ALERT Geomaterials

NEWSLETTER – January 2009
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http://alert.epfl.ch

Summary:

EDITORIAL

This is the fourth issue of our Alert Newsletter. All of the previous issues are available on our web site. This short and periodic review has become a tool for tracing the path of our Association.
This year the Alert Geomaterials Association was renewed. A new Board of Directors was elected and the Alert General Assembly convened for the first time. Two new initiatives were also begun: an Alert Local Doctoral School was approved by the Alert Board of Directors, and starting this year, the invited lecture will be available on the Alert Geomaterials web site both in audio and in video formats.
The first local Doctoral School will be held next summer in Madrid so that, we hope, the expertise of each Alert Institution may in the future be more widely spread within our scientific community.
Please do not hesitate to send us your comments and communications for enriching our issues. Finally, I would like to wish all of you a Happy and Active 2009.
Yours sincerely,

Claudio di Prisco

The Association

According to the Alert Statute, after a transitional period of three years, this year the Association has become *adult* and for the first time the Alert **General Assembly** (**GA**) took place in Aussois during our Annual Alert meeting. All Alert members (professors, researchers, PhD students and permanent staff of Alert Geomaterials Institutions) were invited to participate in the Assembly during which the annual program of the Association was presented and discussed. At the end of the **GA**, the 15 members of the New Board of Directors were elected.
The new Board of Directors decided to confirm as President of the Association Prof. Félix Darve, who confirmed the former Bureau: Claudio di Prisco (Politecnico di Milano) as Director, Lyesse Laloui (EPFL) as Vice-Director, and Bruno Chareyre (INPG) as treasurer.

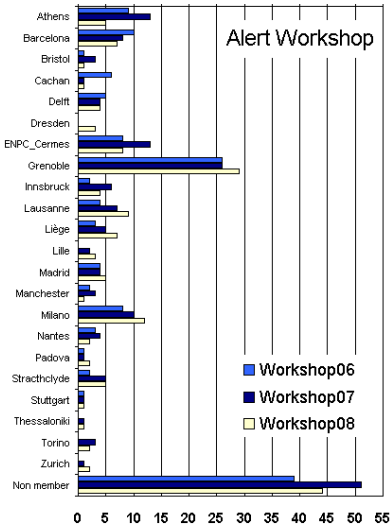
New Alert members

During the last Board of Directors meeting, held in Aussois on October 7th, one European University and one extra-European Institution were accepted as new Alert members: the Heriot-Watt University and the University of Toronto, respectively. This latter Institution has been accepted as an Associate Member.
The number of Alert members is now 24. You can find the updated list of Alert members at http://alert.epfl.ch.
We now report some information about the research activities of the two new Alert Members.

The **Heriot-Watt University** research group (team responsible: Dr. Gary Couples) is composed of three researchers, three post-docs, and four PhD Students. The main research activities of this group concern the numerical simulation of natural deformations, pore-scale investigations of deformed geomaterials, multi-phase fluid flow, acoustic properties of geomaterials, wellbore stability, laboratory testing of reservoir rocks, and natural fracturing.

The research group of the **University of Toronto** (responsible: Dr. Giovanni Grasselli) is composed of eight senior researchers, two research associates, and four post-docs. The main research fields of this group concern rock mechanics and the study of the influence of fractures on the hydro-mechanical behaviour of rock masses, flow and transport in fractured porous media, high strain-rate testing and application to dynamic fracture in rock, rock blasting, dynamic fracture

"The logos of new members of ALERT Geomaterials"



Participants at the workshop from Alert member Institutions

mechanics, particle flow modelling, numerical modelling of hydraulically propagated fractures, and design of underground mining operations. Further details of the research topics tackled by these two groups are now available at:

http://alert.epfl.ch/history/aboutus.html

Workshop 2008

As in the past, the 2008 Alert Workshop lasted three days, and the high participation rate testified to the interest in the topics tackled by the speakers. On the left, the regional distribution of participants from institutional members of Alert Geomaterials is reported. There were also 44 participants from non-Alert Institutions. The total number of participants was 158. The data concerning the past Alert Workshops held in 2006 and 2007 are also reported. The three Alert Workshop 2008 sessions were devoted to:

