#### Fourteenth International Conference on Multiaxial Fatigue & Fracture (ICMFF14) 18 to 20 June 2025 in Würzburg, Germany

### Technical programme (print version)

Last updated on 2025-05-26

## Wednesday, 18 June 2025

- 16:00- Committee Meeting (not public)
  17:00- Registration
  18:00
  17:00- Cott together followed by a free s
- 17:00- Get-together followed by a free evening to
- 19:00 meet and reunite with colleagues and friends.

08:30- Registration 09:00

#### **Plenary Session**

Hall A

09:00 Welcome *M. VORMWALD<sup>1</sup>, A. ESDERTS<sup>2</sup>* <sup>1</sup> Technische Universität Darmstadt, IFSW, Germany <sup>2</sup> Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany

#### A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: *S. VANTADORI*, University of Parma, Department of Engineering & Architecture - DIA, Italy

 09:15 Crack Initiation Life Estimate for Notched Specimens of SUS304 and Mod.9Cr-1Mo Steels under Nonproportional Cyclic Loading (#43)
 <u>M. SAKANE</u>, Ritsumeikan University, Research Organization of Science and Technology, Kusatsu, Japan
 09:40 Evaluation of multi-axial stresses using the

FKM guideline - status quo and how it can be improved (#62)
<u>M. WÄCHTER</u><sup>1</sup>, R. WUTHENOW<sup>1</sup>, C. FÄLLGREN<sup>2</sup>, H.-T. BEIER<sup>2</sup>, M. OBERMAYR<sup>4</sup>, R. RENNERT<sup>3</sup>, M. VORMWALD<sup>2</sup>, A. ESDERTS<sup>1</sup>
<sup>1</sup> Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany
<sup>2</sup> Technische Universität Darmstadt, IFSW, Germany
<sup>3</sup> IMA Materialprüfung und Anwendungstechnik, Dresden, Germany
<sup>4</sup> ZF Friedrichshafen AG, Friedrichshafen, Germany

10:05 Break for room changing

#### Parallel Session A

Hall A

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: still open

10:10 Fatigue strength assessment of different materials under variable amplitude loadings with the Findley damage parameter (#1)
 *C. FÄLLGREN, <u>M. VORMWALD</u>*, Technical University of Darmstadt, Materials Mechanics, Germany

- 10:35 Fatigue assessment of structural components through the Effective Critical Plane approach: methodology and applications (#25) <u>A. CHIOCCA</u>, F. FRENDO, M. SGAMMA, University of Pisa, Department of Civil and Industrial Engineering, Pisa, Italy
- 11:00 New tests and multiaxial fatigue modeling of steels with different small defects (#10)
   L. C. ARAUJO, <u>J. A. ARAÚJO</u>, University of Brasilia, Department of Mechanical Engineering, Brazil
- 11:25- Break

11:45

#### Parallel Session B

A-06 Environmental effects including multiaxial thermal fatigue and coupling with creep phenomena

Chairperson: *T. ŁAGODA,* Opole University of Technology, Poland

10:10 Notch sensitivity and short cracks tolerance in environmentally assisted cracking under multiaxial tension-torsion loadings (#44)
<u>H. WU<sup>1</sup></u>, M. A. MEGGIOLARO<sup>2</sup>, A. C. MIRANDA<sup>3</sup>, J. T.P. CASTRO<sup>2</sup>
<sup>1</sup> Tongji University, School of Aerospace Engineering and Applied Mechanics, Shanghai, China
<sup>2</sup> Pontifical Catholic University of Rio de Janeiro, Mechanical Engineering Department, Brazil
<sup>3</sup> University of Brasília, Department of Civil and Environmental Engineering, Brazil

10:35 Approach on the critical plane using spherical coordinates with the Newton method (#65)
 <u>S. SAUTNER</u>, R. SZLOSAREK, M. KRÖGER, TU Bergakademie Freiberg, Institut for Machine Elements, Design and Manufacturing, Germany

