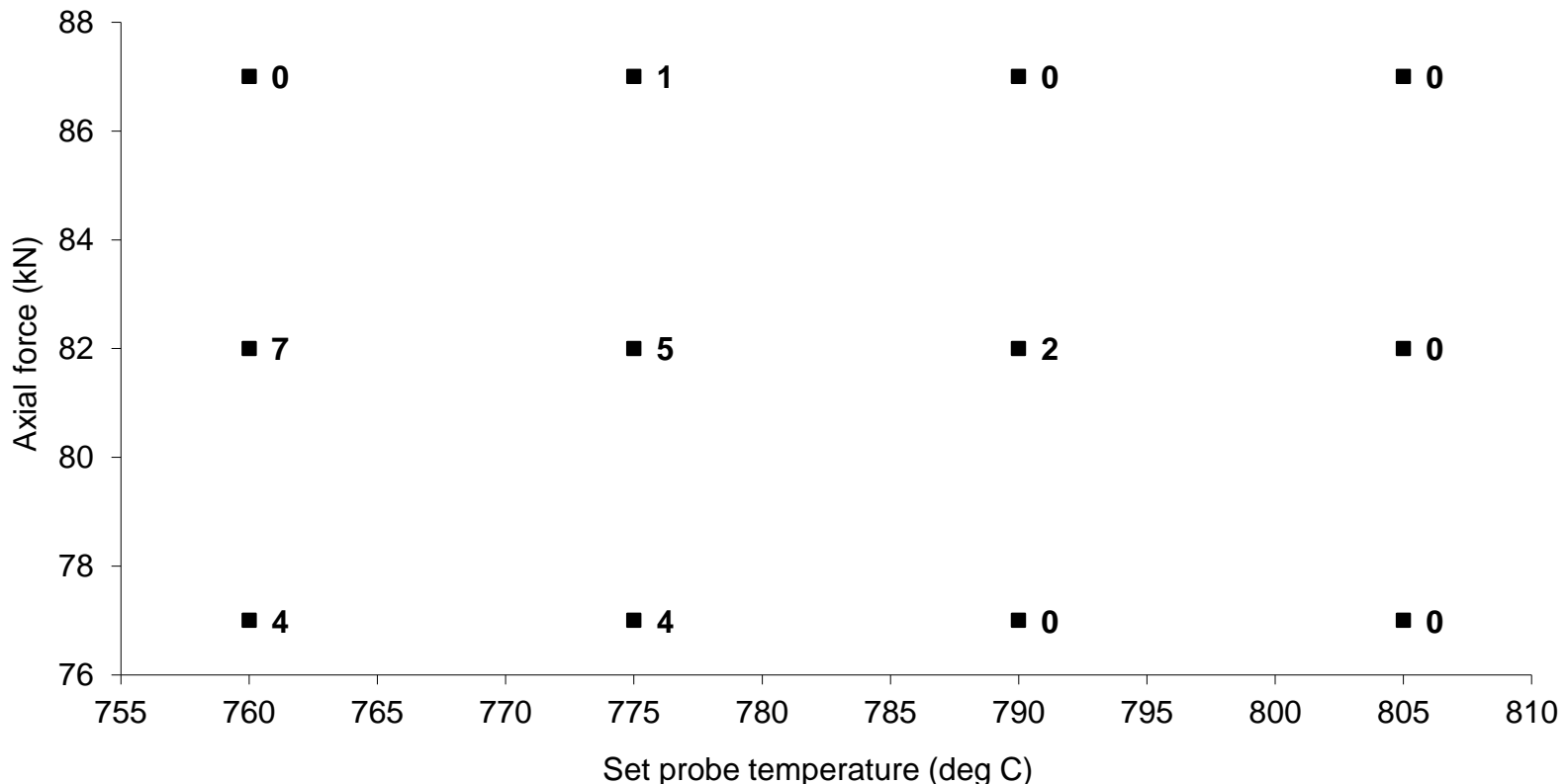


Control of tool depth in force control mode by adjusting the axial force command



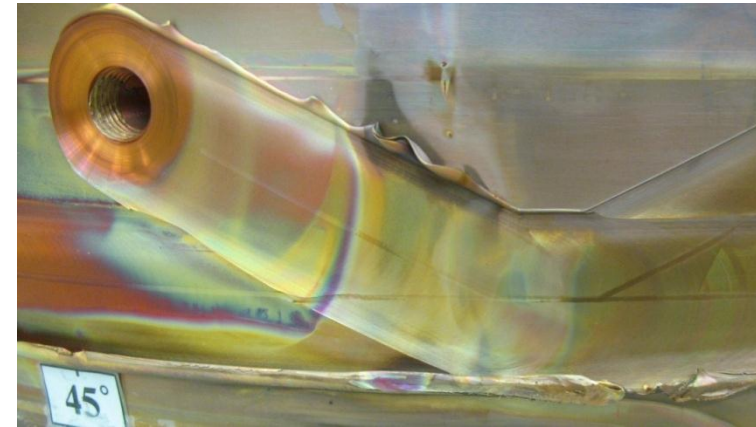
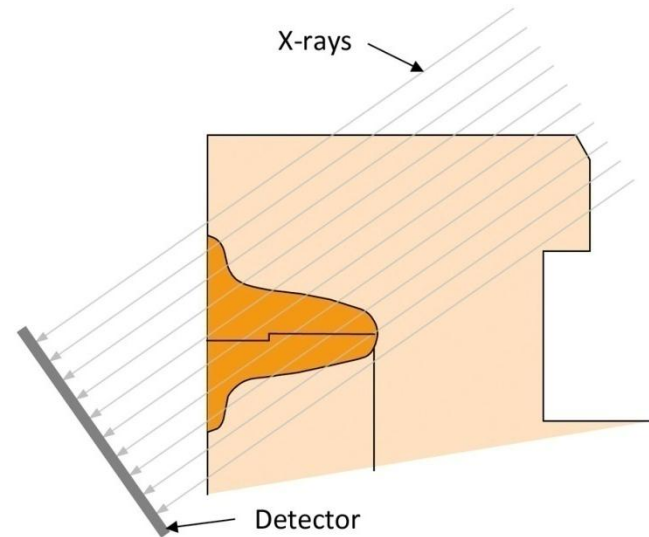
DOE to understand how axial force affects defect formation (tool temp process window)

- 12 cycles (60° long) with constant axial force of 77, 82 and 87 kN, and set probe temp of 760, 775, 790 and 805°C.



Why control the tool depth?

