

TIME TABLE

TIME	Monday October 1	Tuesday October 2	Wednesday October 3	Thursday October 4	Friday October 5
9.00 - 9.45	Registration	Krenk	Carlson	Guyomar	Valasek
9.45 - 10.30	Preumont	Krenk	Carlson	Guyomar	Valasek
11.00 - 11.45	Preumont	Preumont	Carlson	Casciati	Valasek
11.45 - 12.30	Preumont	Preumont	Carlson	Casciati	Valasek
14.30 - 15.15	Krenk	Preumont	Guyomar	Casciati	
15.15 - 16.00	Krenk	Preumont	Guyomar	Casciati	
16.30 - 17.15	Krenk	Carlson	Guyomar	Casciati	
17.15 - 18.00	Krenk	Carlson	Guyomar	Valasek	



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 550,00 €.

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 27, 2007** 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 Mr Höfeld, DFG, Kennedyallee 40, 53175 Bonn, +49 (0) 228 885 2321, <http://www.dfg.de/>).

The European Science Foundation is also sponsoring participation of a number of Ph.D. Students directly involved in the EUROCORES Programme *Smart Structural Systems Technology (S3T)*. Interested candidates should contact their project leaders within their Collaborative Research Programme (CRP). For additional information please contact S3T Programme coordinator: Dr. Farzam RANJBARAN at franjaran@esf.org.

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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Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences



ACADEMIC YEAR 2007
The Zyczkowski Session

SEMI-ACTIVE
VIBRATION SUPPRESSION
THE BEST FROM ACTIVE
AND PASSIVE TECHNOLOGIES

*Advanced School
Coordinated by*

André Preumont
Université Libre de Bruxelles
Belgium

Udine, October 1 - 5, 2007

SEMI-ACTIVE VIBRATION SUPPRESSION - THE BEST FROM ACTIVE AND PASSIVE TECHNOLOGIES

Vibration suppression is an important issue in many fields of engineering, ranging from earthquake mitigation in civil engineering structures to sub-micron jitter in precision engineering. Typical critical vibration amplitudes go from meters (e.g. wind response of a cable-stayed bridge) to a few nanometers (e.g. optical telescope, atomic force microscope, wafer stepper in semi-conductor lithography machines). Passive vibration absorbers have been available for a long time (Den Hartog, 1947) and, more recently, a number of promising applications of active vibration

suppression have been developed. Active control brings more performance, but at the expense of more technological sophistication, more cost, less robustness and more energy consumption, and this is why it has found relatively little applications outside the research labs, except in precision engineering. Semi-active control may remove several of the drawbacks of active control, by combining the robustness of purely passive methods with drastically reduced energy requirements. In many cases, however, it operates as a *parametric* controller which is strongly nonlinear, and cannot be

designed according to classical feedback theory. Smart (or multi-functional) materials respond to stimuli of multiple physical natures (such as mechanical, electrical, magnetic, thermal, etc...). They can be used for transducers and energy conversion devices (e.g. piezoelectric materials converting mechanical energy into electrical energy and vice versa), but also to modify the constitutive parameters of materials (e.g. magnetorheological (MR) fluids, MR polymers). This course is intended to offer a comprehensive treatment of the

theoretical as well as technological aspects of a wide class of semi-active systems applied to vibration damping and isolation, and a review of current and prospective applications in civil engineering, transportation, vibroacoustics, and precision engineering. The comparison between the semi-active devices and their passive and active counterpart will be stressed all along the course. Related issues such as energy harvesting will also be addressed during the course. The course will provide ample time for discussion and networking.

PRELIMINARY SUGGESTED READINGS

Tom BLACK and J. David CARLSON, "Magnetizable Fluids", chapter in *Synthetics, Mineral Oils, and Bio-Based Lubricants*, L. RUDNICK, ed., Taylor and Francis CRC Press (2005)566-583.

Fabio CASCIATI, George MAGONETTE & Francesco MARAZZI, *Technology of semi-active devices and applications in vibration mitigation*, Wiley, 2006.

Hartmut JANOCHA, Editor, *Adaptronics and Smart Structures, Basics, Materials, and Applications*, Springer 1999.

André PREUMONT, *Vibration Control of Active Structures, An Introduction* (2nd Edition), Kluwer, 2002.

André PREUMONT, *Mechatronics: Dynamics of Electromechanical and Piezoelectric Systems*, Springer, 2006.

INVITED LECTURERS

David Carlson - *Lord Corp., Cary, NC, USA*
6 lectures on: Magnetorheological fluids and their applications: Physics, chemistry and rheology; MR device basics; MR fluid dampers; performance and limitations; applications in automotive, civil engineering and other...

Fabio Casciati - *University of Pavia, Italy*
5 lectures on: Various applications of semi-active technology in civil engineering.

Daniel Guyomar - *INSA, Lyon, France*
6 lectures on: Piezoelectricity and transduction mechanisms, Self-powered semi-passive techniques for narrow band vibration damping, Semi-passive techniques for acoustic wave transmission reduction, Extension of semi-passive techniques to broadband signals, Electrical energy harvesting from mechanical vibrations.

Steen Krenk - *Technical University of Denmark, Lyngby*
6 lectures on: Basic principle for damping and dampers; energy balance and equivalent damping properties; tuned-mass damper; passive damping of flexible structures; damping predictions, optimal calibration; cable vibration, footbridge example.

André Preumont - *Université Libre de Bruxelles, Belgium*
7 lectures on: Modelling of electromechanical and piezoelectric systems, active vibration damping with collocated actuator-sensor pairs, application to large trusses and cable-structures, active vibration isolation, sky-hook damper, passive and semi-active damping with piezoelectric transducers.

Michael Valasek - *Czech Technical Univ. Prague, Czech Republic*
5 lectures on: Methods for semi-active suppression synthesis and various applications of semi-active technology in vehicles (road friendly, bridge friendly, soil friendly, brake friendly, etc...); torsional vibration suppression on machinery.

LECTURES

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

**SEMI-ACTIVE VIBRATION SUPPRESSION -
THE BEST FROM ACTIVE AND PASSIVE TECHNOLOGIES**

Udine, October 1 - 5, 2007

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 550,00 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 _____