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Fatigue and Fracture Test Planning, Test Data Acquisitions and Analysis

STP 1598

Editors:
Zhigang Wei
Kamran Nikbin
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Foreword

THIS COMPILATION OF Selected Technical Papers, STP1598, *Fatigue and Fracture Test Planning, Test Data Acquisitions and Analysis*, contains peer-reviewed papers that were presented at a symposium held May 4–5, 2016, in San Antonio, Texas, USA. The symposium was sponsored by ASTM International Committee E08 on Fatigue and Fracture and Subcommittee E08.03 on Advanced Apparatus and Techniques.

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Contents

Overview	vii
Establishing a Multi-Laboratory Test Plan for Environmentally Assisted Fatigue Matthias Bruchhausen, Kevin Mottershead, Caitlin Hurley, Thomas Métais, Román Cicero, Marc Vankeerberghen, and Jean-Christophe Le Roux	1
Experimental Study on Surrogate Nuclear Fuel Rods Under Reversed Cyclic Bending Hong Wang and Jy-An John Wang	19
Low Cycle Fatigue of Cast Austenitic Steel Xijia Wu, Guangchun Quan, and Clayton Sloss	37
Fracture Mechanical Testing of In-Service Thermally Aged Cast Stainless Steel Martin Bjurman, Björn Forssgren, and Pål Efsing	58
Calorimetric Studies and Self-Heating Measurements for a Dual-Phase Steel Under Ultrasonic Fatigue Loading Noushin Torabian, Véronique Favier, Saeed Ziaei-Rad, Justin Dirrenberger, Frédéric Adamski, and Nicolas Ranc	81
Fatigue Studies on Impacted and Unimpacted CFRP Laminates Raghu V. Prakash, Mathew John, Deepika Sudevan, Andrea Gianneo, and Michele Carboni	94
Application of $K_{residual}$ Measurements to Fracture Toughness Evaluations Gongyao Wang, Kimberly Maciejewski, and Mark James	119
Sensitivity Study on Parameters that Influence Automated Slope Determination Stephen M. Graham	133
Contribution to the Evaluation of Stress-Strain and Strain-Life Curves Michael Wächter and Alfons Esderts	151

Methods Development for Nonlinear Analysis of Fatigue Data	186
Bruce A. Young, Richard C. Rice, Steven R. Thompson, and Doug Hall	
Data Processing Procedure for Fatigue Life Prediction of Spot-Welded Joints Using a Structural Stress Method	198
Hong-Tae Kang, Xiao Wu, Abolhassan K. Khosrovaneh, and Zhen Li	
More Accurate Elastic Compliance Equation and Its Inverse Solution for Compact Specimens	212
Xian-Kui Zhu	
A Novel Nonlinear Kinematic Hardening Model for Uniaxial/Multiaxial Ratcheting and Mean Stress Relaxation	227
Hao Wu and Zheng Zhong	
Fatigue Damage Indicators Based on Plastic Deformation	246
Grzegorz Socha	
A Fatigue Failure Mode Transition Criterion for Sizing Load-Carrying Fillet-Welded Connections	258
Shizhu Xing and Pingsha Dong	
Analysis of Nonproportional Multiaxial Fatigue Test Data of Various Aluminum Alloys Using a New Damage Parameter	278
Jifa Mei and Pingsha Dong	
A Theory for Mathematical Framework and Fatigue Damage Function for the S-N Plane	299
Hoda Eskandari and Ho Sung Kim	
Verification and Validation of Accelerated Testing Methods for Fatigue Life Assessment	337
Limin Luo, Jason Hamilton, Zhigang Wei, and Robert Rebandt	
Load Spectrum Test and Fatigue Failure Study of High-Speed Train Carbody Anti-Yawing Seat	359
Wenjing Wang, Jinyi Bai, Sichun Li, Hongwei Zhao, and Weiguang Sun	
Practical and Technical Challenges of the Exhaust System Fatigue Life Assessment Process at Elevated Temperature	371
Mark T. Seitz, Jason D. Hamilton, Richard K. Voltenburg, Limin Luo, Zhigang Wei, and Robert G. Rebandt	

Overview

ASTM STP1598 contains a collection of 20 peer-reviewed papers from the Symposium on Fatigue and Fracture Test Planning, Test Data Acquisitions and Analysis held May 4–5, 2016, in San Antonio, Texas, USA. The symposium was sponsored by ASTM Committee E08 on Fatigue and Fracture in conjunction with the 2016 May standards development meetings of the Committee. The symposium was attended by a number of professionals representing several countries, including the United States, Canada, United Kingdom, Germany, Australia, Netherlands, Sweden, China, and India. The driving force behind this symposium is the revision of several relevant ASTM standards, especially ASTM E739-10 (2015), *Standard Practice for Statistical Analysis of Linear or Linearized Stress-Life (S-N) and Strain-Life (ϵ -N) Fatigue Data*.

