



PRELIMINARY PROGRAMME

12th International Seminar
Numerical Analysis of Weldability
23 - 26 September 2018

Graz - Seggau - Austria

IIW Commission IX
WG Mathematical Modelling of Weld Phenomena



12th International Seminar Numerical Analysis of Weldability Chairman: C. Sommitsch Co-Chairmen: N. Enzinger, P. Mayr Honorary Chairman: H. Cerjak

With the 12th International Seminar „Numerical Analysis of Weldability“, a tradition of successful meetings will be continued. Since the first of these events in 1991, this seminar series has developed to be a world leading conference in the growing field of the development of methods for predicting the microstructure and properties of welds. It is both, of practical importance and academic interest and it supports the philosophy of computer modelling, which helps to optimise welding processes and consumables as well as the service behaviour of welded components. Leading experts in this field attend the seminar and present their latest results in the calm atmosphere of an ancient castle. The seminar is organized by the Institute of Materials Science, Joining and Forming of Graz University of Technology.

The following items (among others) of development and application of numerical analysis shall be discussed:

- Arc Welding, Melt Pool and Solidification
- Microstructural Modelling in Weld Metal and Heat Affected Zone
- Microstructure and Mechanical Properties
- Residual Stresses and Distortion
- Cracking Phenomena and Hydrogen Effects
- Solid State and Friction Stir Welding
- Special Joining Processes
- Modelling Tools and Computer Programs
- Additive Manufacturing



Publication

After a peer review process, the contributions will be published as a book. Furthermore, all papers can be published as open access articles.

IIW Kenneth Easterling Best Paper Award

This IIW award, which is sponsored by the Institute for Materials Science, Joining and Forming of Graz University of Technology, will be awarded for the sixth time.

It is given to the paper *“which is valued by an international committee as the best contribution made over the three years proceeding on the advancement of knowledge or practice in respect of mathematical modelling of weld phenomena”*.

Post Conference Workshop announcement: Optimal Design and Computational Weld Mechanics (John Goldak)

Time: Wednesday, 26 September 2018 from 2:00 pm - 6:00 pm

Fee: € 100,- (Post Conference Workshop places are limited so early registration is advised).

The Programme of the workshop can be found on our conference website: www.seggau.tugraz.at

The programme at a glance

Sunday, 23 rd September 2018	Arrival day	
	19:00	Welcome reception Special act: Music performance Dinner at Schloss Seggau
Monday, 24 th September 2018	08:15 - 08:30	Welcome address and introduction
	08:30 - 17:35	Presentations
	18:00	Bus departure to dinner location at 18:00 (Bus 1) and at 18:30 (Bus 2) Buschenschank Schneeberger
Tuesday, 25 th September 2018	08:30 - 17:15	Presentations
	17:50 - 18:45	Guided tour through Schloss Seggau
	19:00	Wine tasting and styrian evening Best paper award ceremony
Wednesday, 26 th September 2016	08:30 - 12:50	Presentations
	12:50 - 14:00	Lunch and End of the seminar

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Scientific committee

Chairman: Christof Sommitsch, Graz University of Technology - IMAT, Austria
Vice Chairmen: Norbert Enzinger, Graz University of Technology - IMAT, Austria
 Peter Mayr, Technische Universität Chemnitz - IFMT, Germany
Honorary Chairman: Horst Cerjak, Graz University of Technology - IMAT, Austria

Murugaiyan Amirthalingam, Indian Institute of Technology Madras, India
Sudarsanam Babu, The University of Tennessee, USA
Thomas Böllinghaus, BAM - Federal Institute for Materials Research and Testing Berlin, Germany
Amitava De, Indian Institute of Technology, Bombay, India
Jesper Hattel, Technical University of Denmark, Denmark
Toshihiko Koseki, The University of Tokyo, Japan
Ernst Kozeschnik, Vienna University of Technology, Austria
Tobias Loose, DynaWeld GmbH & Co. KG, Germany
Wenya Li, Northwestern Polytechnical University, P.R. China
Stephen Liu, Colorado School of Mines, USA
Patricio F. Mendez, University of Alberta, Canada
Suck Joo Na, Department of Mechanical Engineering, KAIST, Republic of Korea
Uwe Reisgen, RWTH Aachen University, Germany
Michael Rethmeier, Technische Universität Berlin, Germany
Ian M. Richardson, Delft University of Technology, The Netherlands
Kazuyoshi Saida, Osaka University, Japan
Gleb A. Turichin, Saint Petersburg State Polytechnical University, Russia
ChuanSong Wu, Shandong University, Jinan, China
Norman Y. Zhou, University of Waterloo, Canada

