15th International ASTM/ESIS Symposium on Fatigue and Fracture Mechanics (40th National Symposium on Fatigue and Fracture Mechanics)

Sponsored by ASTM International - Committee E08 on Fatigue and Fracture, ESIS - the European Structural Integrity Society and ICF the International Congress on Fracture

May 20-22, 2015
Anaheim Marriott
Anaheim, CA

Symposium Chairs:  Dr. Markus Heinimann
Alcoa Technical Center
Alcoa Center, PA, USA

Prof. Steve R. Daniewicz
Mississippi State University
Starkville, MS, USA

Prof. Stefano Beretta
Politecnico di Milano
Milano, ITALY

ABOUT THE SYMPOSIUM
Multi-scale physics- and mechanics-based approaches have gained increasing prominence in assessing the fatigue- and fracture-related design lives of the structures, components and devices used in a wide variety of industries. The prevention of fatigue and fracture failures is critical to the safe operation and economic viability of machines, devices, and components across an increasingly broad spectrum, ranging from the aerospace and surface transportation, power generation, and petroleum communities to the semiconductor, biomedical, and micro-electromechanical systems (MEMS) worlds. Each of these areas presents its own particular challenges to the development and application of engineering approaches to predict the structural integrity and remaining life of critical components and systems.

Fatigue- and fracture-based methodologies invariably require models of the damage initiation, damage accumulation and failure mechanisms that operate within each of the application domains, as well as accurate characterization of the material and structural response to the combined effects of loading, loading rate, environmental conditions, and engineered or naturally-occurring material heterogeneity. Currently-available fatigue and fracture models are increasingly being stretched to their limits (and beyond) and the demand for models that are more robust, faster, adaptable, and of higher fidelity is continuous and intense.

This symposium is intended to provide a forum for researchers and technologists from the academic, industrial and government sectors to share, discuss, and debate the latest improvements in the science, technology, and applications of fatigue and fracture. Experimental, analytical, and computational perspectives are all equally appropriate for discussion, especially given the reality that the improved understanding being sought will most likely come from a synergistic
combination of advances in all three perspectives. Broad, international participation is also sought to make this a powerful forum to identify recent advances in fatigue and fracture and propel the worldwide community to develop more accurate models, experimental methods, analytical insights, and computational simulation capabilities to better predict and characterize the fatigue and fracture behavior of materials and structures.

The language of the symposium will be English.
SESSION 1: Swedlow Memorial Lecture and Opening Papers

8:45 AM
Jerry R. Swedlow Memorial Lecture: Integrating Fracture Mechanics into the Material and Structural Design Process
R. Craig McClung, Southwest Research Institute, San Antonio, Texas, USA

9:45 AM BREAK

SESSION 2: Residual Stress Effects

1:30 PM
An Engineering Approach to Evaluating Cold Working Improvement Factors of Fastener Holes under Spectrum Loading
Keith Donald, Fracture Technology Associates, Bethlehem, PA, USA; Young Kwon, Lockheed Martin Aeronautics Co, Marietta, GA, USA; and Trung Nguyen, NAVAIR Air Vehicle Engineering, Patuxent River, MD, USA
1:55 PM
Using Barkhausen Noise and Digital Image Correlation to Investigate the Influence of Micro Residual Stresses on Fatigue Crack Propagation
Matthias Thielem, Michael Marx, Christian Motz, Meisam Sheikh Amiri, Christian Boller, Saarland University, Saarbruecken, Germany

2:20 PM
A Methodology for Partitioning Residual Stress Effects from Fatigue Crack Growth Rate Test Data
Mark James, Robert Bucci, Alcoa Technical Center, Alcoa Center, Pennsylvania, USA; and Dale Ball, Lockheed Martin Aeronautics Corporation, Ft. Worth, Texas, USA

2:45 PM BREAK

SESSION 3: Environmental Effects

3:15 PM
Understanding the Effect of Interspersed Hold-Time on Corrosion Fatigue Crack Growth Rate
Raghu V. Prakash, S. Dhinakaran, Department of Mechanical Engineering, Indian Institute of Technology Madras, Chennai, Tamil Nadu, India

3:40 PM
The Characteristics of Load Frequency and its Mechanism of Corrosion Fatigue Crack Growth Rate for Ti-6Al-4V Alloys
A. Toshimitsu Yokobori Jr., Toshihito Ohmi, Hajime Nunokawa and Shuichi Takagi
Faculty of Graduate School of Engineering Department of Nano Mechanics, Tohoku University, Sendai-shi, Japan

