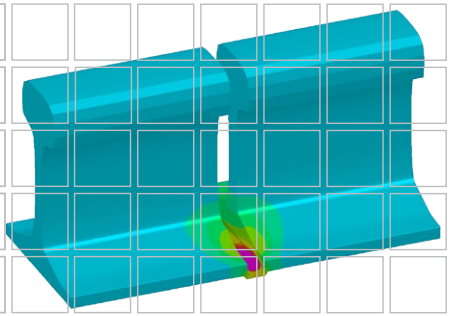
Graz University of Technology

Institute of Materials Science, Joining and Forming
Univ.-Prof. Dipl.-Ing. Dr.techn. Christof Sommitsch

IMAT



FINAL PROGRAMME

12th International Seminar

Numerical Analysis of Weldability

23 - 26 September 2018

Graz - Seggau - Austria

IIW Commission IX
WG Mathematical Modelling of Weld Phenomena

IMAT
Institute of Materials Science, Joining and Forming – TU Graz

Welcome note

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 Programmes
- 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 as well as by the Metals Journal, 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, 23rd September 2018	**Arrival day**	
	19:00	**Welcome reception** **Special act: Music performance** **Dinner at Schloss Seggau**
Monday, 24th September 2018	08:30 - 08:45	**Welcome address and introduction**
	08:45 - 17:20	**Presentations**
	18:00	**Bus departure to dinner location at 18:00 (Bus 1) and at 18:30 (Bus 2)** **Buschenschank Schneeberger**
Tuesday, 25th September 2018	08:30 - 17:30	**Presentations**
	17:50 - 18:45	**Guided tour through Schloss Seggau**
	19:00	**Wine tasting and styrian evening** **Best paper award ceremony**
Wednesday, 26th September 2018	08:30 - 12:30	**Presentations**
	12:30 - 14:00	**Lunch and End of the seminar**
	14:00 - 18:00	**Post Conference Workshop**

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 Inst itute 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

Seminar programme

Monday, 24th September 2018

08:30 - 08:45 **Welcome address and introduction**
Christof Sommitsch, Graz University of Technology - IMAT, Austria

I Arc Welding, Melt Pool and Solidification

Chairman: Peter Mayr

08:45 - 09:10 **KEYNOTE**
Complete 3D heat and fluid flow modeling of keyhole laser welding and methods to reduce calculation times
M. COURTOIS[1], M. CARIN[1], P. LE MASSON[1], S.GAIED[2]
1: IRDL - Univ. Bretagne Sud, France
2: Arcelor Mittal Global R&D Montataire, France

09:10 - 09:30 **Computational prediction of penetration shapes in MIG welding of practical aluminum alloy joints**
H. SERIZAWA[1], S. SATO[2], F. MIYASAKA[2]
1: Joining and Welding Research Institute, Osaka University, Ibaraki, Osaka, Japan
2: Graduate School of Engineering, Osaka University, Suita, Osaka, Japan

09:30 - 09:50 **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

09:50 - 10:10 **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

10:10 - 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. OGURA[1], K. SAIDA[1], T. MATSUMURA[1], L. YU[1], H. INOUE[2],Y. OIKAWA[3]
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. NI[1], J.V. VOORDE[2], J. ANTONISSEN[2], M.A. WAHAB[1]:
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. CHIOCCA[1], F. SOULIÉ[1], F. DESCHAUX-BEAUME[1], J. MICHELL[2], C. BORDREUIL[1]:
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. SUN[1], C.J. HAMELIN[2], T.F. FLINT[1], M.C. SMITH[1], J.A. FRANCIS[1], A.N. VASILEIOU[1]:
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. SMOLJAN[1], D. ILJKIC[2], S.SMOKVINA HANZA[2], L. STIC[2], M. JOKIC[1]:
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. ZÜGNER[1], S. HOLLY[2], R. SCHNITZER[3], P. HASLBERGER[3], W. ERNST[4], E. KOZESCHNIK[1]:
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. DOYNOV[1], C. STAPELFELD[2], V. MICHAILOV[1], H. PASTERNAK[2], B. LAUNERT[2]:
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. WERZ[2], 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. HENDILI[1], V. ROBIN[1], J. DELMAS[1]:
1. EDF R&D, Chatou, France
2. Centre des Matériaux, MINES Paris Tech, CNRS UMR, Evry, France