MONDAY, 23RD SEPTEMBER 2018

08:15 - 08:30 **Welcome address and introduction**
Rector Harald Kainz, Graz University of Technology

I Arc Welding, Melt Pool and Solidification

Chairman: Peter Mayr

08:30 - 08:55 **KEYNOTE**
Complete 3D heat and fluid flow modeling of keyhole laser welding and methods to reduce calculation times
M. COURTOIS¹, M. CARIN¹, P. LE MASSON¹, S. GAIED²
1: IRDL - Univ. Bretagne Sud, France
2: Arcelor Mittal Global R&D Montataire, France

08:55 - 09:15 **Computational prediction of penetration shapes in MIG welding of practical aluminum alloy joints**
H. SERIZAWA¹, S. SATO², F. MIYASAKA²
1: Joining and Welding Research Institute, Osaka University, Ibaraki, Osaka, Japan
2: Graduate School of Engineering, Osaka University, Suita, Osaka, Japan

09:15 - 09:35 **Unsteady numerical coupling of plasma / weldpool models for heat transfer in welding process**
X. YAU, D. BOREL, S. BELOUAH, J. DELMAS: EDF R&D, Chatou, France

09:35 - 09:55 **A modelling approach of hyperbaric gas metal arc welding (GMAW)**
M. RUDSHAUG: Institute for Energy Technology, Computational Materials Processing Department, Norway

09:55 - 10:15 **Numerical investigation on the influence of welding parameters on the weld pool dynamics and the distribution of second phase particles**
R. KABOLI, P. MAYR: Technische Universität Chemnitz, Germany

10:15 - 10:40 COFFEE BREAK

II Microstructure Modelling in WM and HAZ

Chairman: Toshihiko Koseki

10:40 - 11:05 **KEYNOTE**
Numerical simulation of ferrite/austenite phase fraction in multipass welds of duplex stainless steels
T. OGURA¹, K. SAIDA¹, T. MATSUMURA¹, L. YU¹, H. INOUE², Y. OIKAWA³
1: Dept. of Materials and Manufacturing Science, Osaka University, Japan
2: Joining & Welding Research Institute, Osaka University, Japan
3: Nippon Steel & Sumikin Stainless Steel Corporation, Japan

- 11:05 - 11:25 **The influence of chemistry inhomogeneity on microstructure development and residual stress**
J. NI¹, J.V. VOORDE², J. ANTONISSEN², M.A. WAHAB¹:
 1. Laboratory Soete, Faculty of Engineering and Architecture, Ghent University, Belgium
 2. Research Centre for the Application of Steel (OCAS), Zwijnaarde, Belgium
- 11:25 - 11:45 **Kinetic monte carlo simulation of pulse Cu30Ni bead on plate**
A. CHIOCCA¹, F. SOULIÉ¹, F. DESCHAUX-BEAUME¹, J. MICHELL², C. BORDREUIL¹:
 1. Université de Montpellier, France
 2. Sandia labs, USA
- 11:45 - 12:05 **Multi-pass ferritic steel weld modelling: phase transformation and residual stress**
Y. SUN¹, C.J. HAMELIN², T.F. FLINT¹, M.C. SMITH¹, J.A. FRANCIS¹, A.N. VASILEIOU¹:
 1. The University of Manchester, Manchester, UK
 2. Australian Nuclear Science and Technology Organisation, Lucas Heights, Australia
- 12:05 - 12:25 **Numerical modelling of welding of martensitic steel**
B. SMOLJAN¹, D. ILJKIC², S. SMOKVINA HANZA², L. STIC², M. JOKIC¹:
 1. Polytechnic of Pula, College of Applied Sciences, Pula, Croatia
 2. University of Rijeka, Faculty of Engineering, Rijeka, Croatia
- 12:25 - 13:45 LUNCH**
- 13:45 - 14:05 **Modeling of welded stainless steel spent fuel canister in atmospheric stress corrosion cracking**
S. LIU, S. GORDON, X. WU, Z. YU: Colorado School of Mines, USA
- 14:05 - 14:25 **Computational analysis of the yield stress of ultra-high strength all-weld metals**
D. ZÜGNER¹, S. HOLLY², R. SCHNITZER³, P. HASLBERGER³, W. ERNST⁴, E. KOZESCHNIK¹:
 1. Institute of Materials Science and Technology, TU Wien, Austria
 2. voestalpine Wire Technology GmbH, Bruck an der Mur, Austria
 3. Department of Physical Metallurgy and Materials Testing, Montanuniversität Leoben, Austria
 4. voestalpine Stahl GmbH, Linz, Austria

