

TIME TABLE

(Registration on Monday at 8:30)

TIME	Monday	Tuesday	Wednesday	Thursday	Friday
	May 9	May 10	May 11	May 12	May 13
9.00 - 9.45	Elishakoff	Ricciardi	Langley	Ricciardi	Soize
9.45 - 10.30	Hanss	Ricciardi	Langley	Ricciardi	Soize
11.00 - 11.45	Hanss	Ricciardi	Oberguggenberger	Oberguggenberger	Soize
11.45 - 12.30	Hanss	Langley	Oberguggenberger	Oberguggenberger	Soize
14.30 - 15.15	Oberguggenberger	Langley	Elishakoff	Elishakoff	
15.15 - 16.00	Oberguggenberger	Hanss	Elishakoff	Elishakoff	
16.30 - 17.15	Langley	Hanss	Elishakoff	Soize	
17.15 - 18.00	Langley	Hanss	Ricciardi	Soize	

ADMISSION AND ACCOMMODATION

Applicants must apply at least one month before the beginning of the course. Application forms should be sent on-line through our web site: <http://www.cism.it> or by post.

A message of confirmation will be sent to accepted participants. If you need assistance for registration please contact our secretariat.

The 700,00 Euro registration fee includes a complimentary bag, four fixed menu buffet lunches (Friday not included), hot beverages, on-line/downloadable lecture notes and wi-fi internet access.

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 **March 9, 2011** along with the applicant's curriculum and a letter of recommendation by the head of the department or a supervisor confirming that the institute cannot provide funding. Preference will be given to applicants from countries that sponsor CISM.

The Deutscher Akademischer Austausch Dienst (DAAD) and the Deutsche Forschungsgemeinschaft (DFG) offer support to German students. Please contact:

DAAD, Kennedyallee 50, 53175 Bonn
tel. +49 (228) 882-0
e-mail: postmaster@daad.de
web site: <http://www.daad.de/de/kontakt.html>

DFG, Kennedyallee 40, 53175 Bonn
tel. +49 (228) 885 2655
e-mail: ing4@dfg.de
web site: <http://www.dfg.de>

Information about travel and accommodation is available on our web site, or can be mailed upon request.

For further information please contact:

CISM
Palazzo del Torso - Piazza Garibaldi 18
33100 Udine (Italy)
tel. +39 0432 248511 (6 lines)
fax +39 0432 248550
e-mail: cism@cism.it

Centre International des Sciences Mécaniques
International Centre for Mechanical Sciences



ACADEMIC YEAR 2011
The Germain Session

NONDETERMINISTIC MECHANICS

Advanced School
coordinated by

Isaac Elishakoff

Florida Atlantic University
Boca Raton, FL
USA

Christian Soize

Université Paris-Est Marne-la-Vallée
France

Udine, May 9 - 13, 2011

NONDETERMINISTIC MECHANICS

The aim of this course is to give a current state of the art of nondeterministic mechanics in its various forms; the topics will range from stochastic problems to fuzzy sets, from linear to nonlinear problems; from specific methodology to combination of various techniques; from theoretical considerations to practical applications. It has been recognized for several decades that uncertainty and lack of determinism play an important role in engineering; until now three basic techniques have been developed to deal with various uncertainties, namely with variations and scatter in mechanical properties, in geometric parameters, as well as actions of earthquakes, wind loads, imperfect road profiles, turbulence experienced by aircraft. Spectacular advances have been

recorded in stochastic mechanics that postulates that uncertainty equals probability; likewise many industrial applications have been developed worldwide in using fuzzy sets and logic for devising reliable machines and their components; relatively recently new field has emerged, referred to as anti-optimization that identifies uncertainty with boundedness. Specifically convex modeling of uncertainty and its simplest form, interval analysis were developed to deal with worst and best case scenarios under uncertainty. However, the main question, namely, which methodology should be used to address the uncertainty is lacking consensus, as one can anticipate. This course is specially designed to illuminate the various aspects of these three approaches with deep discussion of their pros and cons.

This course will deal with three different and somewhat opposite techniques: stochastic analysis; fuzzy-sets-based treatment; guaranteed, ellipsoidal and interval approaches. The lecturers will indicate strengths and weaknesses of various methodologies delineate boundaries that show which method ought to be applied and suggest when various methods should be combined. Internationally recognized experts will deliver their lectures to review the current state of the art as well as engage audience in discussion of the future directions. Special emphasis will be placed on practical applications so that the theories would not be left for theories sake. Hopefully, integration of various methodologies would emerge as a result of the lecture course.

