TIME TABLE

TIME	Monday September 6	Tuesday September 7	Wednesday September 8	Thursday September 9	Friday September 10
9.00 - 9.45	Registration	Lai	Wilmanski	Maugin	Maugin
9.45 - 10.30	Rix	Rix	Wilmanski	Maugin	Maugin
11.00 - 11.45	Rix	Rix	Lai	Albers	Albers
11.45 - 12.30	Rix	Rix	Lai	Albers	Albers
14.30 - 15.15	Lai	Kausel	Kausel	Lancellotta	
15.15 - 16.00	Lai	Kausel	Kausel	Lancellotta	
16.30 - 17.15	Lai	Kausel	Kausel	Foti	
17.15 - 18.00	Wilmanski	Wilmanski	Maugin	Foti	
18.00 - 18.45	Wilmanski	Wilmanski	Maugin	Field demo.	

ADMISSION AND ACCOMMODATION

The registration fee is 450,00 € for students and participants on the regular staff of universities and research centres, or 650,00 € for other participants.

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.

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 6, 2004** 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/).

A list of hotels in Udine is available at http://www.cism.it/cism/hotels_2004.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:
CISM - Palazzo del Torso - Piazza Garibaldi 18
33100 Udine (Italy)
tel. +39 0432 248511 (6 lines)
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E-mail: cism@cism.it
http://www.cism.it

ACADEMIC YEAR 2004
The D'Alembert Session

SURFACE WAVES IN GEOMECHANICS
DIRECT AND INVERSE MODELING FOR SOILS AND ROCKS

Advanced School
Coordinated by

C. Lai, European Centre for Training and Research in Earthquake Engineering, Pavia, Italy

K. Wilmanski, WIAS-Berlin, Germany

Udine, September 6 - 10, 2004

International Centre for Mechanical Sciences
Centre International des Sciences Mécaniques

SURFACE WAVES IN GEOMECHANICS: DIRECT AND INVERSE MODELING FOR SOILS AND ROCKS

Surface waves are appealing because they suffer a much smaller geometric attenuation if compared with that associated with bulk waves and this is due to the inherent two-dimensional nature of interface wave propagation. This feature makes their exploitation particularly adventageous in disciplines where the mechanical disturbance is generated through active sources such as geophysical prospecting or nondestructive testing. Their decay with depth from the free boundary is exponential and at the same time frequency-dependent. This is important in the applications since it allows to properly choose the experimental frequencies based on the desired investigation depth.

The course has two main objectives: first to illustrate how surface waves can be profitably used for near surface characterization of geomaterials. This is accomplished through a series of lectures dedicated to surface wave methods and include topics like constitutive modeling of geomaterials, surface wave propagation in heterogeneous, dissipative media, numerical techniques for the solution of the forward problem, data acquisition with active and passive methods, spatial array signal processing, inversion analysis of surface wave data. It ends with a field demonstration. The second objective of the course is to address those situations in which one component linear elasticity or viscoelasticity do not represent the adequate framework for an accurate description of wave phenomena in geomaterials. In particular, the topics presented at this course include surface waves in two or three component poroelastic media, and systems with microstructure. A section of the course will also be devoted to the study of some peculiar features of wave propagation like surface waves in nonlinear continua or in media bounded by curved, nonsmooth surfaces, and to surface wave interaction with non-mechanical fields. The emphasis will be given to the use of surface wave methods for geotechnical site characterization.

The course is addressed to PhD students, seismologists, geophysicists, engineers, and applied mathematicians working in the field of dynamics of continua both theoretically and from the point of view of applications.

INVITED LECTURERS

B. Albers - Weierstrass Inst. (WIAS), Berlin, Germany
4 lectures on: Modeling of surface waves in poroelastic saturated materials by means of a two component continuum.

S. Foti - Politecnico di Torino, Italy
2 lectures on: Surface wave testing for geotechnical characterization of a real site.