IV Residual Stresses and Distortion

Chairman: Jesper Hattel

- 14:25 - 14:50 **KEYNOTE**
Distortion analysis of large scaled welded structures
N. DOYNOV¹, C. STAPELFELD², V. MICHAILOV¹, H. PASTERNAK², B. LAUNERT²:
 1. Department of Joining and Welding Technology, Brandenburg University of Technology (BTU) Cottbus - Senftenberg, Germany
 2. Chair of Steel and Timber Structures, Brandenburg University of Technology (BTU), Cottbus - Senftenberg, Germany

- 14:50 - 15:10 **Finite element simulation of temperature fields and residual stresses in selective laser melting**
M. KÄß^{1,2}, M. WERZ², S. WEIHE^{1,2}
1. Materials Testing Institute (MPA), University of Stuttgart, Germany
2. Institute for Materials Testing, Materials Science and Strength of Materials (IMWF), University of Stuttgart, Germany
- 15:10 - 15:30 **A shift technique for multi-pass welding simulation**
P. PEREIRA-ALVAREZ^{1,2}, T. DINH-TRONG^{1,2}, S. HENDILI¹, V. ROBIN¹, J. DELMAS¹:
1. EDF R&D, Chatou, France
2. Centre des Matériaux, MINES Paris Tech, CNRS UMR, Evry, France
- 15:30 - 15:55 **COFFEE BREAK**
- 15:55 - 16:15 **How reliable are prediction and measurement of weld residual stresses - lessons from the NeT Network**
M. C. SMITH: The University of Manchester, Manchester, UK
- 16:15 - 16:35 **Numerical analysis of load carrying capacity of butt welds of high-strength steels**
J. HILDEBRAND¹, J. SPIEGLER², J.P. BERGMANN¹, U. KUHLMANN²
1. Production Technology Group, TU Ilmenau, Ilmenau, Germany
2. Universität Stuttgart, Stuttgart, Germany

V Cracking Phenomena and Hydrogen Effects

Chairman: Chuan Song Wu

- 16:35 - 16:55 **Numerical simulation of hydrogen assisted stress corrosion cracking originating from pits**
M.C. MADIGAN^{1,2}, T. MENTE¹, T. BÖLLINGHAUS¹
1. Bundesanstalt für Materialforschung und -prüfung (BAM), Germany
2. DNV GL, Norway
- 16:55 - 17:15 **Study of solidification cracking in automotive advanced high strength steels**
G. AGARWAL¹, H. GAO^{1,2}, M. AMIRTHALINGAM³, I.M. RICHARDSON¹, M.J.M. HERMANS¹:
1. Delft University of Technology, Delft, The Netherlands
2. Tata Steel, CA IJmuiden, The Netherlands
3. Indian Institute of Technology Madras, Chennai, India
- 17:15 - 17:35 **Simulation of weld hot cracking in nickel-based superalloys**
J. DRAXLER, P.J. EDBERG, L-E. LINDGREN: Lulea University of Technology, 97187, Lulea, Sweden
- 18:00 **Bus I departure to dinner: Buschenschank Schneeberger**
18:30 **Bus II departure to dinner: Buschenschank Schneeberger**

VI Solid State and Friction Stir Welding

Chairman: Wenya Li

- 08:30 - 08:55 **KEYNOTE**
3D finite element analysis of the linear friction welding of a beta titanium alloy
Q. YE¹, W. LI¹, X. WANG¹, T. MA¹, X. YANG¹, A. VAIRIS^{1,2}:
1. State Key Laboratory of Solidification Processing, Shaanxi Key Laboratory of Friction Welding Technologies, Northwestern Polytechnical University, China, People's Republic of China.
2. Mechanical Engineering Department, TEI of Crete, Heraklion, Greece
- 08:55 - 09:20 **KEYNOTE**
Analysis of acoustic softening, heat and material flow in ultrasonic vibration enhanced friction stir welding
C.S. WU, L. SHI, J. CHEN: Shandong University, People's Republic of China
- 09:20 - 09:40 **Numerical analysis of interfacial strength evolution between dissimilar metals during solid-state bonding at low temperatures**
S. NAMBU, K. PONGMORAKOT, T. KOSEKI
The University of Tokyo, Bunkyo-ku, Tokyo, Japan
- 09:40 - 10:00 **Grain refinement via FSP on the basis of Zener-Hollomon parameter analyses**
Y. KIMOTO¹, T. NAGAOKA¹, T. TAKEUCHI¹, P. CENGER², G. KREXNER², D. SETMAN², E. SHAFER², M. ZEHETBAUER², A. HÜTTER³, N. ENZINGER³:
1. Osaka Research Institute of Industrial Science and Technology, Japan
2. Faculty of Physics, University of Vienna, Austria
3. IMAT, Graz University of Technology, Austria
- 10:00 - 10:20 **Thermo-mechanical model of the friction stir welding process and its application for the aluminum alloy AA5754**
U. REISGEN¹, A. SCHIEBAHN¹, A. NAUMOV¹, A. MASLENNIKOV¹, V. EROFEEV²
1. Welding and Joining Institute of RWTH Aachen University, Germany
2. Tula State University, Welding department, Russia
- 10:20 - 10:45 **COFFEE BREAK**
- 10:45 - 11:05 **Development of a model to investigate the interaction between process and machine tool and the resulting dynamics of friction stir welding**
F. PANZER¹, M. WERZ², S. WEIHE²:
1. Institute for Materials Testing, Materials Science and Strength of Materials (IMWF), Stuttgart, Germany
2. Materials Testing Institute (MPA), University of Stuttgart, Germany

