



XFEM Fracture Analysis of Composites

Soheil Mohammadi

University of Tehran

Copyright © 2000-2012 by John Wiley & Sons, Inc.

ISBN: 978-1-1199-7406-2

Hardcover

368 pages

October 2012

£93.95 / €112.30

Description

This book describes the basics and developments of the new XFEM approach to fracture analysis of structures and materials. It provides state of the art techniques and algorithms for fracture analysis of structures including numeric examples at the end of each chapter as well as an accompanying website which will include MATLAB resources, executables, data files, and simulation procedures of XFEM.

- The first reference text for the extended finite element method (XFEM) for fracture analysis of structures and materials
- Includes theory and applications, with worked numerical problems and solutions, and MATLAB examples on an accompanying website with further XFEM resources
- Provides a comprehensive overview of this new area of research, including a review of Fracture Mechanics, basic through to advanced XFEM theory, as well as current problems and applications
- Includes a chapter on the future developments in the field, new research areas and possible future applications of the method

Table of Contents

Chapter 1 Introduction.

- 1.1 Composite structures.
- 1.2 Failure of composites.
- 1.3 Crack analysis.
- 1.4 Analytical solutions for composites.
- 1.5 Numerical techniques.
- 1.6 Scope of the book.

Chapter 2 Fracture Mechanics, a Review.

- 2.1 Introduction.
- 2.2 Basics of elasticity.
- 2.3 Basics of LEFM.
- 2.4 stress intensity factor.
- 2.5 Classical solution procedures for K and G.
- 2.6 Quarter point singular elements.
- 2.7 J integral.
- 2.8 Elastoplastic fracture mechanics (EPFM).

Chapter 3 Extended Finite Element Method.

- 3.1 Introduction.
- 3.2 Historic development of XFEM.
- 3.3 Enriched approximations.
- 3.4 XFEM formulation.
- 3.5 XFEM strong discontinuity enrichments.
- 3.6 XFEM weak discontinuity enrichments.
- 3.7 XFEM crack tip enrichments.
- 3.8 Transition from standard to enriched approximation.
- 3.9 Tracking moving boundaries.
- 3.10 Numerical simulations.

Chapter 4 Static Fracture Analysis of Composites.

- 4.1 Introduction.
- 4.2 Anisotropic elasticity.
- 4.3 Analytical solutions for near crack tip.
- 4.4 Orthotropic mixed mode fracture.
- 4.5 Anisotropic XFEM.
- 4.6 Numerical simulations.

Chapter 5 Dynamic Fracture Analysis of Composites.

- 5.1 Introduction.
- 5.2 Analytical solutions for near crack tips in dynamic states.
- 5.3 Dynamic stress intensity factors.
- 5.4 Dynamic XFEM.
- 5.5 Numerical simulations.

Chapter 6 Fracture Analysis of Functionally Graded Materials.

- 6.1 Introduction.
- 6.2 Analytical solution for near crack tip.
- 6.3 Stress intensity factor.
- 6.4 Crack propagation in FGM composites.
- 6.5 Inhomogeneous XFEM.
- 6.6 Numerical examples.

Chapter 7 Delamination/Interlaminar Crack Analysis.

- 7.1 Introduction.
- 7.2 Fracture mechanics for bimaterial interface cracks.
- 7.3 Stress intensity factors for interlaminar cracks.
- 7.4 Delamination propagation.
- 7.5 Bimaterial XFEM.
- 7.6 Numerical examples.

Chapter 8 New Orthotropic Frontiers.

- 8.1 Introduction.
- 8.2 Orthotropic XIGA.
- 8.3 Orthotropic dislocation dynamics.
- 8.4 Other anisotropic applications.

References.

Index.