Stockholm 2015-04-07

Royal Institute of Technology | University of Southern Denmark | AARHUS SCHOOL OF ENGINEERING

Advanced Structural Dynamics, Modelling and Measurements

(KTH graduate course FAF3201, 7.5 ECTS credits)

Content and Objectives

The purpose of this course is to give engineers, scientists and researchers a deeper insight into the theory and methods for the analysis of dynamically loaded structures. The course also demonstrates the possibilities of using modelling and field measurements to assess the behaviour of existing structures. Practical implications of recent research developments will be stressed.

Aim

The aim of the course is to give knowledge on:

- Behaviour of structural elements acted on by dynamic loads
- Solution procedures for linear and non-linear problems
- Human induced vibrations
- Dynamic vehicle-structure interaction
- Soil dynamics and soil-structure interaction
- Stochastic processes with application in wind engineering
- How to use field measurements to assess structures
- Signal analysis
- Operational modal testing and analysis

Prerequisites

- Passed basic course in structural dynamics
- Experience in MATLAB programming

Target Audience

- MSc students, PhD students, teachers and researchers in engineering.
- Practising engineers, wanting to learn about structural dynamics, assessment of structures, vehicle-structure-soil interaction and analysis of measured signals.

This course can also be of great interest for professionals in the building and civil engineering sector as a part of specialist training.

Organisation of the course

The course is organised by:

- Professor Raid Karoumi, The Division of Structural Engineering and Bridges, KTH Royal institute of Technology, Sweden
- Professor Rune Brincker, Aarhus School of Engineering, Aarhus University, Denmark
- Associate Professor Anders Brandt, Department of Technology and Innovation, University of Southern Denmark.

The course will be given in two concentrated blocks (**8th–11th June** and **17th–20th August 2015**) with lectures and one field test on a bridge in Stockholm (see preliminary timetable on the last page). The first day in each block starts at 10 am and the last day ends at 3 pm. The course will be given in English.

Apart from the scheduled teaching, the participants are expected to do independent homework in the form of analytical problem solving, computer based exercises and a written project report/paper.

The course venue is KTH Royal institute of Technology, Department of civil and architectural engineering. Brinellvägen 23, Stockholm, Sweden (see www.kth.se). The field test will be performed on a pedestrian bridge in Stockholm.

Examination

The course corresponds to 7.5 ECTS credits. To pass the course the student must perform the homework and a project task (bridge test). All must be documented and accepted. At least 80% participation on the course is needed. The student will get the grade pass or not pass.

Literature

- Anders Brandt, Noise and Vibration Analysis: Signal Analysis and Experimental Procedures, John Wiley & Sons.
- Selected journal papers and other texts handed out during the course.

The following literature is also recommended

- Cook, Malkus and Plesha, Concepts and applications of finite element analysis, John Wiley & Sons.

Registration

Registration for the course should be made no later than **30th April 2015** by e-mail to raidk@kth.se. Please state your name, address, phone, e-mail address and affiliation.

Registration fee is 15000 SEK (1500 EUR) excl. VAT and includes coffee and lunch. For PhD-students from research groups within the Structural Engineering field of '*Sveriges Bygguniversitet*' participation is free. Information about payment can be obtained from the contact person. All participants will be provided with binders which includes all the course material. The cost for travel and accommodation has to be covered by each participant.

Contact

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Preliminary timetable

PART I

Day/Date	Time	Teacher	Curriculum
Monday 8 June	10 – 16	Raid Karoumi and Jean-Marc Battini	Fundamentals Equilibrium equations for linear and non-linear problems Continuous systems Solution procedures FEM in dynamics and vibrations
Tuesday 9 June	09 – 16	Raid Karoumi, Christoffer Svedholm and Costin Pacoste	Resonance, Damping, Dynamic amplification, Isolator Vehicle-structure dynamic interaction Human induced vibrations Non-proportional damped systems Case studies
Wednesday 10 June	09 – 16	Abbas Zangeneh and Mahir Ülker	Soil dynamics, Soil-structure dynamic interaction Fundamentals in stochastic processes with application to wind engineering problems Case studies
Thursday 11 June	09 – 15	Ignacio Gonzalez, and Andreas Andersson	Sensors and systems for dynamic measurements Bridge test

PART II

Monday 17 August	10 – 16	Anders Brandt	Dynamic signals and systems Analysis of time signals Modal analysis theory from an experimental point-of-view
Tuesday 18 August	09 – 16	Anders Brandt	Linear systems theory Spectrum analysis Estimating frequency response
Wednesday 19 August	09 – 16	Rune Brincker	Traditional experimental modal analysis Main idea of Operational Modal Analysis (OMA) OMA testing
Thursday 20 August	09 – 15	Rune Brincker	OMA signal processing OMA parameter identification in frequency domain OMA ID in time domain Advanced subjects (mode shape scaling)