- 11:05 - 11:25 **Advances in numerical modelling of linear friction welded high strength steel chains**
P. EFFERTZ¹, F. FUCHS², N. ENZINGER¹:
 1. IMAT, Graz University of Technology, Graz, Austria
 2. Pewag Austria GmbH, Kapfenberg, Austria
- 11:25 - 11:45 **Numerical Simulation of Rotary Friction Welding of Molybdenum**
M. STÜTZ¹, F. KOGLER¹, J. WAGNER, N. REHEIS², N. ENZINGER¹:
 1. IMAT, Graz University of Technology, Graz, Austria
 2. Plansee SE, Austria
- ## VII Special Joining Processes
- ### Chairman: Michael Rethmeier
- 11:45 - 12:05 **A novel approach for calculating the thermal cycle of a laser beam welding process using a stationary CFD model**
A. ARTINOV¹, M. BACHMANN¹, V. KARKHIN², M. RETHMEIER^{1,2,3}:
 1. BAM Federal Institute for Materials Research and Testing, Berlin
 2. Department of Laser Technologies, Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia
 3. Department of Joining Technology, Berlin Institute of Technology, Berlin, Germany
- 12:05 - 12:25 **Electrical contact resistance model for aluminum resistance spot welding**
M. PIOTT¹, A. WERBER¹, L. SCHLEUß², N. DOYNOV², R. OSSENBRINK², V.G. MICHAILOV²:
 1. Daimler AG, Germany
 2. Department of Joining and Welding Technology, Brandenburg University of Technology, Germany
- 12:25 - 13:45 LUNCH**
- 13:45 - 14:05 **Overheating induced by Al-Si coating during spot welding of a dissymmetrical three sheets assembly**
E. GESLAIN¹, P. ROGEON¹, T. PIERRE¹, C. POUVREAU¹, L. CRETTEUR²:
 1. IRDL, UMR CNRS 6027, Université Bretagne Sud, Lorient, France
 2. ArcelorMittal Global R&D, Montataire, France
- 14:05 - 14:25: **Advancing spot welding process assessment**
J. KAARS¹, P. MAYR¹, K. KOPPE²:
 1. TU Chemnitz, Germany
 2. HS Anhalt, Köthen, Germany
- 14:25 - 14:45 **Multiphysics finite element simulation of resistance spot welding to evaluate liquid metal embrittlement in Advanced High Strength Steels**
K. M. PRABITZ¹, W. ECKER¹, M. BORCHERT¹, T. ANTRETTER², H. SCHUBERT³, B. HILPERT³:
 1. Materials Center Leoben Forschung GmbH, Austria
 2. Montanuniversität Leoben, Austria
 3. Daimler AG, Germany
- 14:45 - 15:05 **Magnetic pulse welding of tubular parts - process modeling**
R. SHOTRI, A. DE: Indian Institute of Technology, Mumbai, India
- 15:05 - 15:30 COFFEE BREAK**