E. Kausel - Massachusetts Institute of Technology, USA
6 lectures on: Numerical techniques in eigenvalue problems for surface waves.

C.G. Lai - European Centre for Training and Research in Earthquake Engineering (EUCENTRE), Pavia, Italy
6 lectures on: Surface waves in dissipative media: forward and inverse modeling.

R. Lancellotta - Politecnico di Torino, Italy
2 lectures on: Experimental soil behavior, its testing by waves, engineering applications.

G. Maugin - Univ. Pierre et Marie Curie, Paris, France
6 lectures on: Theory of nonlinear surface waves and solitons.

G. J. Rix - Georgia Inst. of Technology, Atlanta, USA
6 lectures on: Surface testing for near-surface site characterization.

K. Wilmanski - Weierstrass Institute (WIAS), Berlin, Germany
6 lectures on: Elastic modeling of surface waves in single and multicomponent systems.

LECTURES

All lectures will be given in English. Lecture notes will be distributed by CISM to the participants during the course.

PRELIMINARY SUGGESTED READING

Books

K. Aki, P.G. Richards; *Quantitative Seismology*, University Science Books, 2nd Edition, Sausalito, 2002.

T. Bourbie, O. Coussy, B. Zinszner; *Acoustics of Porous Media*, Editions Technip, Paris, 1987.

R. Lancellotta; *Geotechnical Engineering*, Balkema Publishers, 1995.

D.F. Parker, G.A. Maugin; *Recent Developments in Surface Acoustic Waves*, Springer Verlag, Berlin, 1988.

I. A. Viktorov, *Rayleigh and Lamb Waves*, Plenum Press, N.Y., 1967.

K. Wilmanski; *Thermomechanics of Continua*, Springer, Berlin, 1998.

Articles

B. Albers, K. Wilmanski; *Acoustic Waves in Porous Solid- Fluid Mixtures*, in: Dynamic Response of Granular and Porous Materials under Large and Catastrophic Deformations, K. Hutter, N. Kirchner (eds.), Springer, Berlin, 285-314, 2003.

S. Foti; *Small Strain Stiffness and Damping Ratio of Pisa Clay from Surface Wave Tests*, Geotechnique, **53**, 5, 455-461, 2003.

E. Kausel, J.M. Roesset; *Stiffness Matrices for Layered Soils*, Bull. Seismol. Soc. Amer., **71**, 6, 1743-1761, 1981.

E. Kausel; *An Explicit Solution for the Green Functions for Dynamic Loads in Layered Media*, MIT Research Report R81, 1981.

C.G. Lai, G.J. Rix, S. Foti, V. Roma; *Simultaneous Measurement and Inversion of Surface Wave Dispersion and Attenuation Curves*, Soil Dynamics and Earthquake Engineering, **22**, 9-12, 923-930, 2002.

C.G. Lai, G.J. Rix; *Solution of the Rayleigh Eigenproblem in Viscoelastic Media*, Bull. Seism. Soc. Amer., **92**, 6, 2297-2309, 2002.

SURFACE WAVES IN GEOMECHANICS: DIRECT AND INVERSE MODELING FOR SOILS AND ROCKS

Udine, September 6 - 10, 2004

Application Form

(Please print or type)

Surname _____

Name _____

Affiliation _____

Address _____

_____

E-mail _____

Phone _____ Fax _____

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

❏ I shall send a check of Euro 650,00 / 450,00
VAT (IVA) included and bank charges excluded

❏ 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, CartaSì)*

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)* _____

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

Privacy policy: I understand that, according to the Italian law 675/96 in defence of privacy, personal data will be used exclusively for CISM's activities; any other use will require my explicit authorisation.

Cancellation policy: I have read the "Admission and Accommodation" terms and conditions and agree to the policy.

Date _____ Signature _____

Please return to:

CISM, Piazza Garibaldi 18 - 33100 UDINE (Italy)