AALBORG UNIVERSITY
Department of Mechanical Engineering

Ph.D. course

on

Analysis and Design Optimisation of Laminated Composite Structures

31 May – 4 June 2010 (week 18)

at

Department of Mechanical Engineering
Aalborg University
Pontoppidanstraede 101
DK-9220 Aalborg
DENMARK

Organized by

DCAMM, Danish Center for Applied Mathematics and Mechanics
(www.dcamm.dk)

Aalborg University
The Faculties of Engineering, Science and Medicine
The International Doctoral School of Technology and Science
(http://phd.ins.aau.dk)

and

The Department of Mechanical Engineering, Aalborg University
(www.me.aau.dk)

Lecturers

Professor Erik Lund (el@me.aau.dk),

Professor Niels Olhoff (no@me.aau.dk),

Professor Ole Thybo Thomsen (ott@me.aau.dk) ,

Department of Mechanical Engineering, Aalborg University

Course Content

Background and motivation:
Polymeric resin fibre reinforced materials (FRP´s or composite materials) are being used increasingly for structural applications where properties such as high strength, high stiffness and low weight are determining design parameters. The driving force behind the development and application of these materials has been the demands posed by the aerospace industry, but the use of advanced composite materials is expanding rapidly to other industrial sectors as well. Pertinent examples of this include applications for ship structures, automotive and train applications, wind turbine blades and civil engineering applications including bridge structures.

Objectives and contents:
The purpose of the course is to present the participants with a general overview and an introduction to recent advances and modern techniques for analysis and design of advanced composite structures. The following topics will be treated:

- Applications: Past, present and future
- Fibres and resin materials: Types and properties
- Laminae and laminates: Micro-mechanical models, modelling of the laminae, classical lamination theory (CLT)
- Analysis of composite structures: Beam, plate and shell modelling
- Thermal effects
- Fracture and failure
- Finite element analysis of laminated composite structures
- Non-linear finite element analysis and prediction of progressive damage evolution, debonding and failure/collapse
- Sensitivity analysis and optimisation techniques. Examples of sensitivity analysis and optimisation include: Thermally induced residual stresses due to the manufacturing process; integrated stiffeners, vibration and buckling problems; optimisation of laminates using both ply-angles and lamination parameters as design variables
- Brief introduction to 3-D effects and general design principles

Course Language

The course will be given in English.

Teaching Material

The text book R. M. Jones: ***Mechanics of Composite Materials,*** Taylor & Francis, London, 1998, 519 pp., ISBN 156032712X, is the baseline reference used.
In addition, extensive course notes will be handed out to the participants.

Course Format and Work Load

The course will consist of a condensed session comprised of 5 full days of lectures, work on assignments and discussions at AAU. After the course session the course participants (PhD students) are expected to solve and submit homework assignments. Diplomas will be issued on the basis of course participation and evaluation of homework assignments, and entitle Ph.D. students to 5 ECTS, corresponding to 125-150 hours of work load.

Participants

The participants are expected to have a basic knowledge in mechanics. The course is aimed specifically at Ph.D. students, but the course is also recommended for industrial engineers and engineering scientists. University staff and final year M.Sc. students are welcome as well. University staff, M.Sc. students and participants from industry may be exempted from the homework assignments and the course evaluation/examination.

Accommodation - Hotels

Aalborg offers a variety of accommodations. An overview over the city and the accommodations can be found at www.aalborg-tourist.dk. The organizers have selected a few places that are conveniently located and offer special rates for course participants. Please make your reservations directly with the hotel of your choice. In order to obtain the special prices, refer to "Department of Mechanical Engineering, AAU" and ask for Aalborg University rates. The selected hotels are listed below:

Park Hotel (www.park-hotel-aalborg.dk)
John F. Kennedys Plads 41, DK-9000 Aalborg
Located next to the railway station and close to the centre of the city.
Prices: single/double w/breakfast, Monday to Sunday DKK 795/877 (single/double room) per night incl. breakfast.
Phone: +45 9812 3133, Fax: +45 9813 3166
E-mail: park.hotel.aalborg@mail.dk

Radisson SAS Limfjord Hotel (http://www.radissonblu.com/hotel-aalborg)
Ved Stranden 14-16, DK-9000 Aalborg
Located right in the centre of the city facing the heart of Aalborg's famous nightlife.
Prices: single/double w/breakfast, Monday to Sunday DKK 930/1130 (single/double room) per night incl. breakfast.
Phone: +45 9816 4333, Fax: +45 9816 1747
E-mail: Limfjord@RadissonSAS.com

Registration and Deadline

Further information and registration: http://adm.aau.dk/fak-tekn/phd/kurser/index.htm, where the course is listed at the web page http://adm.aau.dk/fak-tekn/phd/kurser/index.htm#mec_eng.

Deadline for registration: To be decided.
Course participation is free for Ph.D. students and university staff. Participants from industry will be charged DKK 9,600 (DKK 1,920 pr. ECTS).

For further information contact Professor Ole Thybo Thomsen, Phone (+45) 9940 9319, E-mail: ott@me.aau.dk.