VIII Modelling Tools and Computer Programs

Chairman: Patricio Mendez

- 15:30 - 15:55 **KEYNOTE**
Correlating large sets of experimental data with high resolution computational weld mechanics models
J.A. GOLDAK¹, M. MARTINEZ², D. AIDUN², Z. JIANGUO¹, T. STANISLAV¹, N. HOSSEIN¹:
1. Carleton University, Ottawa, Canada
2. Clarkson University, New York, USA
- 15:55 - 16:15 **Investigation of the influence of the welding geometry and heat input on the parameters of the adaptive function**
M.B. NASIRI, N. ENZINGER: IMAT, Graz University of Technology, Austria
- 16:15 - 16:35 **Prediction of grain boundary evolution in an titanium alloy substrate using a novel phase field model coupled with a semi-analytical thermal solution**
T.F. FLINT, Y. SUN, M.C. SMITH:
The University of Manchester, United Kingdom
- 16:35 - 16:55 **Experimental validation of a simplified welding simulation approach for fatigue assessments**
N. FRIEDRICH, S. EHLERS:
Hamburg University of Technology, Hamburg, Germany
- 16:55 - 17:15 **Real-time welding simulation for education**
O. MOKROV¹, A. SCHMIDT¹, U. REISGEN¹, A. BEHMEL², J. MARTIN², A. BECIROVIC³:
1. Institut für Schweißtechnik und Fügetechnik der RWTH Aachen University, Aachen, Germany
2. Institute of Design & Communication der FH JOANNEUM Gesellschaft mbH, Graz, Austria
3. Fronius International GmbH, Wels, Thalheim, Austria
- 17:50 - 18:45 **Guided tour through Schloss Seggau (optional - please register by 12:30 pm)**
- 19:00 **Wine tasting and Styrian evening at Schloss Seggau**
Best paper award ceremony

WEDNESDAY, 26TH SEPTEMBER 2018

- 08:30 - 08:50 **Asymptotics and blending in the modeling of welding**
P. MENDEZ, Y. WANG, Y. LU; M. GRAMS, D. HAVRYLOV:
University of Alberta, Canada
- 08:50 - 09:10 **Development of simultaneous transformation kinetics model for AM**
N. RAGHAVAN, S. SIMUNOVIC, J. TURNER:
Oak Ridge National Laboratory, USA

IX Additive Manufacturing

Chairman: I. Richardson

- 09:10 - 09:35 **KEYNOTE**
Role of Integrated Computational Weld Models in Accelerating the Qualification of Additively Manufactured Metallic Components
S. BABU: University of Tennessee, Knoxville/Oak Ridge, National Laboratory, USA
- 09:35 - 09:55 **Improvement of numerical simulation model setup and calculation time in additive manufacturing Laser-Metal-Deposition components with an advanced modelling strategy**
M. BIEGLER¹, P. KHAZAN², M. GATZEN², M. RETHMEIER^{1,3}:
1. Fraunhofer Institute of Production Systems and Design Technology (IPK), Berlin, Germany
2. Simufact engineering GmbH, Hamburg, Germany
3. Federal Institute of Materials Research and Testing (BAM), Berlin, Germany
- 09:55 - 10:15 **Additive Manufacturing Part Manufacturability**
P.-A. PIRES¹, O. DESMAISON¹, J. WILLEMS², M. MEGAHED²:
1. ESI Group, France
2. ESI Software Germany GmbH, Germany

10:15 - 10:40 COFFEE BREAK

Chairman: C. Sommitsch

- 10:40 : 11:00 **Influence of the first weld bead on strain and stress states in Wire+Arc Additive Manufacturing**
C. CAMBON, I. BENDAOU, S. ROUQUETTE, F. SOULIE:
Université de Montpellier, France
- 11:00 - 11:20 **Case studies on topology optimization for AddJoining metal-polymer hybrid structures**
R. FALCK¹, J. F. DOS SANTOS¹, S. T. AMANCIO-FILHO²:
1. Helmholtz-Zentrum Geesthacht, Geesthacht, Germany
2. IMAT, Graz University of Technology, Graz, Austria

- 11:20 - 11:40 **New approach for fast numerical prediction of residual stress and distortion of AM parts considering phase transformations**
M. SCHÄNZEL¹, A. ILIN¹, V. PLOSHIKHIN²:
 1. Robert Bosch GmbH, Renningen, Germany
 2. University of Bremen, Bremen, Germany
- 11:40 - 12:00 **Numerical modelling of thermal phenomenon during Wire Laser Additive Manufacturing (WLAM)**
V. K. PARUCHURI, M. HERMANS, I. RICHARDSON:
 Department of Materials Science and Engineering, TU Delft,
 The Netherlands
- 12:00 - 12:20 **Numerical simulation of the distortion and residual stress of a multi-layered 3D joint structure with low-alloyed filler metal**
J. HILDEBRAND; J. REIMANN, J.P. BERGMANN:
 TU Ilmenau, Ilmenau, Germany
- 12:20 - 12:40 **Multi-scale multiphysics simulation of metal powder bed fusion AM process and subsequent mechanical analysis**
M. BAYAT, M. MOSHIRI, S. MOHANTY, J.H. HATTEL:
 Technical University of Denmark, Denmark
- 12:40 - 12:50 **Summary and conclusion**
C. SOMMITSCH
- 12:50 - 14:00 **LUNCH**
- 14:00 - 18:00 **POST CONFERENCE WORKSHOP: PROF. J. GOLDAK**

