

Plenary lectures

Special on August Wöhler (1819 -1914) – Fatigue of Components – A Historical Review 3

H. Zenner, K. Hinkelmann

Reliability of Gas Turbine Materials compatible with renewable Energy Systems 5

M. Okazaki

Isothermal LCF

Early fatigue damage in high temperature materials 15

R. Petráš, V. Mazánová, J. Polák

Crack propagation under LCF for a coarse-grained Ni-based superalloy at high temperatures 17

E. Vacchieri, S. Beretta, S. Foletti, L. Patriarca, S. Monti

High temperature low-cycle- fatigue of the Ni-base superalloy René80 23

T. Beck, B. Engel, S. Schmitz

Crack initiation and propagation in a single crystal Ni-base superalloy with respect to TCP phase formation during low cycle fatigue 29

A. Kostka, A. Subramaniam, M. Bartsch, C. Meid, M. Eggeler

Effect of systematic pre-ageing on crack initiation and propagation in a coated super alloy during low cycle fatigue at 950°C 35

A. Subramaniam, L. Chernova, M. Bartsch, J. Wischek

Isothermal Low Cycle Fatigue of a Lost Foam Cast Al-Si-Cu alloy: study of the damage mechanisms with X-ray tomography and Digital Volume Correlation 41

E. Charkaluk, A. El Bartali, R. Seghir, L. Wang, J.-F. Witz, J.-Y. Buffière,
N. Dahdah, N. Limodin

Damage mechanisms of cast aluminium in low-cycle fatigue 47

S. Bergamo, T. Palin-Luc, N. Saintier, B. Sudret, P. Wilson

LCF response of AlSi10Mg obtained by Additive Manufacturing 53

S. Foletti, S. Romano, S. Beretta

Crack growth under biaxial fatigue loading leading to large scale yielding 59

A. Koster, V. Maurel, M. Rambaudon, M. Trabelsi

Verification of the Effectiveness of Miner's Rule at Elevated Temperatures 61

S. Holdsworth

Non-local analysis of Fatigue crack growth under large scale yielding 67

S. Dezecot, V. Fontanet, M. Rambaudon, V. Chiaruttini, A. Koster,
D. Missoum-Benziane, L. Rémy, F. Szymtka, J. Buffière, M. Trabelsi, V. Maurel

Low Cycle Fatigue behaviour of an ultrafine-grained CrMnNi TRIP steel	69
M. Fleischer, H. Biermann, A. Weidner, M. Droste	
EXPERIMENTAL EVALUATION OF METAL MECHANICAL PROPERTIES OF SPECIFIC ZONES OF STAMPED T-JOINT in PIPELINE	71
A. Gopkalo	
Fatigue lives and damage mechanisms in ultrafine-grained laminated metallic composites produced by accumulative roll bonding	77
F. Kümmel, M. Göken, H. W. Höppel	
 Thermomechanical Fatigue	
Probabilistic Thermomechanical Fatigue Criteria for Spheroidal Graphite Cast-irons	81
E. Charkaluk, A. Constantinescu, L. Rémy, F. Szmytka	
A Unified Approach for Isothermal and Thermomechanical Fatigue Life Assessment of TiAl-Based Alloy TNB-V2	87
A. El-Chaikh, B. Wollny, H.-J. Christ	
Lifetime calculation for turbine housing of turbocharger under thermo-mechanical loading: damage operator approach	93
M. Španiel, M. Bartošák, J. Cerný	
Finite element simulation of plasticity-induced crack closure under thermomechanical fatigue loading	99
C. Schweizer, T. Seifert, C. Fischer	
Thermo-mechanical fatigue behavior of P91/P92	101
B. Fedelich, J. Olbricht, B. Skrotzki, M. Jürgens	
Fatigue crack initiation in austenitic stainless steel during thermomechanical fatigue loading with dwells	105
J. Polák, R. Petráš, O. Dobeš	
On thermomechanical fatigue crack growth analysis in gas turbine blading in a 3D finite element context	111
D. Gustafsson, P. Almroth	
Fatigue crack growth of thin film copper on WTi and silicon substrate	117
S. Bigl, M. J. Cordill, R. Pippan, S. Hartl	
 Superimposed LCF/HCF and TMF/HCF Loadings	
Lifetime behaviour of MAR-M247LC at superimposed LCF and HCF loading	121
D. Gelmedin, K.-H. Lang	

