

TIME TABLE

TIME	Monday September 22	Tuesday September 23	Wednesday September 24	Thursday September 25	Friday September 26
9.00 - 9.45	Registration	Deraemaeker	Farrar	Kullaa	De Roeck
9.45 - 10.30	Farrar	Deraemaeker	Farrar	Kullaa	De Roeck
11.00 - 11.45	Farrar	De Roeck	Farrar	Deraemaeker	Farrar
11.45 - 12.30	Kullaa	De Roeck	Ostachowicz	Deraemaeker	Farrar
14.00 - 14.45	Kullaa	De Roeck	Ostachowicz	Deraemaeker	
14.45 - 15.30	Ostachowicz	Worden	Worden	Ostachowicz	
16.00 - 16.45	Ostachowicz	Worden	Worden	Worden	
16.45 - 17.30	Ostachowicz	Worden	Kullaa	Kullaa	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms can be sent by post or on-line through our web site: <http://www.cism.it>. A letter of confirmation will be sent to accepted participants.

The registration fee is 600,00 €.

A limited number of participants from universities and research centres who are not supported by their own institutions can be offered board and/or lodging in a reasonably priced hotel. Requests should be sent to CISM Secretariat by **July 22, 2008** together with the applicant's curriculum and a letter of recommendation by the head of the department or supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries which sponsor CISM.

The Deutsche Forschungsgemeinschaft offers scholarships to German students (please contact Dr-Ing. Marcel Urban, DFG, Kennedyallee 40, 53175 Bonn, Germany, tel. +49 (228) 885 2655, e-mail: Marcel.Urban@dfg.de - web site: <http://www.dfg.de>).

Information about travel and accommodation are available at <http://www.cism.it/cism/travel-reach.htm>, or can be mailed upon request.

Please note that the Centre will be closed for summer vacation the first three weeks in August.

For further information please contact:

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NEW TRENDS IN VIBRATION BASED STRUCTURAL HEALTH MONITORING

*Advanced School
coordinated by*

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Belgium

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Sheffield University
UK

Udine, September 22 - 26, 2008

NEW TRENDS IN VIBRATION BASED STRUCTURAL HEALTH MONITORING

Vibration based Structural Health Monitoring (SHM) has been extensively studied over the last 20 years as an alternative to the current costly scheduled visual inspections. Most of these studies were an extension of the traditional methods of modal identification and finite element model updating methods relying on the state-of-the-art of instrumentation around the 80's (typically a few accelerometers attached to the structure). Today, with the aging of buildings, bridges and aircrafts, the demand for reliable and

robust SHM systems is still important. At the same time, in the last ten years, there have been tremendous improvements in different fields of engineering which open new avenues for vibration based SHM: new types of possibly wireless and embedded sensors have become available capable of measuring new types of quantities (towards the concept of 'Smart Dust'), increased computational power, data rate transfers and data storage allowing the use of very large networks of sensors, novel

techniques in the field of data mining and artificial intelligence for data processing. With these technological advances, monitoring structures in real time using very large networks of sensors is becoming a reality. In practice however, the engineers lack efficient tools to process the huge amount of available data. In addition, the structures to be monitored are subject to changing environmental conditions which may cause false alarms in the monitoring systems if nothing is done in order to remove those effects.

The course is intended to give an overview of future trends in SHM, including sensors, hardware for acquisition, software and methodologies. Important issues such as data reduction in large sensor networks, feature extraction from ambient vibration measurements, effects of the environment, statistical analysis tools and damage modelling will be addressed. Practical applications in civil, mechanical and aerospace engineering will be presented in order to show the degree of maturity of SHM techniques in these different fields.

PRELIMINARY SUGGESTED READINGS

Introductory readings:

Health Monitoring of Aerospace Structures
W. Staszewski, C. Boller, G. Tomlinson, 2004, John Wiley & Sons.

Health Monitoring of Structural Materials and Components Methods with applications
D.E. Adams, John Wiley & Sons Inc, 2007.

Health Monitoring of Bridges
H. Wenzel, John Wiley & Sons, 2007.