END OF SEMINAR

Sponsors of the seminar



POSTERS

The posters are accessible during the whole seminar. Please place your poster on Monday morning. Coffee breaks are served in the poster session rooms. All authors are kindly asked and invited to stay with their posters during the breaks.

I Arc Welding, Melt Pool and Solidification

A fine modification of the double ellipsoid heat source

O. MOKROV, M.S. SIMON, A. SCHIEBAHN, U. REISGEN: RWTH Aachen, Germany

Validation of heat source model for metal active gas welding

D. KOLLÁR, B. KÖVESDI:

Budapest University of Technology and Economics, Budapest, Hungary

Study of coupled influence of evaporation and fluid flow inside a weld pool on welded seam formation in GMAW

O. MOKROV, O. LISNYI, M.S. SIMON, A. SCHIEBAHN, U. REISGEN: RWTH Aachen, Germany

The influence of the heat source implementation method on numerical predictions of free surface oscillation during a laser spot welding process

A. EBRAHIMI¹, C. R. KLEIJN², I.M. RICHARDSON¹:

1. Department of Materials Science and Engineering, Delft University of Technology, Delft, The Netherlands
2. Department of Chemical Engineering, Delft University of Technology, Delft, The Netherlands

Experimental and analytical analysis of metal transfer in gas metal arc welding

E. UDDIN, S.R. SHAH, U.IQBAL, N. ARIF:

National University of Sciences and Technology (NUST), Islamabad, Pakistan

Effect of shielding gas on heat transfer in pulsed gas metal arc welding

N. ARIF¹, E. UDDIN², A. BUTT², S.R. SHAH²:

1. Centre of Excellence in Science & Applied Technologies, Islamabad, Pakistan
2. National University of Sciences and Technology (NUST), Islamabad, Pakistan

II Microstructural Modelling in Weld Metal and Heat Affected Zone

3D-FE welding simulation in DynaWeld® with an integrated model to calculate the change of hardness inside the HAZ during GMAW of pearlitic rails

L. WEINGRILL¹, T. LOOSE², N. ENZINGER¹:

1. IMAT, Graz University of Technology, Austria
2. DynaWeld GmbH & Co. KG, Walzbachtal, Germany

Numerical Simulation of Cu-rich precipitate evolution in Cu-bearing 316L austenitic stainless steel

Q. XIONG, M. SMITH: University of Manchester, United Kingdom

Application and evaluation of residual stresses obtained experimentally by the contour method for friction stir welding of a precipitate hardened aluminum alloy
M.R. SONNE, J.H. HATTEL: Technical University of Denmark, Denmark

Electron beam weld modelling of ferritic steel: effect of prior-austenite grain size on transformation kinetics

A. N. VAILEIOU¹, C.J. HAMELIN², M.C. SMITH¹, J.A. FRANCIS¹, Y. SUN¹, T. FLINT¹:

1. The University of Manchester, Manchester, UK

2. Australian Nuclear Science and Technology Organisation, NSW, Lucas Heights, Australia

III Microstructure and Mechanical Properties

Mechanical properties and microstructure development for precipitation hardened aluminium alloy 6082 in thermal welding cycles for FEM simulations

M. REICH¹, P. WIECHMANN¹, M. SANDER², O. KESSLER¹:

1. Chair of Materials Science, University of Rostock, Germany

2. Chair of Structural Mechanics, University of Rostock, Germany

Sequentially coupled electrothermal - mechanical finite element calculations of the resistance spot welding process of high strength steels with focus on the modelling of microstructure and softening zone

F. SCHREYER, S. WEIHE: Materials Testing Institute (MPA), University of Stuttgart, Germany

IV Residual Stresses and Distortion

Investigation of transverse shrinkage and angular distortion caused by Laser-Arc Hybrid Welding