Multiaxial and Variable Amplitude Loadings

- Understanding variable amplitude crack growth mechanisms by analysis of local stress fields, crack tip driving force and material behaviour** 129
M. Thielen, M. Marx, C. Motz, F. Schäfer
- Material Dependence on Tension-Torsion Multiaxial Low Cycle Fatigue at Elevated Temperatures** 131
M. Sakane
- Calculation of Path-Equivalent Strain Ranges of Multiaxial Non-Proportional Histories using the Moment Of Inertia Method** 137
J. T. P. Castro, H. Wu, M. A. Meggiolaro
- A multiscale analysis of Low cycle fatigue of shape memory alloys** 143
C. Menna, F. Auricchio, G. Scalet, A. Constantinescu

Creep-Fatigue Interaction

- Dwell-fatigue properties of cast & wrought superalloys at high temperature** 147
A. Devaux, J.-M. Franchet, J. Cormier, C. Crozet, P. Villechaise, L. Thebaud
- Creep-fatigue lifetime modelling of bellows made of AISI 316** 153
C. Quintus, G. Maier, C. Schweizer, V. Friedmann
- Low cycle fatigue properties of lead-free solders acquired using small sized specimen** 159
Y. Konishi, N. Hiyoshi, M. Sakane, F. Ogawa, T. Itoh

Cyclic Deformation Mechanisms

- Constitutive models for stainless steels exposed to low-cycle fatigue** 167
L. Rémy, F. Szymtka, A. Forré
- Cyclic plasticity and damage localization in ferritic steels investigated by EBSD** 173
F. Palleschi, J.-B. Vogt, F. Leaux, C. Schayes, J. Bouquerel
- High-temperature low-cycle fatigue behavior of a tempered martensitic 9Cr-ODS steel** 179
J. Aktaa, A. Chauhan
- Correlation of cyclic yield stress and precipitate size evolution of aluminum alloy 2618A at elevated temperature** 181
M. Metzger, C. Rockenhäuser, C. Schweizer, B. Skrotzki, P. von Hartrott
- Low cycle fatigue of a precipitation hardened Cu-Ni-Si alloy** 183
M. Delbove, J. Bouquerel, J.-B. Vogt

Influence of Environmental Conditions and Corrosion

Short cracks behavior in the elastoplastic regime 191

M. A. Meggiolaro, V. Miquelin, J. T. P. Castro

Electrochemical- and microstructure-correlated characterization of the corrosion fatigue behavior of creep-resistant magnesium alloys DieMag422 and AE42 197

F. Walther, M. Klein

Advanced Materials and Protective Coatings

LCF behaviour of 301LN steel: coarse grained vs. UFG-bimodal structure 205

A. Järvenpää, I. Kubena, O. Man, L. P. Karjalainen, T. Kruml, J. Polák, A. Chlupová, J. Man

Experimental Techniques and Standardization

Observation of the local deformation behaviour of coarse grained nickel cast alloys under thermo-mechanical fatigue loading using digital image correlation 213

K. Langschwager, F. Mueller, M. Oechsner, K. M. Kraemer

Influence of crack location on load-drop based detection of crack initiation lifetime in strain controlled LCF tests 219

B. Engel, E. Kohlhoff, B. Buchholz, T. Beck, M. Gollmer

In situ observation of the damage evolution in nickel-based superalloys under thermo-mechanical fatigue loading 225

C. Schweizer, S. Eckmann

Demands for improvement of the temperature stability of extensometers 227

H. Klingelhöffer

Crack propagation in quasi-brittle materials under conditions of low-cycle loading 233

A. Demeshkin, A. Larichkin, V. Kornev

Actual developments of fatigue standardization 239

H. Klingelhöffer

Fatigue Damage, Crack Initiation and -Growth

On the fatigue crack initiation by grain boundaries/slip bands interactions in polycrystals 247