15:30 - 16:00 COFFEE BREAK

16:00 - 16:20 **How reliable are prediction and measurement of weld residual stresses - lessons from the NeT Network**
M. C. SMITH: The University of Manchester, Manchester, UK

V Cracking Phenomena and Hydrogen Effects

Chairman: Chuan Song Wu

16:20 - 16:40 **Numerical simulation of hydrogen assisted stress corrosion cracking originating from pits**
M.C. MADIGAN[1,2], T. MENTE[1], T. BÖLLINGHAUS[1]
1. Bundesanstalt für Materialforschung und -prüfung (BAM), Germany
2. DNV GL, Norway

16:40 - 17:00 **Study of solidification cracking in automotive advanced high strength steels**
G. AGARWAL[1], H. GAO[1,2], M. AMIRTHALINGAM[3], I.M. RICHARDSON[1], M.J.M. HERMANS[1]:
1. Delft University of Technology, Delft,The Netherlands
2.Tata Steel, CA IJmuiden, The Netherlands
3. Indian Institute of Technology Madras, Chennai, India

17:00 - 17:20 **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

Tuesday, 25th September 2018

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. YE[1], W. LI[1], X. WANG[1], T. MA[1], X. YANG[1], A. VAIRIS[1,2]:
1. State Key Laboratory of Solidification Processing, Shaanxi Key Laboratory of Friction WeldingTechnologies, 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. KIMOTO[1], T. NAGAOKA[1], T. TAKEUCHI[1], P. CENGERI[2], G. KREXNER[2], D. SETMAN[2], E. SHAFLER[2], M. ZEHETBAUER[2], A. HÜTTER[3], N. ENZINGER[3]:
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. REISGEN[1], A. SCHIEBAHN[1], A. NAUMOV[1], A. MASLENNIKOV[1], V. EROFEEV[2]
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. PANZER[1], M. WERZ[2], S. WEIHE[2]:
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. EFFERTZ[1], F. FUCHS[2], N. ENZINGER[1]:
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. STÜTZ[1], F. KOGLER[1], J. WAGNER, N. REHEIS[2], N. ENZINGER[1]:
1. IMAT, Graz University of Technology, Graz, Austria
2. Plansee SE, Austria

VII Special Joining Processes

Chairman: Marcel Bachmann

11:45 - 12:05 **A novel approach for calculating the thermal cycle of a laser beam welding process using a stationary CFD model**
A. ARTINOV[1], M. BACHMANN[1], V. KARKHIN[2], 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. PIOTT[1], A. WERBER[1], L. SCHLEUß[2], N. DOYNOV[2], R. OSSENBRINK[2], V.G. MICHAILOV[2]:
1. Daimler AG, Germany
2. Department of Joining and Welding Technology, Brandenburg University of Technology, Germany

12:25 - 12:45 **Improvement of weldability of dissymetric assembly with very thin sheet during resistance spot welding**
J. QUEVAL[1], E. GESLAIN[1], P. ROGEON[1], T. PIERRE[1], C. POUVREAU[1], L. CRETTEUR[2], S. MARIE[3]:
1. Université Bretagne Sud, IRDL, Lorient, France
2. Arcelor Mittal Global R&D, Montataire, France
3. Transvalor S.A. Mougins, France

12:45 - 14:00 LUNCH

14:00 - 14:20 **Overheating induced by Al-Si coating during spot welding of a dissymmetrical three sheets assembly**
E. GESLAIN[1], P. ROGEON[1], T. PIERRE[1], C. POUVREAU[1], L. CRETTEUR[2]:
1. IRDL, UMR CNRS 6027, Université Bretagne Sud, Lorient, France
2. ArcelorMittal Global R&D, Montataire, France

14:20 - 14:40: **Advancing spot welding process assessment**
J. KAARS[1]; P. MAYR[1], K. KOPPE[2]:
1. TU Chemnitz, Germany
2. HS Anhalt, Köthen, Germany
3. Daimler AG, Germany