C. ALBUQUERQUE¹, K. GOTOH², T. F.A. SANTOS¹, S. L. URTIGA FILHO¹:

1. Universidade Federal de Pernambuco, Recife, Brazil

2. Kyushu University, Fukuoka, Japan

Process chain simulation of laser cladding and cold metal forming

P. KHAZAN¹, A. KZZO¹, R. HAMA-SALEH², A. WEISHEIT², I. UNSAL³, M. BAMBACH³:

1. Simufact Engineering GmbH, Hamburg, Germany

2. Fraunhofer-Institut für Lasertechnik, Aachen, Germany

3. Chair of Mechanical Design and Manufacturing, BTU Cottbus-Senftenberg, Cottbus, Germany

Analysis of viscoplastic and hardening modelling choices on numerically predicted stresses and distortions in a single-pass grade S960QL steel weld

N. HAEBERL, A. PITTNER, M. RETHMEIER:

BAM: Bundesanstalt für Materialforschung und -prüfung, Germany

Evaluation of two methods for welding distortion simulation using the example of a crane component

A. BAUMGARTNER^{1,2}, F. WIRNSPERGER², N. ENZINGER¹:

1. IMAT, Graz University of Technology, Austria

2. Palfinger Europe GmbH, Lengau, Austria

Simulation of welding residual stresses – from theory to practice

S. GKATZOGIANNIS, P. KNOEDEL, T. UMMENHOFER:

KIT Steel & Lightweight Structures Research Center for Steel, Timber & Masonry, Karlsruhe, Germany

Residual stress measurements and model validation of single and double pulse resistance spot welded advanced high strength steel

P. EFTEKHARIMILANI¹, H. GAO², R.M. HUIZENGA¹, E.M. van der AA², M. AMIRTHALINGHAM³, I.M. RICHARDSON¹, M.J.M. HERMANS¹:

1. Delft University of Technology, The Netherlands

2. Tata Steel, The Netherlands; 3. Indian Institute of Technology Madras, India

Numerical simulation of stress behavior during shot peening

K. IKUSHIMA¹, M. SHIBAHARA¹, Y. YAMADA¹, S. NISHIKAWA², T. FURUKAWA², K. AKITA³:

1. Graduate School of Engineering, Osaka Prefecture University, Sakai, Osaka, Japan

2. Japan Power Engineering and Inspection Corporation, Yokohama, Kanagawa, Japan

3. Japan Atomic Energy Agency, Tokai, Ibaraki, Japan

Laser beam welding of steel-aluminum joints - Influence of weld metal elastic-plastic properties on the distortions

A. EVDOKIMOV, R. OSSENBRINK, N. DOYNOV, V. MICHAILOV: Brandenburg University of Technology Cottbus-Senftenberg, Cottbus, Germany

V Cracking Phenomena and Hydrogen Effects

Use of modelling to characterize the risk of hot cracking in austenitic stainless steels during welding

V. ROBIN¹, G. TRAN-VAN¹, D. CARRON², P. LE-MASSON², A. ANDRIEU¹, J. DELMAS¹:

1. EDF R&D, Chatou, France

2. Université Bretagne Sud, CNRS, France

Prediction of solidification cracking on welding considering metallurgical and mechanical behavior

S. MAEDA¹, K. IKUSHIMA², M. SHIBAHARA², N. MA³:

1. Graduate School of Engineering, Osaka, University, Japan

2. Graduate School of Engineering, Osaka Prefecture University, Japan

3. JWRI, Osaka University, Japan

Numerical simulation of temperature and residual stress fields in SLM process

S.-M. RAUSCHER, T. GÖHLER: MTU Aero Engines AG, Munich, Germany

VI Solid State and Friction Stir Welding

Implementation and validation of a new material model for friction stir welding process simulations

M. WERZ: Materials Testing Institute University of Stuttgart (MPA), Germany

A proposal for thermal computational model for API 5L-X80 steel friction stir welds based on thermocouples measurements

G.G. DE SOUSA, M. MONTOYA, N. BOUCHONNEAU; T.F.C. HERMENEGILDO, T.F.A. SANTOS:
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Influence of the probe geometrical features on the stress condition of the tool during friction stir welding

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Numerical analysis of temperature distribution in refill friction stir spot welding

H. SU, J.F. DOS SANTOS: *Helmholtz-Zentrum Geesthacht, Germany*

Modelling approach to the microstructure simulation in pure Aluminium during the RFW process

E. HEPPNER, E. WOSCHKE: *Otto von Guericke University Magdeburg, Germany*

Numerical modelling of material flow in friction stir welding

K.K. MUGADA, K. ADEPU: *National Institute of Technology Warangal, India*

VII Special Joining Processes

CFD Simulation of particle movement during Atmospheric Plasma Spraying

M. STUMMER, N. ENZINGER: *IMAT, Graz University of Technology, Austria*

Improvement of weldability of dissymmetric assembly with very thin sheet during resistance spot welding