1. Multiphysics of multiphase geo-materials
coord E.Papamichos and L.Sanavia

2. Field and laboratory testing
coord P. Delage and M. Arroyo

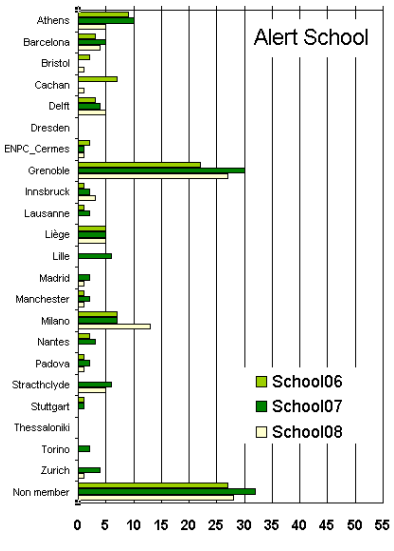
3. Localisation in geomaterials
coord J. Desrues and A. Zervos

The program was very rich, collecting 17 contributions in session 1, 15 in session 2, and 15 in session 3. Thank you to all the active participants and particularly to the coordinators!

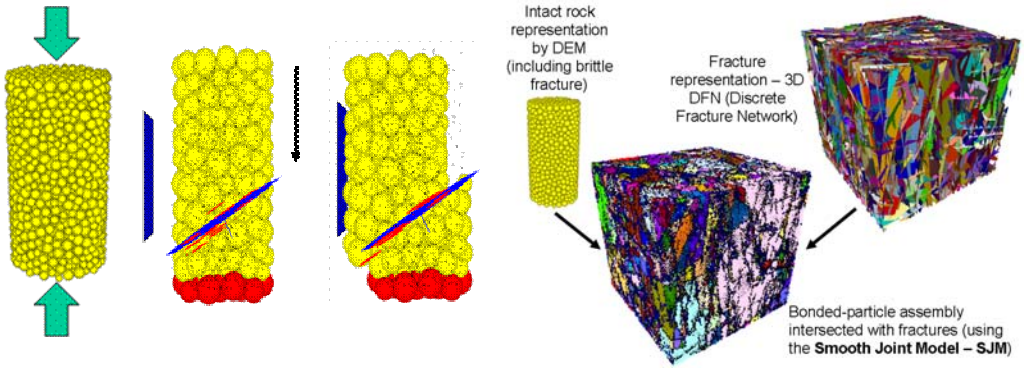
Invited Lecture 2008

Prof. Peter Cundall
Itasca Consulting Group (Minneapolis)

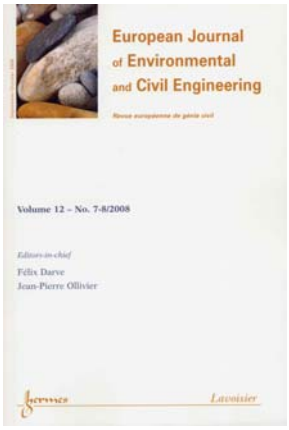
It was a great pleasure for all of us to host **Prof. Peter Cundall** as special invited lecturer during the 2008 Alert Workshop. In recognising his exceptional contributions to scientific research in Geomechanics, Prof. Cundall was awarded the Alert Research Medal. This is only the beginning of a tradition that we hope will continue in the future.
Prof. Cundall performed his doctoral work at Imperial College, London, where he originated the Distinct Element Method for modelling jointed rock and granular materials. He was a faculty member at the University of Minnesota for seven years, and he is now Principal at Itasca Consulting Group in Minneapolis and an Adjunct Professor at the University of Minnesota. Prof. Cundall is the original author of many computer codes, including TRUBAL, FLAC, UDEC, 3DEC, and PFC, which all enjoy widespread use. He has written many papers including the most-cited paper for the journal *Géotechnique* (published in 1979, with co-author Strack). He has received several awards for his work in rock mechanics, and is a Fellow of the Royal Academy of Engineering and a Member of the National Academy of Engineering.
In Aussois, Prof. Cundall presented a learned dissertation titled “Quantifying the Size Effect of Rock Mass Strength.”
This lecture, in video and audio, is now available on the Alert Geomaterials web site. This gives you the opportunity to attend a very interesting lecture while sitting comfortably in your office.
The lecture is focused on the numerical estimation of rock-mass strength. Prof. Cundall presents a newly conceived numerical approach, called synthetic rock mass (SRM), capable of overcoming the shortcomings of an unreliable and often non-conservative empirical estimate of rock mass strength that does not account for any size effect on the strength.
The lecture starts from the crucial observation that the difficulty in characterizing a rock mass’s mechanical behaviour derives essentially from the impossibility of testing directly (to failure) a large extent of rock. Many results of numerical experiments on 3D elements of various sizes are illustrated, and the use of the SRM technique is demonstrated for evaluating rock-mass strength as a function of size. The results are also compared with standard empirical relations commonly used in design practice.



