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Risø DTU
National Laboratory for Sustainable Energy

DTU

Time:	September 1st 2009 at 9.00-17.00
Location:	Technical University of Denmark Risø National Laboratory for Sustainable Energy Frederiksborgvej 399 4000 Roskilde

Refreshments and lunch will be provided. The Seminar is free to attend but due to the anticipated demand and limited availability of delegate seats, **pre-registration** is required.

Please submit your pre-registration by sending an email to Robert Bitsche, **no later** than August 25, 2009.

Robert Bitsche, Postdoc
Wind Energy Division
Structural Blade Design and Testing Group
robi@risoe.dtu.dk

Organized by:

- *Risø, DTU National Laboratory for Sustainable Energy* *www.risoe.dtu.dk*
- *MSC.Software* *www.mscsoftware.com*
- *Idé-Pro Engineering & Software* *www.ipes.dk*

Technology seminar:

Non-Linear Analysis

Composites and Fracture Mechanics Meet and Challenge the Experts

MSC.MARC is recognized as one of the two leading global solutions for advanced non-linear analysis. MSC Software Corporation is a worldwide leader in providing computational simulation solutions.

Normally you see the slick commercially focused marketing machine from the US-based software giant. Hence, we are proud to announce that we have convinced Dr. Per Nordlund, long time member of the core development team, to come out of the software laboratory and to interact with you.

To present and discuss, to listen and learn, and to expose and adjust the future roadmap for core non-linear functionality.

Per is very much looking forward to a productive dialogue with the Danish numerical analysis community – internationally recognized for their expertise in non-linear and composites failure analysis.

Kind regards

Idé-Pro
Engineering & Software A/S

Steen Kibsgaard
VP, CTO

Risø DTU National Laboratory
for Sustainable Energy

Find Mølholt Jensen, PhD
Wind Energy Division
Head of Group “Structural blade design and testing”

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Agenda

9:00	**Registration and Coffee**
9:15	**Welcome and Introduction** *Robert Bitsche,* Risø DTU, National Laboratory for Sustainable Energy
9:30	**MSC Composite Technology, Part 1** **Current and Future Capabilities in Marc** *Per Nordlund* , MSC Software Corporation
10:45	**Coffee Break**
11:00	**MSC Composite Technology, Part 2** **Current and Future Capabilities in Marc** *Per Nordlund* , MSC Software Corporation
12:15	**Lunch**
13:00	**Recent Advances in Non-Linear Contact and Multi Physics Analysis** **Current and Future Capabilities in Marc** *Per Nordlund* , MSC Software Corporation
14:15	**Coffee Break**
14:30	**Technical discussions: Applications of existing technology, Current challenges, Desired functionality from a specialist perspective**
17:00	**End**

Moderator:
Steen Kibsgaard, Idé-Pro Engineering & Software A/S

Topics include

Progressive Failure Analysis (PFA).

Material stiffness reduction based upon failure criteria like Puck, Hashin, Tsai-Wu. Also incorporating technology from Genoa of Alphastar Corp.

Fracture mechanics based crack propagation with VCCT. Fully automatic propagation with remeshing or break-up of glued contact.

Cohesive zone material with interface elements.

Automatic mesh splitting based upon stress criteria. Also includes automatic insertion of interface elements where mesh is split up. Great for modeling composite delamination.

Advanced options for material orientation using NURBS curves.

Mixture models for defining a mix of multiple materials in an element.

Composite curing analysis.

Dr Per Nordlund: *1992-1997: Worked at ABB Corporate Research. Mainly with nonlinear FEM applications using Adina, Abaqus, LS-Dyna and Marc. Part time graduate student at Department of Solid Mechanics, Kungliga Tekniska Högskolan, Stockholm - performing research on fracture mechanics as well as FEM formulation on wrinkling and instability analysis and mesh adaptivity. 1997: PhD Thesis title: "Adaptivity and Wrinkle Indication in Non-Linear Shell Analysis".*

1997-present. Working as software developer at Marc Analysis Research Corporation (acquired by MSC around 1999). Has worked with most aspects of the MSC.Marc code. Special focus:- Fracture mechanics, failure and damage, - Parallel processing (DDM), - Contact analysis, - Composites (general and specifically progressive failure analysis), - Database design, - Wear modeling, - Automatic load stepping, - Remeshing and adaptivity.