i>Imperial College of Science and Technology, London, UK</i> )   |     |
| Numerical treatment of crack growth problems   | 165 |
| G. ROUSSELIER ( <i>EdF, Moret sur Loing, France</i> )  |     |
| The EPRI ductile fracture research program   | 191 |
| T. U. MARSTON ( <i>Electric Power Research Institute, California, USA</i> )  |     |
| Micromechanisms of slow stable crack growth  | 237 |
| D. FRANÇOIS ( <i>Université de Technologie de Compiègne, France</i> )  |     |

### Session 3: The Use of EPFM in Design

|  |     |
|--|-----|
| Use of EPFM in design . . . . .  | 261 |
| L. H. LARSSON ( <i>Joint Research Centre, Ispra, Italy</i> )   |     |
| The COD design curve . . . . .   | 279 |
| M. G. DAWES ( <i>The Welding Institute, Cambridge, UK</i> )  |     |
| A J-based design curve . . . . .   | 301 |
| C. E. TURNER ( <i>Imperial College of Science and Technology, London, UK</i> )   |     |
| The development and application of the CEGB two criteria approach for<br>the assessment of defects in structures . . . . .   | 319 |
| B. J. L. DARLASTON ( <i>CEGB, Berkeley Nuclear Laboratories, Berkeley,<br/>UK</i> )  |     |
| Incorporation of residual and thermal stresses in elastic-plastic fracture<br>mechanics design . . . . .   | 359 |
| G. G. CHELL ( <i>CEGB, Central Electricity Research Laboratories,<br/>Leatherhead, UK</i> )  |     |
| Numerical aspects of elastic-plastic fracture mechanics including<br>3D-applications . . . . .   | 385 |
| W. SCHMITT (formerly, <i>Kraftwerk Union AG, Erlangen, FRG</i> ; now,<br><i>Fraunhofer-Institut für Werkstoffmechanik, Freiburg, FRG</i> ) and E. KEIM<br>( <i>Kraftwerk Union AG, Erlangen, FRG</i> ) |     |
| Probabilistic fracture mechanics . . . . .   | 417 |
| J. CARLSSON ( <i>Royal Institute of Technology, Stockholm, Sweden</i> )  |     |