

I register as a participant for the FLC 2014 Workshop

First Name:

Last Name:

Title:

Company:

Department:

Address:

ZIP, City:

Country:

Phone:

Fax:

E-mail:

Yes, I will participate in the dinner

No, I will not participate in the dinner

Date:

Signature:

Please complete and
- fax to +41 (0)44 632 11 65
- email to flc@ethz.ch
- or mail to:

ETH Zurich
Institute of Virtual Manufacturing
CLA F 7
Tannenstrasse 3
8092 Zurich
Switzerland

Location



Technopark Zurich
Technoparkstrasse 1
8005 Zürich
www.technopark.ch



Accommodation



NOVOTEL Zurich City West ****
Schiffbaustrasse 13 / Am Turbinenplatz
CH-8005 ZURICH
Single Room: CHF 234.-
Double Room: CHF 258.-



IBIS Zurich City West **
Schiffbaustrasse 11
CH- 8005 ZURICH
Single Room: CHF 178.-
Double Room: CHF 194.-



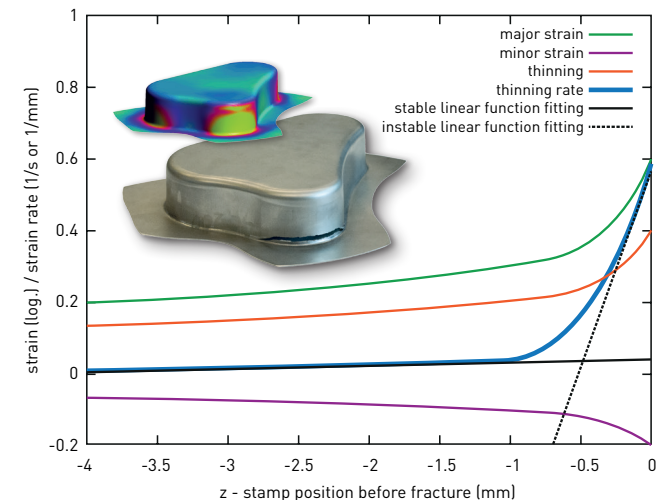
IBIS Budget Zurich City West *
Technoparkstrasse 2
CH- 8005 ZURICH
Single Room: CHF 121.-
Double Room: CHF 132.-

Keyword for reservations until September 24, 2014:
«ETHzürich»
More information: www.ivp.ethz.ch/flc14

WORKSHOP

Time-dependent Methods for the Evaluation of FLC

November 6 & 7, 2014
Zurich, Switzerland



Institut für Virtuelle Produktion
Institute of Virtual Manufacturing
Prof. Dr. P. Hora

Lehrstuhl für Umformtechnik
und Gießereiwesen
Prof. Dr. W. Volk

STATIC AND TIME-DEPENDENT FLC EVALUATION METHODS FOR THE DESIGN OF SHEET METAL PARTS

The formability of metal sheets is up until today evaluated using the Forming Limit Curves (FLC) proposed by Keeler and Backhofen.

Novel digital image correlation (DIC) techniques clearly demonstrate that the transition from homogeneous deformation to localized straining is not abrupt. This means that the limit strain can only be defined based on some heuristic rule.

The workshop aims to outline new approaches for the evaluation of FLCs. Special stress will be put on the comparison between the standard «cross-section» method and the newly proposed «time-dependent» method.

The characteristics of the new evaluation method will be discussed in detail, especially focusing on modifications and extensions, which will enable its use in fully automated optical measurement environments.

As a secondary focus, the workshop will treat the topic of the so-called «Generalized FLCs». In addition to the localization limits, these also describe the fracture strains. The relevance of the latter for forming processes as well as methods for their experimental characterization will be discussed in detail. Furthermore the transferability of these limits to generic forming processes (e.g. hemming, hole expansion etc.) will be assessed. Finally the FLC-based fracture criteria will be compared to stress based approaches, such as the extended Mohr-Coulomb models proposed by Wierzbicki and Bai.

The workshop aims to reach developers of FLC-evaluation methods, students and researchers working in the field of failure characterization, as well as FEM users who envisage a reliable prediction of the formability limits in sheet metal forming.

Prof. Dr. P. Hora

Prof. Dr. W. Volk

During the two-day workshop, the following topics will be discussed:

Part I – Evaluation of classical FLCs

A FLC determination based on optical measurement of Nakajima experiments

- Introduction to formability prediction in sheet metal forming
- Presentation of the standard method according to ISO TC 164/SC 2
- Presentation of the time-dependent method according to Volk-Hora, Merklein and others

B Implementation of the methods in the GOM and VIALUX software

- FLC evaluation with the ARAMIS system
- FLC evaluation with the VIALUX system

C Comparison of the results based on the different evaluation methods

- Discussion of possible discrepancies

Part II – Determination of generalized FLCs using fracture criteria

A Extension of the FLC with the «in-plane shear» fracture limits

- Introduction to generalized FLCs with integrated fracture limits (according to Hora et al.)
- Introduction to generalized FLCs with integrated fracture limits (according to Tekkaya et al.)
- Measurement of fracture strains $\epsilon^f(\beta)$ based on Nakajima experiments:
 - Optical evaluation as well as methods based on thickness measurement
- Bending FLC method (IFU, Liewald)
- Comparison of «generalized FLCs» against the extended Mohr-Coulomb fracture models according to Wierzbicki and Bai

B Extension of the FLC with the «out-of-plane shear» fracture limits

- Identification of failure states based on real sheet metal parts

- Experimental determination of failure limits
- Theoretical modeling

Part III – Simulation aspects of failure modeling

A Accurate failure modeling using FEM

- Discussion of the behavior of explicit and implicit codes in the localized region
- Regularization and elimination of mesh-size effects
- Modeling of localization effects
- Accurate simulation of Nakajima Tests
- Prediction of surface failure in hemming
- Influence of temperature in strip-drawing tests
- Failure modeling for layered aluminum «FUSION» materials

General Information

Workshop Fees

Industry: 350.- Euro

Academics: 200.- Euro

Speakers: invited

(incl. catering during the workshop days)

Registration Deadline

October 15, 2014

Workshop Language

English

Administration and Contact

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Chair

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