4:05 PM
Assessing Gaseous Hydrogen Assisted Fatigue Crack Growth Susceptibility of Pipeline Steel Weld Fusion Zones and Heat Affected Zones
Joseph A. Ronevich, Brian P. Somerday, Sandia National Laboratory, Livermore, CA, USA

4:30 PM
Next Generation Accelerated Laboratory Testing to Quantify the Environment Assisted Cracking Resistance of High Performance Structural Metals
James T. Burns, University of Virginia, Charlottesville, VA, USA; Bradley S. Plotner, Westmoreland Mechanical Testing and Research, Inc., Youngstown, PA, USA; Keith J. Donald, Fracture Technology Associates, Bethlehem, PA, USA; and Richard P. Gangloff, University of Virginia, Charlottesville, VA, USA

4:55 PM SYMPOSIUM ADJOURNS FOR THE DAY

5:30 PM Reception
THURSDAY, MAY 21, 2015

SESSION 4: Probabilistic Approaches

8:30AM
**Statistically Modeling of High Cycle Fatigue with Censored Data**
D. Gary Harlow, Mech. Engr. and Mechanics, Lehigh University, Bethlehem, PA, USA

8:55 AM
**Probabilistic Fracture Mechanics Simulation of Stress Corrosion Cracking Using Accelerated Laboratory Testing and Multi-Scale Modeling**
Richard P. Gangloff, Department of Materials Science & Engineering University of Virginia Charlottesville, VA, USA

9:20 AM
**A Modified Weibull Stress Approach to Determine the Reference Temperature in a Pressure Vessel Steel**
Claudio Ruggieri, University of São Paulo, São Paulo, Brazil; and Robert H. Dodds University of Illinois at Urbana-Champaign, IL, USA

9:45 AM BREAK

SESSION 5: Fatigue

10:15 AM
**Validation Testing and Analysis of Cracked Hole Continuing Damage Solutions**
Luciano Smith and James Feiger, Southwest Research Institute, San Antonio, TX, USA; and Robert Pilarczyk, United States Air Force, Hill AFB, UT, USA

10:40 AM
**Microstructure and Mean Stress Effects on Fatigue Behavior of Type 304L Stainless Steel**
Jonathan Pegues and Nima Shamsaei, Department of Mechanical Engineering and Center for Advanced Vehicular Systems, Mississippi State University, Mississippi State, MS, USA; Marcos Lugo, Center for Advanced Vehicular Systems, Mississippi State University, Mississippi State, MS, USA

11:05 AM
**Fatigue Crack Growth in Haynes 230: A Comparison between Single Crystals and Polycrystal Effective Curve**
Silvio Rabbolinia, Stefano Beretta, Department of Mechanical Engineering, Politecnico di Milano, Milan, Italy; and Huseyin Sehitoglu, Department of Mechanical Science and Engineering, University of Illinois, Urbana IL, USA

11:30 AM
**Fatigue Damage Accumulation in Pristine and Low velocity Impacted CFRP Laminates under Constant Amplitude and Programmed FALSTAFF Loading**
Raghu V. Prakash, Deepika Sudevan and M. Kamaraj, Indian Institute of Technology Madras, Chennai, Tamil Nadu, India

11:55 AM LUNCH
SESSION 6: Probabilistic Approaches

1:30 PM
Considering the Statistical Distribution of Dynamic Fracture Toughness Data and the Actual Loading Rate at Fracture Initiation when applying ASTM E1921 at Elevated Loading Rates
Uwe Mayer, Materials Testing Institute (MPA) University of Stuttgart, Stuttgart, Germany

1:55 PM
An Effective Probabilistic Fatigue Damage and Life Assessment Approach for Engineering Components and Systems
Zhigang Wei, Limin Luo, Tenneco Inc. Grass Lake, Michigan, USA; D. Gary Harlow, Lehigh University, Bethlehem, PA, USA; and Shengbin (Burt) Lin, Tenneco China Engineering Center, Shanghai, China

2:20 PM
New Aspects Regarding the Statistical Distribution of Dynamic Fracture Toughness Values and the Shape of the Dynamic Master Curves
Wolfgang Böhme, Thomas Reichert, Fraunhofer Institute for Mechanics of Materials IWM, Freiburg, Germany