The lecture course will provide a podium for the conversation of the proponents of different methodologies. This is especially important since currently, it so appears, there is a situation of the Tower of Babel, in which scientists and engineers are fully consumed in their own techniques, and do not communicate with the proponents of other thought processes. The course is addressed to master and doctoral students, young researchers and lecturers, senior researchers who want to broaden their perspectives, practical engineers who want to know how to choose from competing methodologies, junior and senior managers in order to be able to identify uncertainties in their respective fields and provide more rigorous designs of their products.

PRELIMINARY SUGGESTED READINGS

Fellin, W., Lessmann, L., Oberguggenberger, M., and Vieider, R. (eds.), *Analyzing Uncertainty in Civil Engineering*, Springer, Berlin, 2005.

Langley, R., *Unified Approach to Probabilistic and Possibilistic Analysis of Uncertain Structures*, *Journal of Engineering Mechanics*, Vol. 126(11), 1163-1172, 2000.

Oberguggenberger, M., *Mathematical Models of Uncertainty*, *Zeitschrift fuer angewandte Mathematik und Mechanik*, Vol. 84, 661-665, 2004.

Oberguggenberger, M., King, J. And Schmelzer, B., *Classical and Imprecise Probability Methods for Sensitivity Analysis in Engineering: a case Study*, *International Journal of Approximate Reasoning*, Vol. 50, 680-693, 2009.

Ricciardi G., *A Non-Gaussian Stochastic Linearization Method*, *Probabilistic Engineering Mechanics*, Vol. 22(1), 1-11, 2007.

Soize C., *A Comprehensive Overview of a Non-Parametric Probabilistic Approach of Model Uncertainties for Predictive Models in Structural Dynamics*, *Journal of Sound and Vibration*, Vol. 288(3), 623-652, 2005.

Elishakoff, I. and Ohsaki, M., *Optimization and Anti-Optimization of Structures under Uncertainty*, Imperial College Press, London, 2010.

Hanss, M., *Applied Fuzzy Arithmetic: An Introduction with Engineering Applications*, Springer, Berlin, 2005.

INVITED LECTURERS

Isaac Elishakoff - Florida Atlantic University, Boca Raton, USA
6 lectures on: Energy methods in stochastic linearization. Topics to be covered: Potential energy based stochastic linearization methods; dissipation energy based stochastic linearization methods; generalization of ANH-Di Paola method; complementary energy based stochastic linearization; fuzzy safety factor; initial imperfection sensitivity in shells: combined optimization and anti-optimization.

Michael Hanss - University of Stuttgart, Germany

6 lectures on: Fuzzy sets.

Topics to be covered: Fuzzy sets based finite element method; applications in machine vibrations; inverse problems; model assessment/validation.

Robin Langley - University of Cambridge, UK

6 lectures on: Nonlinear problems.

Topics to be covered: Exact and approximate solutions of stochastic problems; fokker-planck equations; combined probabilistic and non-probabilistic analyses.

Michael Oberguggenberger - University of Innsbruck, Austria

6 lectures on: Combined methods.

Topics to be covered: Contrast of probabilistic, stochastic and interval based analyses; discussing, in detail the answer to the following question: "which method, stochastic, fuzzy sets based or convex modeling, is preferable under various circumstances?"

Giuseppe Ricciardi - Università di Messina, Italy

6 lectures on: Stochastic linearization.

Topics to be Covered: *Novel Methods in Nonlinear Stochastic Dynamic Analysis, Application of the Entropy Principles in non Deterministic Mechanics, Specifically in Earthquake Engineering*

Christian Soize - Université Paris-Est Marne-la-Vallée, France

6 lectures on: Stochastic mechanics.

Topics to be covered: Probabilistic modeling of uncertainties in computational mechanics and their propagation in complex dynamical systems; industrial applications; recent novel methods of analysis.

LECTURES

All lectures will be given in english. lecture notes can be downloaded from cism web site, instructions will be sent to accepted participants.

**NONDETERMINISTIC
MECHANICS**

Udine, May 9 - 13, 2011
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 700,00 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/BIC 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 _____