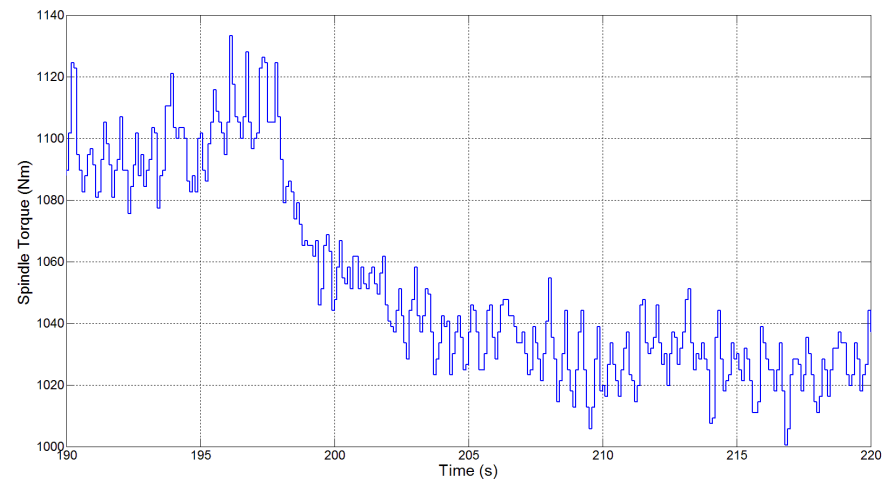
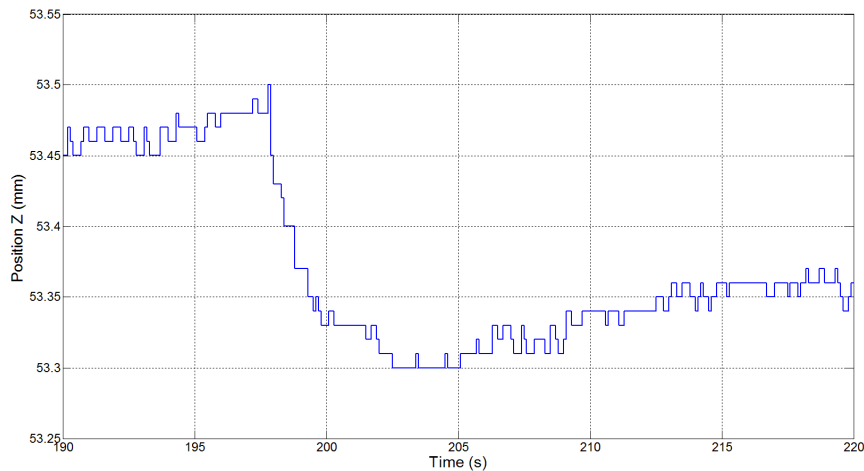
- The goal is to be able to control the amount of JLH and flash
- The tool depth will probably need to be kept within a window of roughly $\pm 0,5$ mm during joint line sequence



Control of tool depth

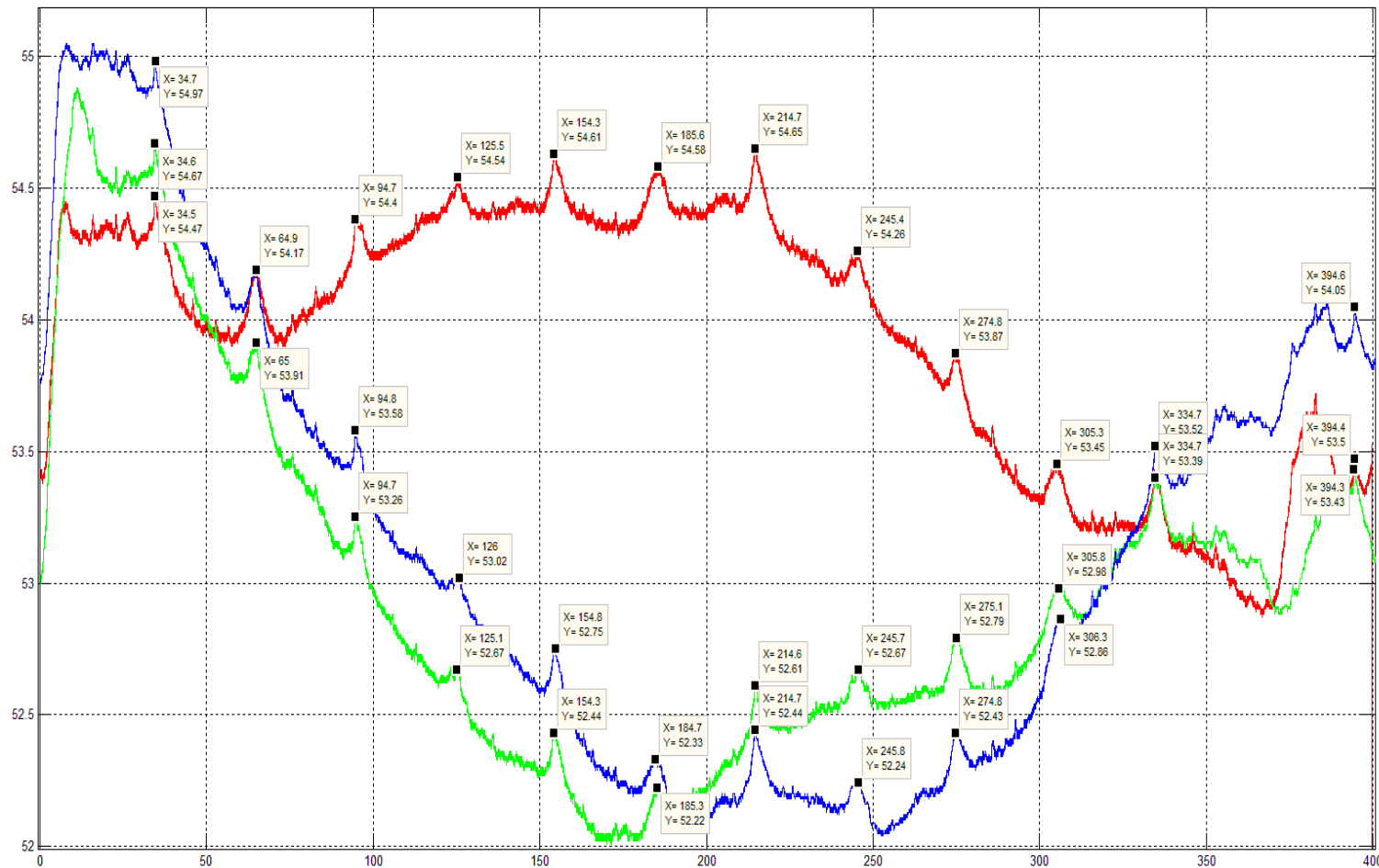
- The tool depth depends clearly on the axial force (see step response to the left)
- It is also probable that the dynamics depend on e.g. the welding temperature and the hardness of the material
- The spindle torque seems to be related both to axial force and tool depth (see step response to the right)