J. Cormier, L. Signor, P. Villechaise, J. Gené

Crystal plasticity assessment to Stage I fatigue crack propagation in a single crystal Nickel-base superalloy	249
R. Komamura, H. Inoue, M. Okazaki, M. Higaki, M. Sakaguchi	
Assessment of fatigue crack growth under isothermal and thermo-mechanical fatigue loading using a time-dependent fracture mechanics approach	255
S. Eckmann, C. Schweizer	
Effect of TMF condition on crack initiation and propagation behaviors in a polycrystalline Ni-base superalloy	261
T. Tomita, Y. Yamazaki	
Imaging of potential crack initiation sites in ferritic steels by Bitter method	263
B. Skrotzki, N. Sonntag	
Micromechanisms investigation on fatigue crack initiation and propagation in high silicon spheroidal graphite cast iron	267
W. Wang, M. Sakaguchi, S. Castagne, S. Sujakhu, E. Ghassemali, A. E. W. Jarfors, K. A. Kasvayee	
Low cycle fatigue behavior of HSD 600 steel	273
T. Beck, M. Klein, M. Smaga	
Crack formation in pearlitic rail steel under uniaxial loading: effect of initial thermal damage	275
J. Ahlström, C. Jessop	
Fatigue life prediction of mechanical components obtained by metal forming	281
H. Badreddine, C. Labergere, K. Saanouni, M. A. Dhifallah	
Effect of phase shifted biaxial stress ratio on fatigue crack growth of metastable austenitic stainless steel	287
L. Zybell, S. Henkel, H. Biermann, S. Ackermann, C. Wolf	
The fatigue behaviour of bolts with large diameters under overloading	289
M. Reininghaus, K. Thiele, J. Unglaub	
Bimodal distribution for crack growth period divided on durability of forged titanium disks in LCF regime	295
A. Nikitin, M. Soldatenkova, A. Shanyavskiy	
Theoretical Prediction and Experimental Verification on Ti/APC-2 Hybrid Composite Laminates with Double-Edged Cracks due to Fatigue Loadings	301
Y.-F. Yen, F.-C. Hsu, C.-K. Chang, M.-H. R. Jen	
Crack Propagation of Sn-5Sb Solder under High Temperature Low Cycle Fatigue	307
K. Terahara, T. Itoh, N. Hiyoshi	
3D and 2D analysis of micro deformation and damage in LCF-loaded Al/Al₂O₃ MMCs by digital image correlation	313
N. B. Anar, R. Mokso, J.-Y. Buffière, W. Tillmann, E. Soppa, J. Nellesen	

Investigation of fatigue and crack propagation of hierarchically structured ceramic materials using nanoindentation	319
W.-D. Mueller, A. Maerten, C. Fleck, C. Mueller	
Fatigue failure of bodies with short macrocracks in materials subjected to embrittlement	325
V. Kornev	
An approach to model the fatigue damage	331
Y. Gargouri, A. Benhamida, F. El Khaldi, H. Hassis, A. Manai	
Numerical critical-damage load order model to predict fatigue crack growth under variable amplitude loads	337
M. A. Meggiolaro, J. T. P. Castro	
A distortional strain energy fatigue damage model for mean stress fatigue loadings	339
A. Ince	
A Guideline for a Smart In-Service Inspection Concept Using the Fracture Mechanics-based Damage Tolerance Methodology	345
A. Schulz, D. Rieck	
 Deformation Modelling	
Comparison between Linear and Non-Linear Kinematic Hardening Models to Predict the Multiaxial Bauschinger Effect	353
J. T. P. Castro, H. Wu, M. A. Meggiolaro	
Plasticity models for LCF mathematical simulation	359
Y. Temis	
Prediction of the cyclic behaviour of 316LN stainless steel at room temperature by a dislocation-based cyclic viscoplastic model	365
P. Lamagnere, M. Sauzay, D. Goncalves	
Constitutive modelling of viscoplastic deformation in single crystal nickel-base superalloys subjected to cyclic and creep loadings at high-temperatures	371
B. Fedelich, V. Kindrachuk	
Stress analysis of TBC coated nickel base superalloys for stationary gas turbine applications with laser drilled holes under cyclic oxidation	377
J. Malzbender, L. Singheiser, V. Ebrahimzade	
Deformation and Damage in LCF-loaded Al6061/Al₂O₃ T6 metal matrix composite analyzed by synchrotron microtomography based FE simulations	379
J. Nellesen, C. Kohler, R. Mokso, J.-Y. Buffière, W. Tillmann, E. Soppa	