14:40 - 15:00 **Multiphysics finite element simulation of resistance spot welding to evaluate liquid metal embrittlement in Advanced High Strength Steels**
K. M. PRABITZ[1], W. ECKER[1], M. BORCHERT[1], T. ANTRETTER[2], H. SCHUBERT[3], B. HILPERT[3]:
1. Materials Center Leoben Forschung GmbH, Austria
2. Montanuniversität Leoben, Austria

15:00 - 15:20 **Magnetic pulse welding of tubular parts - process modeling**
R. SHOTRI, A. DE: Indian Institute of Technology, Mumbai, India

15:20 - 15:45 COFFEE BREAK

VIII Modelling Tools and Computer Programs

Chairman: Patricio Mendez

15:45 - 16:10 **KEYNOTE**
Correlating large sets of experimental data with high resolution computational weld mechanics models
J.A. GOLDAK[1], M. MARTINEZ[2], D. AIDUN[2], Z. JIANGUO[1], T. STANISLAV[1], N. HOSSEIN[1]:
1. Carleton University, Ottawa, Canada
2. Clarkson University, New York, USA

16:10 - 16:30 **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

16:30 - 16:50 **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, Q. XIONG, Y. SUN, A.N. VASILEIOU, M.C.SMITH, J.A. FRANCIS: The University of Manchester, United Kingdom

16:50 - 17:10 **Experimental validation of a simplified welding simulation approach for fatigue assessments**
N. FRIEDRICH, S. EHLERS:
Hamburg University of Technology, Hamburg, Germany

17:10 - 17:30 **Real-time welding simulation for education**
O. MOKROV[1], A. SCHMIDT[1], U. REISGEN[1], A. BEHMEL[2], J. MARTIN[2], A. BECIROVIC[3]:
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, 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. BIEGLER[1], P. KHAZAN[2], M. GATZEN[2], M. RETHMEIER[1,3]:
1. Fraunhofer Institute of Production Systems and Design Technology (IPK), Berlin, Germany
2. Simufact engineering GmbH, Hamburg, Germany
3. Federeal Institute of Materials Research and Testing (BAM), Berlin, Germany

09:55 - 10:15 **Additive Manufacturing Part Manufacturability**
P.-A. PIRES[1], O. DESMAISON[1], J. WILLEMS[2], M. MEGAHED[2]:
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. BENDAOUD, S. ROUQUETTE, F. SOULIE:
Université de Montpellier, France

11:00 - 11:20 **Case studies on topology optimization for AddJoining metal-polymer hybrid structures**
R. FALCK[1], J. F. DOS SANTOS[1], S.T. AMANCIO-FILHO[2]:
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. SCHÄNZEL[1], A. ILIN[1], V. PLOSHIKHIN[2]:* *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	**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*
12:20 - 12:30	**Summary and conclusion** *C. SOMMITSCH*
12:30 - 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 ot 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. EBRAHIMI[1], C. R. KLEIJN[2], I.M. RICHARDSON[1]:
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

II Microstructural Modelling in Weld Metal and Heat Affected Zone

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. VAILEIOU[1], C.J. HAMELIN[2], M.C. SMITH[1], J.A. FRANCIS[1], Y. SUN[1], T. FLINT[1]:
1. The University of Manchester, Manchester, UK
2. Australian Nuclear Science and Technology Organisation, NSW, Lucas Heights, Australia

A coupled temperature-microstructure model for the heat-affected zone of low alloyed high strength steel during two-pass arc welding
J. PAANANEN[1], A. POHJONEN[1], J. LARKIOLA[1], S. ANTTILA[2]
1. University of Oulu, Finland
2. SSAB Europe, Raahe, Finland

III Microstructure and Mechanical Properties

Mechanical properties and microstructure development for precipitation hardened aluminium alloy 6082 in thermal welding cycles for FEM simulations
M. REICH[1], P. WIECHMANN[1], M. SANDER[2], O. KESSLER[1]:
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