More advanced readings:

Introduction to statistical quality control. 3rd edition
D.C. Montgomery, John Wiley & Sons, 1997.

On Wave Propagation in Elastic Solids With Cracks
C. Zhand and D. Gross, WIT Press, Southampton, 1997.

Neural Networks for Pattern Recognition
C.M. Bishop, Oxford University Press 2001.

Applied multivariate techniques
S. Sharma, John Wiley & Sons, 1996.

LECTURES

All lectures will be given in English. Lecture notes can be downloaded from CISM web site, instructions will be sent to accepted participants.

INVITED LECTURERS

Arnaud Deraemaeker - Université Libre de Bruxelles, Belgium
5 lectures on: Advances in sensors and instrumentation, data reduction in large sensor networks, stochastic subspace damage detection and modal filtering for damage detection using ambient vibration measurements under changing environment, damage detection in cables.

Guido De Roeck - Katholiek Universiteit Leuven, Belgium
5 lectures on: System identification by ambient vibration, global optimization methods for damage detection, estimation of variance in the system identification and subsequent uncertainty propagation in the damage identification, experimental applications to damage detection of reinforced and prestressed concrete girders, bridges and buildings.

Charles Farrar - Los Alamos National Laboratory, USA
7 lectures on: A statistical pattern recognition paradigm for SHM, sensor network design considerations for SHM, wireless sensor networks for SHM applications, damage sensitive features derived from linear dynamics, damage sensitive features derived from nonlinear dynamics, applications (Civil, Mechanical, Aerospace), damage prognosis.

Jyrki Kullaa - Helsinki Polytechnic Stadia, Finland
6 lectures on: Functions of an SHM system, sensor fault identification and correction, SHM under changing environmental or operational conditions (linearly and non-linearly correlated), dimensionality reduction and control charts in damage detection, mechanical engineering applications (hydraulic vehicle crane).

Wieslaw Ostachowicz - Polish Acad. of Sciences, Warsaw, Poland
6 lectures on: Methods based on the phenomenon of elastic waves propagation, low and high frequency methods in SHM, wave propagation in composite structures: interaction with damage, optimal Sensor Networks for damage localization using Lamb waves, modeling of structural stiffness loss due to damage, experimental applications of Lamb waves.

Keith Worden - University of Sheffield, UK
6 lectures on: Inverse methods for damage identification, probability theory, pattern recognition and machine learning, neural networks, statistical learning theory and support vector machines, applications of SHM.

**NEW TRENDS IN VIBRATION
BASED STRUCTURAL HEALTH MONITORING**

Udine, September 22 - 26, 2008

Application Form

(Please print or type)

Surname _____

Name _____

Affiliation _____

Address _____

E-mail _____

Phone _____ Fax _____

Method of payment upon receipt of confirmation (Please check the box)

The fee of Euro 600,00 includes IVA/VAT tax and excludes bank charges

I shall send a check of Euro _____

Payment will be made to CISM - Bank Account N° 094570210900,
VENETO BANCA - Udine (CAB 12300 - ABI 05418 - SWIFT AMBPIT2M -
IBAN CODE IT83Z 05418 12300 09457 0210900).

Copy of the receipt should be sent to the secretariat

I shall pay at the registration counter with check, cash or VISA
Credit Card (Mastercard/Eurocard, Visa, CartaSi)

IMPORTANT: CISM is obliged to present an invoice for the above sum. Please indicate to whom the invoice should be addressed.

Name _____

Address _____

C.F.* _____

VAT/IVA* No. _____

(* Only for EU residents or foreigners with a permanent business activity in Italy.

Only for Italian Public Companies

I ask for IVA exemption (ex law n. 537/1993 - art. 14 comma 10).

Privacy policy: I understand that data received via this form will be used only to provide information about CISM and its activities, within the limits set by the Italian legislative decree no. 196/2003 and subsequent amendments.

Complete information on CISM's privacy policy is available at www.cism.it.

I have read the "Admission and Accommodation" terms and conditions and agree.

Date _____ Signature _____