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

Technical programme (print version)

Last updated on 2025-06-13

Wednesday, 18 June 2025

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

Notes on the print version of the ICMFF14 programme

In addition to the day of the event, the **headers** indicate whether it is a plenary session or a parallel session A or B.

The Plenary Sessions
and Parallel Session A
take place in Hall A,

Parallel Session B takes place in **Hall B** of the conference location.

The respective **session number** (e.g. S-01) refers to the <u>ICMFF14 online programme</u>.

The **numbers of the presentations** (e.g. #43) refer to the papers published in the online programme. The corresponding abstracts are also published there.

If you **select a two-page view of the programme** also when printing - you can see the simultaneous presentations in the parallel sessions and can easily put together your individual programme!

08:30- Registration 09:00

Plenary Session (S-01)

Hall A

09:00 Welcome *M. VORMWALD¹, A. ESDERTS²* ¹ Technische Universität Darmstadt, IFSW, Germany ² 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

U9:40 Evaluation of multi-axial stresses using the FKM guideline - status quo and how it can be improved (#62)
<u>M. WÄCHTER</u>¹, R. WUTHENOW¹, C. FÄLLGREN², H.-T. BEIER², M. OBERMAYR⁴, R. RENNERT³, M. VORMWALD², A. ESDERTS¹
¹ Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany
² Technische Universität Darmstadt, IFSW, Germany
³ IMA Materialprüfung und Anwendungstechnik, Dresden, Germany
⁴ ZF Friedrichshafen AG, Friedrichshafen, Germany

10:05 – 10:10 Break for room changing

Parallel Session A (S-02)

Hall A

Chairperson: T. PALIN-LUC^{1,2}

¹ Univ. Bordeaux, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, ; ² Arts et Metiers Institute of Techno-logy, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, France

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

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>I. A. ARAÚJO</u>, University of Brasilia, Department of Mechanical Engineering, Brazil

11:25-11:45 Break

Parallel Session B (S-03)

Hall B

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

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

- 10:10 Notch sensitivity and short cracks tolerance in environmentally assisted cracking under multiaxial tension-torsion loadings (#44)
 <u>H. WU¹, M. A. MEGGIOLARO², A. C. MIRANDA³,</u> J. T.P. CASTRO²
 ¹ Tongji University, School of Aerospace Engineering and Applied Mechanics, Shanghai, China
 ² Pontifical Catholic University of Rio de Janeiro, Mechanical Engineering Department, Brazil
 ³ 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
- 11:25-11:45 Break

Parallel Session A (S-04)

Chairperson: J. A. ARAÚJO, University of Brasilia, Department of Mechanical Engineering, Brazil

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

 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 \$235 steel welded joints (#64) C. T. NG¹, L. SUSMEL² ¹ The University of Sheffield, School of Mechanical, Aerospace and Civil Engineering, United Kingdom ² Sheffield Hallam University, Materials and Engineering Research Institute, United Kingdom Crack growth behavior of steel S235 under 12:35 proportional and non-proportional fatigue loading P. ZERRES¹, M. VORMWALD² (#15) ¹ Jade Hochschule Wilhelmshaven/

Oldenburg/Elsfleth, Germany

² Technical University of Darmstadt, Materials Mechanics Group, Germany

Parallel Session B (S-05)

Hall B

Chairperson: A. CHIOCCA, University of Pisa, Italy

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

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>I.-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 (S-04)

Chairperson: J. A. ARAÚJO, University of Brasilia, Department of Mechanical Engineering, Brazil

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

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

Hall A

Parallel Session B (S-05)

Hall B

Chairperson: A. CHIOCCA, University of Pisa, Italy

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

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^{1, 2}, N. SAINTIER^{1, 2}, M. BONNERIC^{1, 2}, B. VERQUIN³, T. PALIN-LUC^{1, 2}, F. LEFEBVRE⁴ ¹ Univ. Bordeaux, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, France ² Arts et Metiers Institute of Technology, CNRS, Bordeaux INP, I2M, UMR 5295, Talence, France ³ CETIM, Additive Manufacturing team, Saint-Etienne, France ⁴ CETIM, Fatigue team, Senlis, France

13:25-14:20 Break

Parallel Session A (S-06)

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

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

- 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>¹, A. BLUG², G. LASKIN², A. BERTZ², F. CONRAD¹, C. KONTERMANN³, M. OECHSNER¹
 ¹ Technical University of Darmstadt, Department and Institute of Materials Science, Germany
 ² Fraunhofer, Institute for Physical Measurement Techniques IPM, Germany
 ³ 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 (S-07)