# A-02 Fatigue crack formation and early growth processes, mechanisms, and models

- 11:00 Crack Orientation and Multiaxial Fatigue Analysis in Steel and Cast Iron (#2)
   <u>J. KRAFT</u>, M. VORMWALD, Technical University of Darmstadt, Materials Mechanics Group, Germany
- 11:25- Break
- 11:45

#### Parallel Session A

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: still open

 11:45 Fatigue Behaviour of Multiaxially Loaded Topology Optimised Bicycle Components - A Case Study (#63) <u>J. KÖCKRITZ</u>, R. SZLOSAREK, M. KRÖGER, TU Bergakademie Freiberg, Institute for Machine Elements, Design and Manufacturing, Germany

# A-03 Mixed-mode fatigue crack growth, including small fatigue cracks

 12:10 Estimating multiaxial fatigue lifetime of AA6082 T6 aluminium to zinc-coated S235 steel welded joints (#64) *C. T. NG<sup>1</sup>, <u>L. SUSMEL</u><sup>2</sup>* <sup>1</sup> The University of Sheffield, School of Mechanical, Aerospace and Civil Engineering, United Kingdom
 <sup>2</sup> Sheffield Hallam University, Materials and Engineering Research Institute, United Kingdom
 12:35 Crack growth behavior of steel S235 under proportional and non-proportional fatigue

proportional and non-proportional fatigue loading <u>P. ZERRES<sup>1</sup>, M. VORMWALD<sup>2</sup> (</u>#15) <sup>1</sup> Jade Hochschule Wilhelmshaven/ Oldenburg/Elsfleth, Germany <sup>2</sup> Technical University of Darmstadt, Materials Mechanics Group, Germany

#### Parallel Session B

A-02 Fatigue crack formation and early growth processes, mechanisms, and models

Chairperson: A. CHIOCCA, University of Pisa, Italy

11:45 Modeling of small fatigue crack growth under multiaxial stress conditions (#22)
 N. SANTOS, R. COSTA, <u>F. CASTRO</u>, University of Brasilia, Department of Mechanical Engineering, Brazil

12:10 Interior fatigue of gears under special consideration of multiaxial stresses and local material properties (#23) <u>J.-A. MEIS</u>, Flender GmbH, Technology & Innovation, Bocholt, Germany

# A-04 Advances in understanding of multiaxial fatigue offered by in situ experimental methods, microstructure- sensitive computational

 12:35 Multiaxial Fatigue Life Prediction based on Complex Invariants Compared to Critical Cutting Plane Approaches (#11)
 *W. C. HÜBSCH, <u>C. GAIER</u>*, MAGNA, Strukturmechanik, St.Valentin, Austria

#### **Parallel Session A**

Hall A

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: still open

 13:00 Effect of welding spots on the stress intensity and crack propagation angle under plain fretting and fretting fatigue with flat-flat contact (#16) <u>M. MÜLLER</u>, D. KNABNER, L. SUCHY, A. HASSE, Technische Universität Chemnitz, Institute of Design Engineering and Drive Technology, Germany

13:25-14:20 Break

#### Parallel Session B

A-02 Fatigue crack formation and early growth processes, mechanisms, and models

Chairperson: A. CHIOCCA, University of Pisa, Italy

13:00 Numerical Analysis of Defect Population Influence on the Multiaxial High-cycle Fatigue Strength Anisotropy of Ti64 Manufactured by Laser Powder Bed Fusion (L-PBF) (#61) S.S. PENKULINTI<sup>1, 2</sup>, N. SAINTIER<sup>1, 2</sup>, M. BONNERIC<sup>1, 2</sup>, B. VERQUIN<sup>3</sup>, T. PALIN-LUC<sup>1, 2</sup>, F. LEFEBVRE<sup>4</sup> <sup>1</sup> Univ. Bordeaux, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, France <sup>2</sup> Arts et Metiers Institute of Technology, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, France <sup>3</sup> CETIM, Additive Manufacturing team, Saint-Etienne, France <sup>4</sup> CETIM, Fatigue team, Senlis, France

13:25-14:20 Break

#### **Parallel Session A**

A-01 Cyclic deformation under multiaxial loading, including load history effects

Chairperson: *M. WÄCHTER*, Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany

- 14:20 Systematic investigation of the influence of T-stress and LCF overloads in biaxially loaded cruciform specimen on plasticity-induced crack closure using digital image correlation (#27)
  <u>A. ZAIAT</u><sup>1</sup>, A. BLUG<sup>2</sup>, G. LASKIN<sup>2</sup>, A. BERTZ<sup>2</sup>, F. CONRAD<sup>1</sup>, C. KONTERMANN<sup>3</sup>, M. OECHSNER<sup>1</sup>
  <sup>1</sup> Technical University of Darmstadt, Department and Institute of Materials Science, Germany
  <sup>2</sup> Fraunhofer, Institute for Physical Measurement Techniques IPM, Germany
  <sup>3</sup> Trier University of Applied Sciences, Germany
- 14:45 Evaluation of Fatigue Life of Stainless Steels under Combined Axial and Inner Pressure Multiaxial Loading (#42)
   <u>L. HE</u>, T. ITOH, Ritsumeikan University, College of Science and Engineering, Kusatsu, Japan
- 15:10 Using multi-axial fatigue to investigate the anisotropic performance in additively manufactured material (#49) <u>P. B.S. BAILEY</u>, Instron, Dynamic Systems, High Wycombe, United Kingdom

#### Parallel Session B

A-04 Advances in understanding of multiaxial fatigue offered by in situ experimental methods, microstructure- sensitive computational

Chairperson: *P. ZERRES*, Jade Hochschule Wilhelmshaven/Oldenburg/Elsfleth, Wilhelmshaven, Germany

14:20 Advancements in Multiaxial Fatigue Analysis: Application and Optimization of the Maximum Variance Method (#30)
J. N. DIAS, J. A. ARAUJO, C. R. SILVA, F. M. LIMA, J.L. A. FERREIRA, Universidade de Brasília, Mechanical Engineering, Brazil

#### A-09 Phase Field approaches

- 14:45 Simulation of crack propagation in ductile materials under non-proportional loading conditions. Part I: Modelling of deformation-induced plastic anisotropy (#58)
   <u>A. GIBB</u>, A. TSAKMAKIS, M. VORMWALD, TU Darmstadt, Materials Mechanics Group, Germany
- 15:10 Simulation of crack propagation in ductile materials under non-proportional loading conditions. Part II: Phase field modelling of crack propagation (#59)
  A. GIBB, <u>A. TSAKMAKIS</u>, M. VORMWALD, TU Darmstadt, Materials Mechanics Group, Germany

15:35 – 15:50 Break

#### **Plenary Session**

A-04 Advances in understanding of multiaxial fatigue offered by in situ experimental methods, microstructure- sensitive computational simulations, and/or data science

Chairperson: A. ESDERTS, Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany

15:50 Fatigue crack initiations under torsional load of a cast aluminium alloy: a competition of different mechanisms investigated by using synchrotron 3D observations (#53) *V.D. LE*<sup>1</sup>, <u>F. MOREL</u><sup>1</sup>, N. SAINTIER<sup>2</sup>, P. OSMOND<sup>4</sup>, D. BELLETT<sup>1</sup>, W. LUDWIG<sup>3</sup>, M. MAJKUT<sup>5</sup>, J.-Y. BUFFIERE<sup>3</sup>
<sup>1</sup> Arts et Métiers Institute of Technology, LAMPA, Angers, France
<sup>2</sup> Arts et Métiers Institute of Technology, I2M, Bordeaux, France
<sup>3</sup> INSA Lyon, MATEIS, Lyon, France
<sup>4</sup> CETIM, Nantes, France
<sup>5</sup> ESRF, Grenoble, France

# A-02 Fatigue crack formation and early growth processes, mechanisms, and models

 16:15- A Maximum-Damage Critical Plane Formulation
 16:40 considering Peak Deviatoric Stress Effects (#32) <u>M.A. MEGGIOLARO</u><sup>1</sup>, J. T.P. CASTRO<sup>1</sup>, H. WU<sup>2</sup>
 <sup>1</sup> Pontifical Catholic University of Rio de Janeiro, Mechanical Engineering, Brazil
 <sup>2</sup> Tongji University, Shanghai, China

then **Guided Walk through Würzburg´s Old Town** (included) and **Conference Dinner in the conference venue Burkardhushaus** (subject to an extra fee)