Step in the axial force reference from 87 to 83 kN



Control of tool depth - challenges

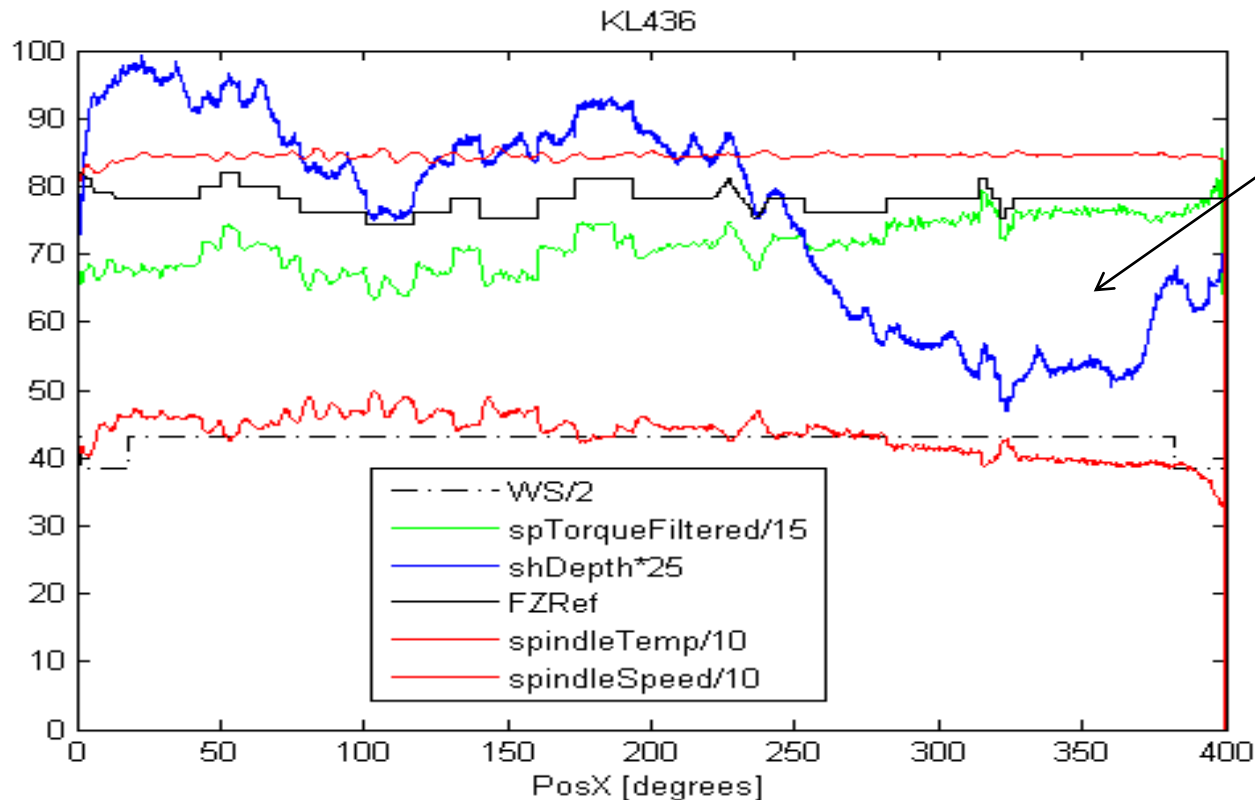
- Periodical disturbances in the position signal, every 30 deg. around the lid – Why?