14:20 Advancements in Multiaxial Fatigue Analysis: Application and Optimization of the Maximum Variance Methodra (1990) J. N. DIAS, J. A. APA(1997), C. R. SILVA, F. M. LIMA, J.L. A. FERREIA ODNIVERSIDADE de Brasília, Mechanical Engineering, Brazil

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

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

Hall B

Plenary Session (S-08)

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

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

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*¹, <u>F. MOREL</u>¹, N. SAINTIER², P. OSMOND⁴, D. BELLETT¹, W. LUDWIG³, M. MAJKUT⁵, J.-Y. BUFFIERE³
¹ Arts et Métiers Institute of Technology, LAMPA, Angers, France
² Arts et Métiers Institute of Technology, I2M, Bordeaux, France
³ INSA Lyon, MATEIS, Lyon, France
⁴ CETIM, Nantes, France
⁵ ESRF, Grenoble, France

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

- 16:15- A Maximum-Damage Critical Plane
- 16:40 Formulation considering Peak Deviatoric Stress Effects (#32)
 <u>M.A. MEGGIOLARO¹, J. T.P. CASTRO¹, H. WU²</u>
 ¹ Pontifical Catholic University of Rio de Janeiro, Mechanical Engineering, Brazil
 ² Tongji University, Shanghai, China
- 17:00- Guided Walk through Würzburg´s Old19:00 Town (included)
- 19:00- **Conference Dinner in the conference**
- 22:00 venue Burkardhushaus (subject to extra fee)

Plenary Session (S-09)

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

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

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

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 (S-10)

Hall A

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

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

- 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. VEILE¹</u>, J. LOTZ^{2, 1}, J. RUDOLPH³, S. WEIHE^{1, 2} ¹ University of Stuttgart, Materials Testing Institute (MPA), Germany

² University of Stuttgart, IMWF, Germany

³ Framatome GmbH, Erlangen, Germany

10:25 Multiaxial fatigue testing of welded steel joints subjected to non-proportional stress states induced by frequency difference between normal and shear stresses (#31)
 <u>N.B. WINTHER^{1,2}</u>, M. L. LARSEN³, S. M. JENSEN¹, J. H. ANDREASEN¹, J. SCHJØDT-THOMSEN²
 ¹ Aalborg University, Department of Materials and Production, Denmark
 ² Liftra, Aalborg, Denmark
 ³ Kverneland Group, Aalborg, Denmark

10:50 – 11:10 Break

Parallel Session B (S-11)

Hall B

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

A-08 Multiaxial aspects of damage mechanics

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>¹, M. SMOLNICKI¹, G. LESIUK¹, A. FATEMI²
¹ Wroclaw University of Science and Technology, Poland
² University of Memphis, Tennessee, United States of America

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

 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, <u>A. ZANICHELLI</u>, University of Parma, Department of Engineering & Architecture -DIA, Italy

A-08 Multiaxial aspects of damage mechanics

10:25 Fatigue lifetime under cyclic bending with torsion of selected steels used in the power industry (#6)
 <u>T. ŁAGODA</u>¹, M. KUREK¹, A. KUREK¹, J. KLEMENC², D. ŠERUGA², J. MAŁECKA¹
 ¹ Opole University of Technology, Poland
 ² Univerza v Ljubljani, Slovenia

10:50 – 11:10 Break

Parallel Session A (S-12)

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

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

- 11:10 Application of Multiaxial Fatigue Criteria for Fretting Fatigue Analysis and Life Predictions (#20)
 S. GHADAR¹, <u>A. FATEMI¹</u>, N. PHAN²
 ¹ The University of Memphis, Mechanical Engineering, Tennessee, United States of America
 ² 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</u>^{1, 2}, K. ROTHER¹ ¹ Munich University of Applied Sciences, Germany ² 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)
 A. TRAPP^{1, 2}, K. ROTHER¹

¹ Munich University of Applied Sciences,

Germany

² Siemens Mobility GmbH, R&D for Traction Components, Nuremberg, Germany

Hall A

Parallel Session B (S-13)

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

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

11:10 Comparative Evaluation of Machine Learning Models and Super Ellipse Criterion for Fatigue Life Prediction of Welded Joints under Multiaxial Loading (#40) M. BEILER¹, N. M. BAUER³, J. BAUMGARTNER³, M. BRAUN^{1, 2} ¹ German Aerospace Center (DLR), Institute of Maritime Energy Systems, Geesthacht, Germany ² Hamburg University of Technology, Institute of Ship Structural Design and Analysis, Germany ³ Fraunhofer LBF, Fraunhofer Institute for Structural Durability and System Reliability, Darmstadt, Germany 11:35 Multiaxial Fatigue Life Prediction using Deep Learning (#56)

