

Volume 19

# **Fatigue and Fracture**

## **1. Introduction**

- Industrial Significance of Fatigue Problems
- Fracture and Structure
- Fatigue Properties in Engineering
- Alloy Design for Fatigue and Fracture
- Micromechanisms of Monotonic and Cyclic Crack Growth

## **2. Fatigue Mechanisms, Crack Growth, and Testing**

- Fatigue Failure in Metals
  - Cyclic Stress-Strain Response and Microstructure
  - Fatigue Crack Nucleation and Microstructure
  - Fatigue Crack Growth under Variable-Amplitude Loading
  - Fatigue Crack Thresholds
  - Behavior of Small Fatigue Cracks
  - Effect of Crack Shape on Fatigue Crack Growth
  - Fatigue Crack Growth Testing
  - Mechanisms of Corrosion Fatigue
  - Corrosion Fatigue Testing
  - Detection and Monitoring of Fatigue Cracks

## **3. Fatigue Strength Prediction and Analysis**

- Fundamentals of Modern Fatigue Analysis for Design
- Estimating Fatigue Life
- Multiaxial Fatigue Strength
- Factors Influencing Weldment Fatigue
- Fatigue of Mechanically Fastened Joints
- Statistical Considerations in Fatigue
- Planning and Evaluation of Fatigue Tests
- Effect of Surface Conditions and Processing on Fatigue Performance
- Fretting Fatigue
- Contact Fatigue
  - Fatigue and Fracture Control for Powder Metallurgy Components
- Fatigue and Life Prediction of Gears
- Fatigue and Life Prediction of Bearings
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#### **4. Fracture Mechanics, Damage Tolerance, and Life Assessment**

- An Introduction to Fracture Mechanics
- Fracture Resistance of Structural Alloys
- Fracture Toughness Testing
- Concepts of Fracture Control and Damage Tolerance Analysis
- The Practice of Damage Tolerance Analysis
- Residual Strength of Metal Structures
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- Fracture Mechanics in Failure Analysis
- Operating Stress Maps for Failure Control
- Failure Control in Process Operations
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- High-Temperature Life Assessment
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- Life Extension and Damage Tolerance of Aircraft
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- The U.S. Air Force Approach to Aircraft Damage Tolerant Design

#### **5. Fatigue and Fracture Resistance of Ferrous Alloys**

- Fracture and Fatigue Properties of Structural Steels
- Fatigue Resistance and Microstructure of Ferrous Alloys
- Fracture Mechanics Properties of Carbon and Alloy Steels
- Fatigue and Fracture Properties of Cast Steels
- Fatigue and Fracture Properties of Cast Irons
- Bending Fatigue of Carburized Steels
- Contact Fatigue of Hardened Steels
- Fatigue and Fracture Resistance of Heat-Resistant (Cr-Mo) Ferritic Steels
- Fatigue and Fracture Properties of Stainless Steels
- Fracture Toughness of Austenitic Stainless Steels and Their Welds
- Fatigue and Fracture Properties of Duplex Stainless Steels

#### **6. Fatigue and Fracture Resistance of Nonferrous Alloys**

- Selecting Aluminum Alloys to Resist Failure by Fracture Mechanisms
- Fatigue and Fracture Properties of Aluminum Alloy Castings
- Fatigue Strength of Aluminum Alloy Welds

Fatigue and Fracture Properties of Titanium Alloys  
Fatigue and Fracture of Nickel-Base Superalloys  
Fatigue Properties of Copper Alloys  
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Fatigue of Composite Laminates  
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## **8. Appendices**

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