Understanding and preventing fatigue failure and fracture of engineering materials and structures are critical in several industries. Material testing is fundamental to gaining a better understanding of fatigue and fracture phenomena, as well as to guide materials selection, product design, and quality control. In fact, engineering design, development, and validation heavily relies on accurate test data and the proper interpretation of test data. Although a significant amount of knowledge and understanding has been gained over the last several decades via material testing, there still remains a substantial amount of improvement needed due to procedural deficiencies and limitations. The need for testing improvement is becoming more critical as materials are increasingly stretched to their limits by extreme conditions of temperature, stress, corrosive environments, and longer service life cycles. With new applications, some of the previously tested materials and procedures prove inadequate and inconsistent, demanding a collective and interdisciplinary effort to generate reliable and high-quality data. To embrace the new developments, the following areas of particular interest were selected as the main themes for the symposium: 1) test planning, 2) data acquisition and processing, and 3) data analysis and interpretation. Although many of the papers and presentations include content focused on these three topics, the symposium co-chairs were pleased to welcome other closely related topics and emerging issues in fatigue and fracture.

The major objective of the symposium was to provide a forum for engineers, managers, researchers and scholars worldwide to exchange ideas, share best practices,

discuss challenges, and identify opportunities and directions for future developments and applications. Specific objectives include:

- 1) Showcase the most current research and advances in these areas;
- 2) Promote a systematic, unified materials test plan for improved data acquisition and analysis; and
- 3) Collect information and supporting documents for updating existing fatigue, creep, and fracture test standards and identify the needs for new standards.

Two keynote lectures at the symposium were presented by Krishnaswamy Ravi-Chandar (The University of Texas at Austin) and Youshi Hong (Institute of Mechanics, Chinese Academy of Sciences), respectively, at the beginning of each day of the two-day symposium. A panel discussion on “The Challenges and Opportunities in Fatigue and Fracture Test Planning, Test Data Acquisitions, and Analysis” was held at the end of the first day of the symposium. The panel consisted of the following experts in their respective areas: Michael Shepard (MTS Systems Corporation), Steven Thompson (AFRL/RXSA), Dan Lingenfelter (HBM nCode Federal LLC), Peter McKeighan (Symmetry Engineering and Forensic Consulting LLC), and Charlotte Belsick (Lockheed Martin). Bruce Young (Battelle) served as a substitute chair in the last day of the symposium.

The papers presented in the symposium were arranged into four sessions:

Session 1: Testing Planning and Performance Characterization

Session 2: Data Acquisition, Quality Assurance, and Analysis

Session 3: Modeling/Simulation, Interpretation, and Correlation

Session 4: Verification, Validation, and Applications

The papers collected in this STP are arranged in the same order. These papers provide a diverse source of new information regarding test planning, data acquisition and analysis that can help accelerate the revision of the existing standards and the development of new standards. These papers also represent a significant contribution to ASTM E08's commitment to expanding the knowledge base that supports design and testing as related to fatigue and fracture.

The symposium co-chairs express our sincere gratitude to ASTM staff for all their contributions to planning throughout the many months preceding the symposium and the STP1598 publication. Additionally, Dr. Markus Heinimann (Arconic) and Charlotte Belsick (Lockheed Martin) are also highly appreciated for their help and support. Furthermore, this STP would not have been possible without the attentiveness and countless hours volunteered by our peer reviewers to ensure that all of the manuscripts were suitable for publication. Finally, special thanks are given to the authors and reviewers of the papers for their outstanding efforts in writing and reviewing efforts that make the symposium and the STP possible. It is our sincere hope that these selected technical papers contribute significantly to the further advancement of the relevant topics.

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