<u>R. V. NARKHEDE</u>, 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 (S-14)

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

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

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, J. A. ARAÚJO, University of Brasilia, Mechanical Engineering, Brazil

A-08 Multiaxial aspects of damage mechanics

- 13:45 The Application of Polar Damage Sum Concept for Calculating Mean Stress Effect in Multiaxial Fatigue Loading Conditions (#29) <u>J. ALBINMOUSA</u>, King Fahd University of Petroleum & Minerals, Mechanical Engineering Department, Dhahran, Saudi Arabia
- 14:10 Awarding of the ICMFF14 Young Scientists Award / DVM Junior Price
- 14:20- Farewell
- 14:30 M. VORMWALD¹, A. ESDERTS²
 ¹ Technische Universität Darmstadt, IFSW, Germany
 ² Technische Universität Clausthal, IMAB, Clausthal-Zellerfeld, Germany

ICMFF14 2025, 18 to 20 June 2025 I Würzburg, Germany - Programme Overview

	Wed, 18 June 2025 Thu, 19 June 2025			Fri, 20 June 2025			
		08:30	Registr	ation			
		09:00	Welcome 2nd day		09:00	Welcom	e 3rd day
			A-05 Multiaxial fatigue design issues including notches, variable		09:05	A-05 Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case studies	
				case studies			
		10:05	Break for room changing		09:30	Break for room changing	
		10:10		A-06 Environmental effects	09:35		A-08 Multiaxial aspects of damage
			A-05 Multiaxial fatigue design	including multiaxial thermal		A-05 Multiaxial fatigue design	mechanics
			issues including notches,	creep phenomena		issues including notches,	A-05 Multiaxial fatigue design issues
			contact and fretting, residual			contact and fretting, residual	
			stress effects, and case studies	A-02 Fatigue crack formation and		stress effects, and case studies	A-08 Multiaxial aspects of damage
				mechanisms, and model			mechanics
		11:25	Break		10:50	Break	
		11:45	A-05 Multiaxial fatigue design		11:10		
			issues	A-02 Fatigue crack formation		A-05 Multiaxial fatigue design	A-07 Feasabilities and limitations of
		12:10		mechanisms and model		issues including notches,	assessment of multiaxial fatigue
			A-03 Mixed-mode fatigue	meenanishis, and model		variable amplitude loading,	5
		12:35	crack growth, including	A-04 Advances in understanding of		stress effects, and case studies	A-05 Multiaxial fatigue design issues
			small ratigue crack	multiaxial fatigue offered by in situ			
		13:00	A-05 Multiaxial fatigue design	experimental methods, microstructure- sensitive computational simulations,	12:25	Break / Comn	nittee Meeting
			issues	and/or data science	13:20	A OF Multiovial fatigue design issues	
		13:25 Break			 A-05 Multiaxial fatigue design issues 		
		14:20			13:45	A 09 Multiovial across	s of domogo mochanics
			A-01 Cyclic deformation			A-08 Multiaxial aspect	s of damage mechanics
		14:45	under multiaxial loading,		14:10	Awarding of the ICMFF14 Young	Scientists Award /DVM Junior Price
			including load history	A-09 Phase Field	14:20-	Far	woll
			effects	approaches	14:30		ewen
		15:35	Break				
		15:50	50 A-04 Advances in understanding of multiaxial fatigue offered by in situ experimental methods, microstructure- sensitive computational simulations				
16:00-	Commitees and Session Chairs		and/or data science				
17:00	Meeting	16:15	A-02 Fatigue crack form	ation and early growth			
			processes, mechar	nisms, and model			
17:00-	Registration 17:00 - 18:00 Get-	16:40 End of 2nd day		nd day			
19:00	together 17:00 - 19:00	17:00-	Guided Walk through Würzburg´s Old Town				
		19:00	(inclu	ded)			
		19:00-	Conference Dinner in t	he conference venue			
		22:00	Burkardushau	us (extra fee)			

A-01	Cyclic deformation under multiaxial loading, including load history effects
A-02	Fatigue crack formation and early growth processes, mechanisms, and models
A-03	Mixed-mode fatigue crack growth, including small fatigue cracks
A-04	Advances in understanding of multiaxial fatigue offered by in situ experimental methods, microstructure- sensitive computational simulations, and/or data science
A-05	Multiaxial fatigue design issues including notches, variable amplitude loading, contact and fretting, residual stress effects, and case studies
A-06	Environmental effects including multiaxial thermal fatigue and coupling with creep phenomena
A-07	Feasabilities and limitations of artificial intelligence for the assessment of multiaxial fatigue
A-08	Multiaxial aspects of damage mechanics
A-09	Phase Field approaches

2025-06-10/DVM