Control of tool depth - challenges

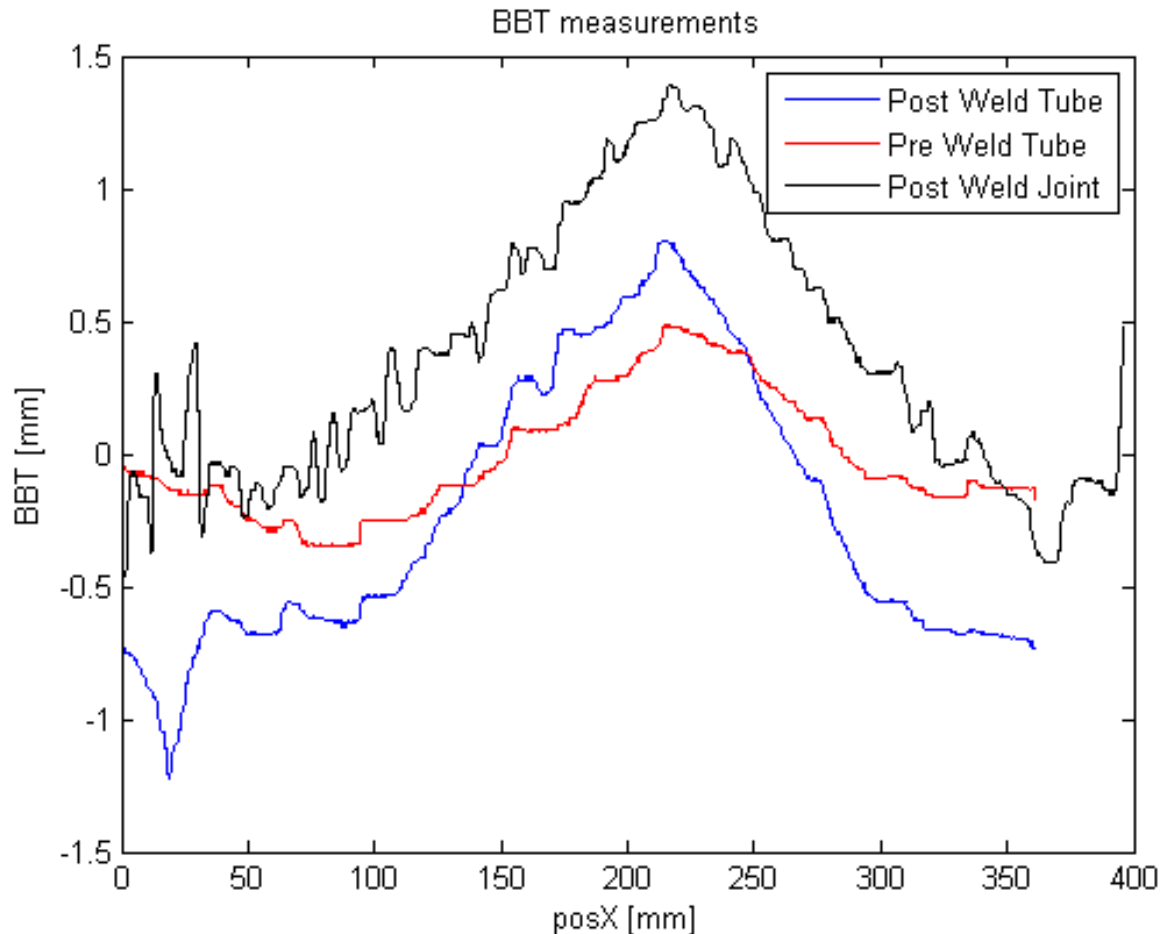
Thermal expansion, makes the depth measures uncertain