Participants at the school from Alert member Institutions



Representation of intact rock by DEM and 3D discrete fracture network



European Journal of Environmental and Civil Engineering: "Discrete Modelling of Geomaterials"

Election of the new Board of Directors

The new Board of Directors convened on October 7th 2008. The Board consists of the members of the Alert Bureau and of the 15 elected candidates (Robert Charlier (Université de Liège), Pierre Delage (École Nationale des Ponts et Chaussées), Felix Darve (INPG), Antonio Gens (UPC), Ivo Herle (TUD), Michael Hicks (University of Manchester), Minna Karstunen (University of Strathclyde), Lyesse Laloui (EPFL), Frans Molenkamp (DUT), David Muir Wood (University of Bristol), Roberto Nova (Politecnico di Milano), Manuel Pastor (CEDEX Madrid), Lorenzo Sanavia (Università di Padova), Ioannis Vardoulakis (National Technical University of Athens), and Gioacchino Viggiani (UJF, Grenoble)).

Dr. Azad Koliji
Stanford University (former EPFL))

If you want to advertise open positions in your Institution or forthcoming scientific events (conferences, symposia, etc.) to the ALERT mailing list, please send an announcement to:
alertdirector@stru.polimi.it
Only files in PDF format will be accepted for transmission.

ALERT Doctoral School 2008

The Alert Doctoral School 2008, organised by Prof. Hans Herrmann (ETH Zürich) and Prof. Francesco Calvetti (Politecnico di Milano), was devoted to Discrete Modelling of Geomaterials with particular emphasis on numerical methods and their applications to Soil and Rock Mechanics and Geotechnical Engineering.
On behalf of the Alert Association, it is our plasure to thank the organisers and all the teachers: Stefan Ludig, Thorsten Pöschel, Farhang Radjai, Josè Lemos, Frédéric Donzé, Nenad Bićanić, and Giovanni Grasselli, for their effort and for the quality of the product.
There were 74 participants from Alert members (see the graph on the previous page) and 28 participants from universities not belongig to Alert. The total number of participants was then 102!

As is well known, Discrete Element Method (DEM) as it is used in soil mechanics is essentially based on the simultaneous numerical solution of Newton's equations of motion for many particles. The School lectures started from the mechanics of contacts and its numerical implementation. Both the "Molecular dynamics" and the "Contact Dynamics" approaches were presented and critically discussed. The different fundamental assumptions of the two methods and their consequent peculiar suitability for different applications were considered. In addition, specific lectures were devoted to presenting the class of "Event Driven" methods and the "Combined Finite-Discrete Element Method".
The second part of the School provided a critical overview of the applications of discrete methods to the analysis of Engineering problems, starting from the modelling of the mechanical behaviour of frictional and cohesive materials. The discrete approach to classical geotechnical problems and to the analysis of jointed rock masses was also discussed, and a selection of some specific problems for which the discrete approach is particularly suited, were presented.
In particular, the lecture by Prof. Hans Herrmann was devoted to the modelling of the interaction between particles and fluids. This topic is quite relevant in many natural and geotechnical problems i.e. seepage through porous media, sedimentation and release of massive tracer particles within fluids.

http://alert.epfl.ch/School/School.html

ALERT Phd Prize 2008

The Jury of the Alert PhD Prize 2008 was composed by Frans MOLENKAMP (*Delft University of Technology*), Robert CHARLIER (*Université de Liége*), Peter CUNDALL (*ITASCA, Minneapolis*), and Félix DARVE (*Institut National Polytechnique de Grenoble* - Alert President) as duty member.
The prize was awarded to **Dr. Azad Koliji,** from the École Polytechnique Féderale de Lausanne, and now working at Stanford University, for his thesis entitled *Mechanical behaviour of aggregated soils*. A PDF version of the thesis is available on the web site.