Process chain simulation of laser cladding and cold metal forming
P. KHAZAN[1], A. KZZO[1], R. HAMA-SALEH[2], A. WEISHEIT[2], I. UNSAL[3], M. BAMBACH[3]:
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. HAEBERLE, 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. WIRNSPERGER[2], N. ENZINGER[1]:
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. EFTEKHARIMILANI[1], H. GAO[2], R.M. HUIZENGA[1], E.M. van der AA[2], M. AMIRTHALINGHAM[3], I.M. RICHARDSON[1], M.J.M. HERMANS[1]:
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. IKUSHIMA[1], M. SHIBAHARA[1], Y. YAMADA[1], S. NISHIKAWA[2], T. FURUKAWA[2], K. AKITA[3]:
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. ROBIN[1], G. TRAN-VAN[1], D. CARRON[2], P. LE-MASSON[2], A. ANDRIEU[1], J. DELMAS[1]:
1. EDF R&D, Chatou, France
2. Université Bretagne Sud, CNRS, France

Prediction of solidification cracking on welding considering metallurgical and mechanical behavior
S. MAEDA[1], K. IKUSHIMA[2], M. SHIBAHARA[2], N. MA[3]:
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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: Universidade Federal de Pernambuco, Recife, Brazil

Influence of the probe geometrical features on the stress condition of the tool during friction stir welding
I. GOLUBEV[1,2], M. WEIGL[1], V. MICHAILOV[2]:
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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

Mechanical properties of the heat affected zone in welded blanks of aluminum alloy EN AW-6063
Z. SILVAYEH[1], B. FELLNER[2], B. GÖTZINGER[2], C. SOMMITSCH[1]:
1. IMAT, Graz University of Technology, Austria
2. Magna Steyr Fahrzeugtechnik, Graz, Austria

Modelling material flow in friction riveting of polymeric materials
G. PINA CIPRIANO[1,2], J.F. DOS SANTOS[3], P. VILACA[1], S.T. AMANCIO-FILHO[2]:
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2. IMAT, Graz University of Technology, Austria
3. Helmholtz-Zentrum Geesthacht, Germany

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
K. ALALUSS[1], P. MAYR[2]:
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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

Virtual manufacturing and prototyping for distortion control and improvement in crash performance
F. BOITOUT[1], S. AGGARWAL[2], A. DUMON[3], Y. VINCENT[1]:
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. SCHMAILZL[1], S. HÜNTELMANN[1], T. LOOSE[2], J. KÄSBAUER[1], F. MAIWALD[1], S. HIERL[1]:
1. OTH Regensburg, Regensburg, Germany
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
S. CADIOU[1], M. COURTOIS[1], M. CARIN[1], P. LE MASSON[1], L. GUILMOIS[2], P. PAILLARD[2]:
1. Univ. Bretagne Sud, FRE CNRS, IRDL, Lorient, France
2. Polytech Nantes, Nantes, France

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, you can execute training and simulation tasks at the Virtual Welding Simulator during the coffee breaks. 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

Notes:

Upper Castle

Ground floor: Managing Directors office, Administration, Toilets
1st floor: Castle Chapel, Castle Meeting Rooms 1–3, Rooms 12, 13, 14, Toilets
2nd floor: Episcopal Chambers, Gallery, Castle Meeting Rooms 4+5, Rooms 6–10

North Wing

Ground floor: Reception, Castle Tavern, Meeting room „Spielsaal"
1st floor: Rooms 4-101 – 4-113
2nd floor: Rooms 4-201 – 4-218

New Building

Ground floor: Dining Rooms 1–3
1st floor: Rooms 3-101 – 3-113

Conference Centre

Basement: Conference-Hall, Lower Lobby, Toilets
Ground floor: Styria-Hall, Meeting Rooms 1–3, Upper Lobby, Wardrobe
3rd floor: Drinks & Snack Corner

Brenner Wing

Ground floor: Brenner Meeting Rooms 1–3, Michael's Chapel, Rooms 5-111 – 5-113
1st floor: Rooms 5-101 – 5-110, Drinks & Snack Corner
2nd floor: Rooms 5-201 – 5-204

Wine Cellar

Basement: Episcopal Wine Cellar, Seggau Wine Shop
Ground floor: Orangery

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TU Graz
Graz University of Technology

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“

Chairman: Prof. Christof Sommitsch
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