- Is it small enough to neglect? (at least 2 mm)
- Is it predictable?



Control of tool depth - challenges

- Eccentricity – Compensate or eliminate



Tool depth sensors

Current sensor:

- Measures the position of the tool
- Does not take eccentricity into account
- Does not take the thermal expansion into account
- Periodical disturbances

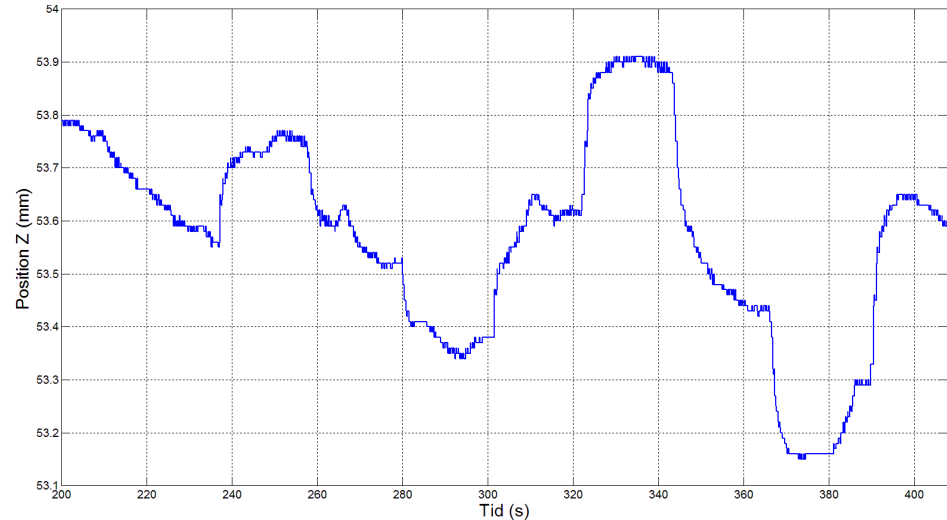
Is the current sensor good enough?

← Inductive sensor?

Laser sensor? →



- Enough space?
- Cost?



Tool depth control - Controller

Strategy I

- Use a decentralized PI/PID controller
- Simple SISO-model for weld depth
- Limitations on variables must be treated by some overhead in the controller

Strategy II

- Model Predictive Control (MPC)
- MIMO-model
- Possible to utilize cross connections in the process
- Limits on variables and slew rates can easily be included in the controller
- Very computationally demanding

How do we procede?