#### **Plenary Session**

 9:00 Welcome
 *M. VORMWALD<sup>1</sup>, A. ESDERTS<sup>2</sup>* <sup>1</sup> Technische Universität Darmstadt, IFSW, Germany
 <sup>2</sup> Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: *L. SUSMEL*, Sheffield Hallam University, Materials and Engineering Research Institute, United Kingdom

 9:05 Multiaxial Fatigue of Weldments: Experiments and Modeling (#21)
 A. RAZI, <u>A. FATEMI</u>, The University of Memphis, Mechanical Engineering, Collierville, United States of America

9:30 – 9:35 Break for room changing

#### **Parallel Session A**

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: *L. SUSMEL*, Sheffield Hallam University, Materials and Engineering Research Institute, United Kingdom

- 9:35 Unifying multiaxial fatigue life prediction of welded joints by considering support effects (#33)
   <u>N. M. BAUER</u>, A. WÖHLE, J. BAUMGARTNER, Fraunhofer Institute for Structural Durability and System Reliability LBF, Darmstadt, Germany
- 10:00 Fatigue assessment of welded component like specimens at 300 °C under variable amplitude loading considering multiaxiality with strainand energy-based fatigue damage parameters (#4)
   <u>G. VEILE<sup>1</sup>, J. LOTZ<sup>2, 1</sup>, J. RUDOLPH<sup>3</sup>, S. WEIHE<sup>1, 2</sup></u>
   <sup>1</sup> University of Stuttgart, Materials Testing Institute (MPA), Germany
   <sup>2</sup> University of Stuttgart, IMWF, Germany
   <sup>3</sup> Framatome GmbH, Erlangen, Germany

10:25 Multiaxial fatigue testing of welded steel joints subjected to non-proportional stress states induced by frequency differences between normal and shear stresses (#31)
<u>N. B. WINTHER</u><sup>1, 3</sup>, M. L. LARSEN<sup>2, 4</sup>, J. H. ANDREASEN<sup>3</sup>, J. SCHJØDT-THOMSEN<sup>1</sup>
<sup>1</sup> Liftra ApS, Aalborg, Denmark
<sup>2</sup> Kverneland Group Kerteminde, Denmark
<sup>3</sup> Aalborg University, Department of Materials and Production, Denmark
<sup>4</sup> University of Southern Denmark, Institute of Mechanical and Electrical Engineering, Odense, Denmark

10:50 – 11:10 Break

Parallel Session B

A-07 Feasabilities and limitations of artificial intelligence for the assessment of multiaxial fatigue

Chairperson: *F. MOREL*, Arts et Métiers Institute of Technology, LAMPA, Angers, France

9:35 Fatigue life prediction of continuous fiber reinforced polymers under multiaxial loading conditions based on the critical plane approach (#19)
<u>S. J. DUDA</u><sup>1</sup>, M. SMOLNICKI<sup>1</sup>, G. LESIUK<sup>1</sup>, A. FATEMI<sup>2</sup>
<sup>1</sup> Wroclaw University of Science and Technology, Poland
<sup>2</sup> University of Memphis, Tennessee, United States of America

 10:00 Fatigue assessment of additively manufactured V-notched Ti6Al4V engineering components under multiaxial stress state in high-cycle regime: a novel approach (#55) S. VANTADORI, A. CARPINTERI, C. RONCHEI, D. SCORZA, A. ZANICHELLI, University of Parma, Department of Engineering & Architecture -DIA, Italy

10:25 Fatigue lifetime under cyclic bending with torsion of selected steels used in the power industry (#6)
 <u>T. ŁAGODA</u><sup>1</sup>, M. KUREK<sup>1</sup>, A. KUREK<sup>1</sup>, J. KLEMENC<sup>2</sup>, D. ŠERUGA<sup>2</sup>, J. MAŁECKA<sup>1</sup>
 <sup>1</sup> Opole University of Technology, Poland