J. QUEVAL¹, E. GESLAIN¹, P. ROGEON¹, T. PIERRE¹, C. POUVREAU¹, L. CRETTEUR², S. MARIE³:

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2. Arcelor Mittal Global R&D, Montataire, France

3. Transvalor S.A. Mougins, France

Numerical analysis of an aluminum-steel compound during one-sided conductive heating

M. BIELENIN, K. SZALLIS, J. HILDEBRAND, J.P. BERGMANN:

TU Ilmenau, Ilmenau, Germany

Mechanical properties of the heat affected zone in welded blanks of aluminum alloy EN AW-6063

Z. SILVAYEH¹, B. FELLNER², B. GÖTZINGER², C. SOMMITSCH¹:

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Modelling material flow in friction riveting of polymeric materials

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VIII Modelling Tools and Computer Programs

Process simulation of TIG welding for the development of an automatic robot torch through heat pipe - head cooling system

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2 Institute of Joining and Assembly Technologies, Chemnitz University of Technology, Germany

Evaporation-determined model for arc heat input in the cathode area by GMA welding

O. MOKROV, M.S. SIMON, A. SCHIEBAHN, U. REISGEN:

RWTH Aachen University, Aachen, Germany

Improving product performance and distortion control with end-to-end account of stamp, weld and assembly manufacturing histories

F. BOITOU¹, S. AGGARWAL², A. DUMON³, Y. VINCENT¹:

1. ESI Group, France

2. Calcom ESI, Switzerland

3. ESI Group Shanghai, China

Potentials of the ALE-method for modeling plastics welding processes, in particular for the quasi-simultaneous laser transmission welding

A. SCHMAILZL¹, S. HÜNTELMANN¹, T. LOOSE², J. KÄSBAUER¹, F. MAIWALD¹, S. HIERL¹:

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2. DynaWeld GmbH & Co. KG, Wössingen, Germany

Open-source numerical simulation softwares and skill-module for welding simulations

S. BELOUAH, D. BOREL, J. DELMAS, S. HENDILI, V. ROBIN: EDF R&D, Chatou, France

IX Additive Manufacturing

Development of a two-dimensional axial symmetry model for wire arc additive manufacturing

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Exhibitors

Fronius Virtual Welding Competition

All participants of the 12th International Seminar Numerical Analysis of Weldability are invited to take part in the Virtual Welding competition.

On the two conference days Monday and Tuesday, 24th and 25th of September, during the coffee breaks, you can execute training and simulation tasks at the Virtual Welding Simulator. Your score will be recorded in a ranking list. The three participants with the highest scores will be awarded during the „Styrian Evening“ (Tuesday, 25th of September).

Fronius International GmbH is looking forward to welcoming you at the booth and wishes all participants in advance good luck for the Virtual Welding competition.

Further Information:

Information regarding Fronius Virtual Welding Simulator will be given during the conference by Fronius International GmbH employees and researchers of FH JOANNEUM Graz.

If you want to get some information in advance please visit the homepage of Fronius International GmbH www.fronius.com.



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Recognizing and preventing welding distortions

Welding distortions represent the greatest economic problem for welding process design, next to reduced tensile strength. The simulation software Simufact.welding caters to this problem and allows the user to calculate distortions ahead of time. By implementing complex material models, the resulting local material properties can be calculated and considered during the calculation of distortion on a single user interface. As a result, the number of development loops is greatly reduced.

The Software conveys a broad understanding of the process to the user and aids in the process design by

- Visualization of process influencing values, especially on the temperature distribution, residual stresses and deformations
- Virtual try-out of clamping, welding sequences, clamping times, effects of preheating as well as variation of materials

The new release Simufact.welding 5 also offers an extended application spectrum and covers arc and beam welding in addition to resistance spot welding.



Venue

The 12th International Seminar „Numerical Analysis of Weldability“ will take place at Schloss Seggau, the former bishop residence in the Styrian wine area 40 km south of Graz, Austria.



How to reach Graz

Graz has currently direct scheduled flight connections from Amsterdam, Berlin, Düsseldorf, Frankfurt, Istanbul, München, Palma de Mallorca, Stuttgart, Vienna and Zurich. For more information please visit the website Graz Airport <http://www.flughafen-graz.at/en/home>.

Seminar Organisation

Graz University of Technology, Institute for Materials Science, Joining and Forming and IIW Commission IX, Working Group „Mathematical Modelling of Weld Phenomena“

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