Low cycle fatigue behaviour of butt welds from austenitic stainless steel and assessment under consideration of local cyclic material	385
M. Vormwald, E. Lang	
Rotary fatigue life of NiTi alloy wires and FEA modelling of fatigue damage	391
D. Montalvão, L. Reis, M. Freitas, A. Carvalho	
 Life Assessment	
Investigation on LCF damage accumulation of superalloy René80 at elevated temperatures	399
B. Engel, E. Kohlhoff, B. Buchholz, T. Beck, M. Gollmer	
Experimental and computational investigations of a lost foam cast aluminium-silicon alloy under thermomechanical loading	405
M. Decker, M. Hoyer, M. Riva, H.-J. Christ, M. Wagner	
Cyclic deformation behavior and physically based lifetime calculation (PhyBaL) of the ductile cast iron EN-GJS-600 (ASTM 80-55-06) at low frequency fatigue in temperature range AT - 400 °C	411
T. Beck, D. Eifler, M. Klein, B. Jost	
Characterization of the fatigue crack growth rate in presence of significant plasticity	417
O. Kolednik, W. Ochensberger	
Low cycle fatigue of short fibre reinforced Polyamides	419
N. Stötzner, A. Büter, D. Spancken, D. Laveuve	
Fatigue life of casted structures by probabilistic approach	425
G. Narayanan, U. Nackenhorst	
Probabilistic simulation of notched fatigue behavior and life scatter of materials	433
S. Foletti, S.-P. Zhu, S. Beretta	
Enhancing fatigue life through ultrasonic shot peening	439
V. Harrinanan, G. J. Pataky	
Fatigue life assessment of high-strength steel butt welds by the notch strain approach considering the elastic-plastic behavior	445
H. Kaufmann, R. Wagener, T. Melz, B. Möller	
The mismatch effect on LCF resistance of Q+T high strength steels and their welded joints	451
M. Gáspár, G. Nagy, Á. Dobosy	
Contribution to the estimation of cyclic material properties	457
A. Esderts, M. Wächter	

Case Studies SF2M

Automotive engine parts: recent advances on thermalmechanical fatigue design and upcoming challenges	465
P. D. Masson, P. Osmond, F. Szymtka, F. Hoche, L. Rémy	
Fatigue assessment of thick-walled nodular cast iron with regard to highly loaded machine structures using the strainlife approach	471
T. Melz, R. Wagener, J. Hesseler, C. Bleicher, J. Baumgartner, K. Schnabel, H. Kaufmann	
Scale effects in LCF fatigue: from the specimen to the aircraft engine part	477
F. Denard, A. Longuet, Q. Pujol	
LCF based Critical Parts Lifing for Aero Engine Discs made of the Nickel-base alloy ALLVAC® 718Plus™ – a case study	479
P. Duó, A. Lacher, W. Rothkegel, H. Schlums, M. Schurig	
Creep-fatigue Failure Mechanism and Life Prediction Methodology of Liquid Rocket Engine Combustors under Severe Multi-physics Environments	485
H. Akiba, S. Hori, N. Kasahara, H. Negishi, H. Sunakawa, S. Yoshimura, M. Nishimoto	
Lifetime Assessment of Notched Components under LCF-Loading	491
A. Scholz, C. Kontermann, M. Oechsner	
Small Creep-Faigue Crack Propagation Rates Accelerated under Small Scale Creep Condition around Cooling Holes in A Ni-base superalloy.	493
S. Rajivgandhi, S. Yamagishi, M. Okazaki, A. Metoki	
Low cycle fatigue of automotive heat exchangers: Reliability of engine cooling radiators	499
M. Bonato, P. Goge	
Thermo-mechanical fatigue of stainless steels for the life time prediction of automotive exhaust component	505
B. Prout, P.-O. Santacreu, I. Evenepoel, C. Prudhomme	
A review of thermomechanical fatigue damage calculations with the damage operator approach	511
A. Gosar, M. Hack, E. Hansenne, D. Šeruga, M. Nagode	
Author Index	517