Structural integrity, qualification, and certification of AM materials and parts

The rapid adoption of additive manufacturing across different industry sectors for multiple applications demands the need to demonstrating methodologies for the mitigation of risk arising from material flaws. For safety-critical applications, it is imperative to have an understanding of the effects of defects on the performance of the parts. This becomes more difficult as there is limited historical data to compare with and the inherent variability in the process characteristics associated with the additive manufacturing technology. This lack of understanding is also hindering the qualification and certification of components produced by additive manufacturing technologies.

This symposium broadly covers the following topics:
- Characterization of AM materials
- Establishing process-structure-property-performance relationships
- Methods to verify the structural integrity of 3D printed parts
- Factors influencing the structural integrity
- Modelling of mechanical behavior

ORGANIZERS
- Stefano Beretta, Politecnico di Milano, Italy
- Thomas Niendorf, University of Kassel, Germany
- Doug Wells, NASA MSFC, USA
- Michael Gorelik, FAA, USA
Session 1

**Structural Integrity, Qualification and Certification of AM Materials and Parts**

Session Chairs TBD

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8:00 a.m. Invited Talk: Benchmark of a software for fatigue assessment of AM components
Johannes Gumpinger, European Space Agency

8:30 a.m. Invited Talk: Qualification of an Additively Manufactured Non-Critical Missile Metallic Part
Rashid Miraj, AlphaSTAR Corporation

9:00 a.m. Invited Talk: On the evaluation of surface roughness: X-ray tomography reveals hidden details
Anton Du Plessis, Stellenbosch University

9:30 a.m. Regular Talk: Classification of particle shape using various shape descriptors
Cindy Charbonneau, NRC

9:50 a.m. Regular Talk: Micro-focus x-ray tomography: A potential standard method for the quantification of contaminants in 3D printing metal powders
Roger Pelletier, National Research Council Canada

10:30 a.m. Invited Talk: Static assessment of 3D printed AlSi10Mg parts with surface flaws
Stefano Beretta, Politecnico di Milano

11:00 a.m. Regular Talk: High-cycle and very-high-cycle fatigue behavior of LB-PBF Inconel 718 including test frequency, layer orientation, and surface finish effects
Jutima Simsiriwong, University of North Florida

11:20 p.m. Regular Talk: Towards Secure Cyber-physical Information Association for Parts
Michael Sandborn, Computer Science Vanderbilt University

11:40 p.m. Invited Talk: Microstructure-based assessment and modeling of fatigue evolution and damage in additive manufactured metals
Mustafa Awd, TU Dortmund University, Department of Materials Test Engineering (WPT)

1:00 p.m. Invited Talk: MMPDS Framework for Characterization and Use of Material Allowables for Additively Manufactured Metals
Doug Hall, MMPDS Program Manager Battelle Memorial Institute

1:30 p.m. Invited Talk: Additive manufacturing for fusion energy
Frank Schoofs, United Kingdom Atomic Energy Authority

2:00 p.m. Invited Talk: Cost Effective Characterisation of Defect Populations in AM Materials
Simon J. Lewis, Norton Straw Consultants Ltd.

2:30 p.m. Invited Talk: Use of Additive Manufacturing in Aerospace Components
Jesse R. Boyer, Pratt & Whitney

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10:10 BREAK  |  12:10 LUNCH  |  3:00 SESSION ENDS
Session 1

Structural Integrity, Qualification and Certification of AM Materials and Parts

Session Chairs TBD

8:00 a.m. Invited Talk: AM Structural Modelling as an Enabler for Targeted Inspection
Benjamin Dutton, The MTC

8:30 a.m. Invited Talk: Influence of the Defect Tolerance on the Fatigue Behavior of Selectively Laser Melted AISI 316L
Bastian Blinn, Institute of Materials Science and Engineering

9:00 a.m. Invited Talk: Post-processing LB-PBF build monitoring “defectiveness level” parameters to reveal further build quality and structural integrity information
Rob Plaskitt, HBM Prenscia

9:30 a.m. Invited Talk: A stepwise fatigue assessment of additively manufactured materials using machine learning and X-ray tomography
Shengchuan Wu, Southwest Jiaotong University

10:00 a.m. Invited Talk: Probabilistic reliability assessment of laser-based additively manufactured Ti-6Al-4V components in the presence of internal defects
Nikolai Kashaev, Helmholtz-Zentrum Geesthacht

10:30 a.m. Invited Talk: Probabilistic Damage Tolerance Methods for Structural Integrity of Additively Manufactured Parts
Robert McClung, Southwest Research Institute

11:00 a.m. Invited Talk: Characterising the Fatigue Performance of Additively Manufactured Alloys Using Innovative Small Scale Test Methods
Robert Lancaster, Swansea University

10:00 BREAK | 10:30 AWARDS CEREMONY | 12:00 LUNCH | 3:00 BREAK | 4:40 SESSION ENDS

1:00 p.m. Invited Talk: Government Agency Requirements for Additive Manufacturing, from an OEM Perspective
Dan Matejczyk, Aerojet Rocketdyne

1:30 p.m. Invited Talk: The Determination of Residual Stresses in AM Lattice Structures
Giovanni Bruno, BAM

2:00 p.m. Invited Talk: State of the art and qualification plans for Wire + Arc Additive Manufacture
Filomena Martina, Waam3D

2:30 p.m. Invited Talk: Fatigue life assessment of ALM AlSi10Mg
Yves Nadot, ISAE-ENSMA/Institut Prime

3:00 p.m. Invited Talk: Implementation of Probabilistic Machine Learning Strategies for Feature Based Qualification of AM Ti64
Genghis Khan, Soumya Nag, Yiming Zhang, GE Research

3:30 p.m. Regular Talk: Qualifying Laser Based Directed Energy Deposition Repair Strategies for Thin Walled Components
Cory Jamieson, The Pennsylvania State University ARL

3:50 p.m. Invited Talk: Assurance Performance of Additively Manufactured and Composite Parts through Embedded Sensing and Life Cycle Monitoring: An Enabler for In-Space Use
Godfrey Sauti, NASA Langley Research Center