- Selection of suitable sensor
- Updating the controller implementation
- Should we add the possibility of hard constraints on the axial force already?
- Add LVDT sensor (used before Ar chamber)





Friction Stir Welding and Processing

January 26th – 27th Saint-Étienne, France



Home Scope & Topics Committees Location Registration Program Sessions Partner Institutions Accommodation Your space

FSWP'2012

The 2nd International Conference on Friction Stir Welding and Processing (FSW) in this multidisciplinary field of scientific endeavor. This conference brings together researchers in recent advances in friction stir welding and related processes. It will also serve as a vehicle that strengthens relationships between industry, research laboratories, and universities.

The purpose of this conference is to facilitate the communication between specialists in various aspects of friction stir welding processes. Presentations concerning all the steps are welcome: from fundamental studies to applied aspects, from experimental to numerical research.



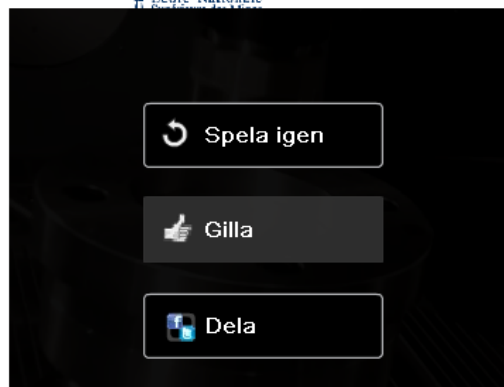
Publications

Selected papers will be published in a special issue of the international journal **Science and Technology of Welding & Joining**



Invited speakers

- Jorge F. dos Santos: "Precipitation Phenomena in AA7449 Friction Stir Welds: Results of an in-situ Study"
- Motomichi Yamamoto: "Improvement of Joint Strength Based on Material Flow during Friction Stir Spot Welding"
- Russel Steel: "Advancements in Friction Stir Welding of Thick Section Steels"



SF2M

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Seggau 2012 - Windows Internet Explorer enhåller från Svensk Kärnbränslehantering AB

http://portal.tugraz.at/portal/page/portal/TU_Graz/Einrichtungen/Institute/Hompages/i3030/seggau_2012

Arkiv Redigera Visa Favoriter Verktyg Hjälp

Seggau 2012

10th International Seminar
Numerical Analysis of Weldability

24 - 26 September 2012 at Schloss Seggau

Chairman: Christof Sommitsch

Vice Chairman: N. Enzinger

Honorary Chairman: Horst Cerjak

Scope and Relevant Topics

With the 10th 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 for Materials Science and Welding of the Graz University of Technology under the sponsorship of IIW Commission IX, Working Group „Mathematical Modelling of Weld Phenomena“.

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

- Arc Phenomena, Melt Pool and Solidification
- Microstructural Modelling in Weld Metal and Heat Affected Zone
- Microstructure and Mechanical Properties
- Influence of Post Weld Heat Treatment
- Cracking Phenomena
- Residual Stresses and Distortion
- Service Behaviour of Welded Structures
- Hydrogen Effects
- Special Welding Processes
- Solid State and Friction Stir Welding
- Modelling Tools and Computer Programs

Language

The official language will be English.

Proceedings Book

After a peer review process, the contributions will be published as a book containing in-depth articles similar to the previous seminars.

Previous books are available from:

Mathematical Modelling of Weld Phenomena 1 - 6
Institute for Materials 1993, 1995, 1997, 1998, 2001, 2002
Book 533, 594, 650, 695, 738, 784

Mathematical Modelling of Weld Phenomena 7, 8 & 9
Verlag der Technischen Universität Graz, 2005, 2007, 2010

SEARCH

CONTACT

Seminar Organisation

Graz University of Technology, Institute for Materials Science and Welding and

IIW Commission IX, Working Group
"Mathematical Modelling of Weld Phenomena"

**Chairman
Christof Sommitsch**

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