BOOK REVIEW

Fracture Mechanics Technology Applied to Material Evaluation and Structure Design

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REFERENCE: Sih, G. C., Ryan, N. E., and Jones, R., Eds., *Fracture Mechanics Technology Applied to Material Evaluation and Structure Design*, Martinus Nijhoff Publishers, 1983, hardcover, 671 pp.

This text covers a wide range of technical areas. Each area significantly impacts the application of fracture mechanics to actual structures. The specific areas include Microstructure, Stress and Failure Analysis, Fracture and Material Testing, Analytical and Experimental Modeling, Mixed-Mode Fracture, Fatigue Crack Growth, Environmental Effects, and Composite and Nonmetallic Materials. There is also a series of General papers on selected topics.

The Microstructure section reviews the relationship between microstructure and fracture toughness, fatigue crack growth and static crack growth. It also compares the fatigue crack growth characteristics of laminated and solid steel specimens.

The Stress and Fracture section covers the development of stress intensity solutions for (*a*) cracks in notches, (*b*) surface cracks subjected to tensile and bending loads, and (*c*) cracks in pressure vessels subjected to residual and thermal stresses. It also covers the influence of crack closure on stress intensity solutions.

The third section covers Fracture and Material Testing. It presents fracture toughness and fatigue crack growth data for materials used in off-shore and nuclear-power structures. It also reviews current fracture toughness requirements for materials used in aerospace structures.

The Analytical and Experimental Modeling section describes (*a*) fracture models for fiber-reinforced cements and mixed-mode fracture, and (*b*) a fatigue-crack-growth model for predicting crack growth in ductile materials. It further describes the development of stress intensity solutions for corner-cracks in nozzles and for surface cracks in plates.

The mixed-mode fracture of mill rollers, bars, and thin sheet materials is described in the Mixed-Mode Fracture section.

The Fatigue-Crack Growth section discusses models for predicting the effects of residual stresses, crack closure, and stress ratio on fatigue-crack growth. It presents the effects of welds, weld defects, and stress concentration factors on fatigue-crack growth. This section also discusses the impact of stress-intensity-factor range and loading rate on fatigue-crack growth.

The Environmental Effects section describes the effects of chemical and thermal environments on a wide range of materials (e.g., steels, polystyrene, and brass). It also discusses fracture criteria for concrete.

The Composite and Nonmetallic Materials section reviews the effects of ballistic impact on the integrity of carbon-fiber-reinforced panels. It also covers (*a*) the fatigue behavior of fiber composites, and (*b*) the applicability of fracture mechanics to fiber composites.

The book closes with a General section that (*a*) discusses the application of fracture mechanics to structures, and (*b*) promotes the development of design tools which incorporate fracture mechanics concepts. It also recognizes the need for good nondestructive examination in order to make accurate life predictions.

Information from a wide range of technical disciplines must be integrated in order to make meaningful fracture mechanics predictions. This text does an excellent job of elucidating the need for this integration and in providing important advances in a number of disciplines.

The book is well edited; consequently the various papers from all over the world are easily read. The tables are quite clear. The figures clearly show data trends, but tend to be small.

Overall, this text is a valuable tool for those using fracture mechanics for material evaluation and/or design.

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