2:45 PM BREAK

SESSION 7: Fatigue

3:15 PM
Fatigue Micro-crack Growth and Modeling for Magnesium Alloys
Tanner Cauthen, Johnathan Pegues, Nima Shamsaei, James Newman, Jr., Mississippi State University, MS, USA; and Marcos Lugo, Center for Advanced Vehicular Systems, Mississippi State University, MS, USA

3:40 PM
A Path-Dependent Mixed-Mode Crack Growth Model for Non-Proportional Multi-Axial Fatigue Loading
Jifa Mei and Pingsha Dong, University of Michigan Ann Arbor, Michigan, USA; Yanyao Jiang, University of Nevada, Reno, Nevada, USA; and Zhigang Wei, Tenneco Inc. Grass Lake, Michigan, USA

4:05 PM
Mechanical Properties of Magnesium Single Crystal under Compressive Cyclic Loading
Qizhen Li, Washington State University, Pullman, WA, USA

4:30 PM
A Universal Method for Applying the Mean Stress Effect Correction in Stochastic Fatigue Damage Accumulation
Adam Nielsony and Michał Böhm, Opole University of Technology, Opole, Poland
Effect of Specimen Shape on Closure of Small Cracks at Notches in LCF Regime
Stefano Beretta, Stefano Folettia, Lorenzo Rusconia, S. Rabbolinia, Department of Mechanical Engineering, Politecnico di Milano, Milan, Italy; and Mihaela E. Cristea and Enrico Palermo, Tenaris Dalmine R&D – Structural Integrity Department, Dalmine SpA, Dalmine Italy

Experimental and Finite Element Modeling of Near-Threshold Fatigue Crack Growth for the K-Decreasing Test Method
Stephen W. Smith, John A. Newman, NASA Langley Research Center, Hampton, VA, USA; and Banavara R. Seshadri, National Institute of Aerospace, Hampton, VA, USA

Methodology of Residual Fatigue Lifetime Assessment of Railway Axles
Pavel Pokorný, Institute of Physics of Materials, Academy of Sciences of the Czech Republic, Brno, Czech Republic, Martin Ševčík, Luboš Náhlík and Pavel Hutař, Institute of Physics of Materials, Academy of Sciences of the Czech Republic, Brno, Czech Republic

SYMPOSIUM ADJOURNS FOR THE DAY
SESSION 8: Fretting

8:30 AM
Effect of Different Material Inhomogeneities on Fretting Fatigue Crack Nucleation
Reza Hojjati-Talemi, Patrick De Beats, Magd Abdel Wahab, Department of Mechanical Constructions and Productions, Ghent University, Ghent, Belgium

8:55 AM
The Effect of Fretting on the Rolling Contact Fatigue Performance of Tapered Roller Bearings
Gerardo Carvajal, Jeferson Araujo de Oliveira, Jan Kowal, Tony Nixon and John Bouchard; Materials Engineering Group, The Open University, Milton Keynes, UK

9:20 AM
Characterization of Frictional Behavior of Double Bolted Lap Joints Subjected to Fretting Fatigue Loading Conditions
Reza Hojjati-Talemi, Patrick De Beats, Magd Abdel Wahab, Department of Mechanical Constructions and Productions, Ghent University, Ghent, Belgium

9:45 AM BREAK

SESSION 9: Analysis

10:15 AM
Physically Correct Assessment of Fatigue Crack Growth in Elastic–Plastic Materials with the J-Integral
Walter Ochensberger, Otmar Kolednik, Erich Schmid Institute of Materials Science, Austrian Academy of Sciences, Leoben, Austria

10:40 AM
Finite-Element Fracture Simulations on Extremely Large Cracked Panels using the Critical CTOA Fracture Criterion
J. C. Newman, Jr., Mississippi State University, Mississippi State, MS, USA; and J. C. Newman, III, University of Tennessee-Chattanooga, TN, USA

11:05 AM
Validation of the Two-Parameter Fracture Criterion using 3D Finite-Element Analyses with the Critical CTOA Fracture Criterion
J. M. Warren, T. Lacy, J. C. Newman, Jr., Mississippi State University, Mississippi State, MS, USA

11:30 AM
Comparison of CTOD Evaluation Procedures in SE(T) Specimens for Stationary and Growing Cracks
Claudio Ruggieri, Diego F. B. Sarzosa, Rodolfo F. de Sousa, University of São Paulo, São Paulo, Brazil
11:55 AM
Closing Remarks
M. Heinimann, S.R. Daniewicz, and S. Beretta, Symposium Co-Chairs

12:00 PM SYMPOSIUM ADJOURNS