<sup>2</sup> Univerza v Ljubljani, Slovenia

#### Parallel Session A

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: *L. HE*, Ritsumeikan University, College of Science and Engineering, Kusatsu, Japan

- 11:10 Application of Multiaxial Fatigue Criteria for Fretting Fatigue Analysis and Life Predictions (#20)
  S. GHADAR<sup>1</sup>, <u>A. FATEMI<sup>1</sup></u>, N. PHAN<sup>2</sup>
  <sup>1</sup> The University of Memphis, Mechanical Engineering, Tennessee, United States of America
  <sup>2</sup> NAVAIR, Structures Division, Patuxent River, United States of America
- 11:35 Assessing Phase Relationships Between Stress Components in Statistical Fatigue Evaluations (#46)

<u>A. TRAPP<sup>1, 2</sup>, K. ROTHER<sup>1</sup></u> <sup>1</sup> Munich University of Applied Sciences, Germany <sup>2</sup> Siemens Mobility GmbH, R&D for Traction Components, Nuremberg, Germany

12:00 Data-Driven Approach to Statistical-Based Fatigue Predictions of the Findley Criterion (#47)

<u>A. TRAPP<sup>1, 2</sup>, K. ROTHER<sup>1</sup></u>

<sup>1</sup> Munich University of Applied Sciences, Germany

<sup>2</sup> Siemens Mobility GmbH, R&D for Traction Components, Nuremberg, Germany

#### Parallel Session B

A-07 Feasabilities and limitations of artificial intelligence for the assessment of multiaxial fatigue

Chairperson: *M. SAKANE,* Ritsumeikan University, Research Organization of Science and Technology, Kusatsu, Japan

11:10 Comparative Evaluation of Machine Learning Models and Super Ellipse Criterion for Fatigue Life Prediction of Welded Joints under Multiaxial Loading (#40) M. BEILER<sup>1</sup>, N. M. BAUER<sup>3</sup>, J. BAUMGARTNER<sup>3</sup>, M. BRAUN<sup>1, 2</sup> <sup>1</sup> German Aerospace Center (DLR), Institute of Maritime Energy Systems, Geesthacht, Germany <sup>2</sup> Hamburg University of Technology, Institute of Ship Structural Design and Analysis, Germany <sup>3</sup> Fraunhofer LBF, Fraunhofer Institute for Structural Durability and System Reliability, Darmstadt, Germany 11:35 Multiaxial Fatigue Life Prediction using Deep Learning (#56) R. V. NARKHEDE, B. EIDEL, TU Bergakademie

Freiberg, IMFD, Germany

#### A—05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

12:00 Introducing a dynamic equivalent stress approach for the invariant description of oscillating, superimposed and nonproportional stresses (#28) <u>A. T. SCHMIDT</u>, Robert Bosch GmbH, Center of Competence Vibration, Schwieberdingen, Germany

#### **Plenary Session**

Hall A

A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case

Chairperson: M. A. MEGGIOLARO, Pontifical Catholic University of Rio de Janeiro, Mechanical Engineering Department, Brazil

- 13:20 On the life estimation of wires using non-local machine learning methodology (#51) G. A. BRITO OLIVEIRA, I. M. MATOS, R. A. CARDOSO, I. A. ARAÚIO, University of Brasilia, Mechanical Engineering, Brazil
- 13:45 The Use of Polar Damage Sum Concept for Calculating Mean Stress Effect in Multiaxial Fatigue Loading Conditions (#29) J. ALBINMOUSA<sup>1, 2</sup>, A. ALHAMMALI<sup>1</sup>, M. ISMAIL<sup>1</sup> <sup>1</sup> King Fahd University of Petroleum & Minerals, Mechanical Engineering Department, Dhahran, Saudi Arabia <sup>2</sup> Interdisciplinary Research Center for Advanced Materials, King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia
- 14:10 Awarding of the ICMFF14 Young Scientists Award / DVM Junior Price
- 14:20-Farewell
- 14:30 M. VORMWALD<sup>1</sup>, A. ESDERTS<sup>2</sup> <sup>1</sup> Technische Universität Darmstadt, IFSW, Germany <sup>2</sup> Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany