Dissertation in Solid Mechanics
- “Microstructure based modelling of ductile fracture in quench-hardenable boron steel”

On April 17, 2015 Rickard Östlund made his thesis defense in the subject Solid Mechanics at Luleå University of Technology. The research has been conducted in the field of thermo-mechanical forming. The thesis is entitled “Microstructure based modelling of ductile fracture in quench-hardenable boron steel”.

Rickard’s research concerns failure models for multiphase materials with applications to crashworthiness simulations involving components with continuously varying microstructure, i.e. press hardened components with “tailored” properties or soft zones.

Faculty opponent was Professor Michael Worswick, University of Waterloo, Waterloo, Ontario, Canada. The dissertation was chaired by Professor Mats Oldenburg, Department of Engineering Sciences and Mathematics, Luleå University of Technology.

CHS² conference in Toronto
- “5th International Conference on Hot Sheet Metal Forming of High-Performance Steel CHS² 2015”

The conference CHS² – International conference on hot sheet metal forming was held in Toronto, Canada 1 to 3 June 2015. The conference had more than 260 participants from all around the world and 82 papers was presented with the subject thermoforming of high performance steel.

During the conference the delegates had the opportunity to deepen their knowledge in thermo-mechanical forming processes. The presentations included the topics microstructure evolution, thermal properties, surface heat transfer, high temperature tribology, heat treatment, simulations, and much more.

Redesign of frame

This industrial development project is implemented in collaboration with Norrlands Teknikcenter AB (NTC)

The company has seen an improvement potential in one of their existing products. There is a wish for an updated and improved design solution for a front end of a snowmobile. The current design of the front end has limitations when exposes to extreme condition. A new design solution structure will be designed with the help of modeling and simulation results.

Funding Organisations

LULEÅ UNIVERSITY OF TECHNOLOGY

County Administrative Board of Norrbotten

LULEÅ KOMMUN
Dissertation in Steel Structures
- “Resistance of Friction Connections with Open Slotted Holes in Towers for Wind Turbines”.

Christine Heistermann presented her doctoral thesis in steel structures on December 18th, 2014. The title of Christine's thesis is “Resistance of Friction Connections with Open Slotted Holes in Towers for Wind Turbines”.

Opponent at the public defense was Professor Peter Schaumann, Institut für Stahlbau, Leibniz Universität Hannover, Germany.

Friction connections with open slotted holes are an alternative solution to joining two segments of a steel tubular tower. The resistance of the connection is investigated by a finite element modeling technique, which is validated based on laboratory tests of a down-scaled tubular tower connection in 4-point bending. Various scales of the connection, as well as circular and polygonal cross-sections of the tower are considered by advanced FEA and recommendations for the design of the connection are given, including tolerances necessary for assembling.

Licentiate in Material Mechanics
- “Multiresolution continuum theory finite element for implicit stepping methods”

Hao Qin presented his licentiate thesis work in December 12, 2014. Discussion leader was, Sebastian Skatulla, University of Cape Town, South Africa.

The work for the licentiate thesis has focused on the implementation and verification of an implicit version of the element formulation.

The formulation is called a Multiscale Resolution Continuum Theory, MRCT-element. It has the possibility to include microstructural information in domains embedded “inside” a point in space. In traditional plasticity theory, no length scale is considered in material constitutive relations. A length scale is in MRCT associated with each embedded domain.

The project aims at simulating fracture of metals by using the MRCT-element. The work will evaluate this, not so common, element in order to find what are the problems and possibilities in the approach.

The research question can be phrased as: “How can an MRCT-element be used to simulate fracture of metals?”