The thesis concerns soils characterised by two levels of porosity: the intra and interaggregate porosity. In the research of Dr. Koliji, the role of the size and strength of the aggregates in altering both the water retention and the mechanical behaviour of the material is discussed.
The work is aimed at studying the mechanical behaviour of unsaturated, aggregated soils with respect to soil structure effects. It involves theoretical developments, a multi-scale experimental study, and constitutive modeling.
For investigating the stress-strain response and water retention properties of the soil, Dr. Koliji developed a new suction-controlled œdometer. From the tests carried out, the apparent preconsolidation stress was seen to depend not only on stress state and stress history, but also on the soil structure.
Soil structure and its evolution were also tested using a combination of three methods: mercury intrusion porosimetry (MIP), environmental scanning electron microscopy (ESEM), and neutron tomography. Comparison of different observations revealed that the larger pores in the aggregated soil disappear as a result of mechanical loading or wetting. The change in the volume fraction of macropores is mainly associated with irreversible deformations.
Based on the experimental results, a new constitutive framework was proposed for the extension of the elasto-plastic models of reconstituted soils to aggregated soils. A parameter called "degree of soil structure" was introduced to quantify the soil structure physically in terms of macroporosity.
The model adopts the effective stress and suction as stress variables. The proposed mechanical model, coupled with the water retention model, unifies the combined effects of partial saturation, inter-particle bonding, and soil fabric.
The model is then used to simulate the experiments carried out during the course of this study. Simulations showed that the model could successfully address the main features of the behavior of aggregated soils. Typically, it can reproduce the non-linearity of stress-strain response under virgin compression and the increase in degree of saturation during compression at constant suction.

Prof. Zienkiewic and the ALERT Geomaterials

Olek Zienkiewicz died peacefully in Swansea at the age of 87 on the 2nd of January 2009.

His many contributions to engineering and science are known worldwide and have materialised in his rich scientific output, including papers (around 600), books (especially *The Finite Element Method* with Bob Taylor, which his students and colleagues used to call "The Bible").
Recognition came to him in the form of numerous honours and distinctions (Gauss Medal of the German Academy of Science, Royal Medal of the Royal Society, Commander of the British Empire, a title awarded by HM Queen Elizabeth II), membership of Academies (Royal Society, Royal Academy of Engineering, US National Academy of Sciences) and honorary academic degrees (Northwestern, Hong Kong, Dalian, LNEC, Tessaloniki, ENS Cachan, UPM Madrid, Krakow).
Olek Zienkiewicz contributed to the creation of ALERT since the first lunch in Tucson, which was probably the first "unofficial" meeting of the Board of Directors, and also participated at the subsequent meetings where Félix Darve's idea of ALERT took shape. He participated in several European Projects launched within ALERT, and supported any ALERT member who approached him.
It will certainly be very sad not having him with us in the future, but we are glad and grateful for having experienced his technical advice, his collaboration, and his warm friendship.

Manuel Pastor

Creation of the 1st ALERT Olek Zienkiewicz Course

The first Alert Geomaterials Local Doctoral Course will be held next June in Madrid and it will be titled, as suggested by Prof. Pastor:

ALERT Olek Zienkiewicz Course on Computational Geomechanics

By extending the idea of Manolo, the Bureau has also decided to dedicate to the memory of Prof. Olek Zienkiewicz all the future Alert Local Doctoral Courses.
The course will include lectures at four levels: (i) ***Basic***: providing the fundamentals of the discretisation techniques used; (ii) ***Advanced***: the students will learn special techniques to deal with nonlinear problems, dynamics, and integration of constitutive equations; (iii) ***Research***: in this group of lectures, the current research within ALERT in this field is presented; (iv) ***Practical cases***: practise is fundamental when learning a computational technique. Therefore, a group of sessions where the students, with the help of instructors, will practise with the finite element code GeHoMadrid will be organised.

Practical details

The organization will provide advice on inexpensive hotels and student accommodation in Madrid. We estimate the cost as 70 euros per day, including meals and accommodation.
The course will take place over a full week, Monday to Friday. There will be 4 lectures in the morning devoted to theory and 3 practical sessions in the afternoon. Students are permitted to use the university facilities. The list of lecturers is reported here on the right, and further details will soon be available on the ALERT website.

ALERT Workshop & School 2009

The **ALERT Workshop 2009** will be held in Aussois from October 12th to 14th 2009. The titles of the sessions chosen by the Alert Board of Directors and the relative coordinators are listed here below.

1. Modelling of natural hazard and vulnerability of structures in geomechanics
coord M. Pastor and P. Kotronis
mpastor@cedex.es
panagiotis.kotronis@hmg.inpg.fr

2. Geomechanics at small scale
coord D. Muir Wood and P. Delage
d.muir-wood@bristol.ac.uk
delage@cermes.enpc.fr

3. Erosion in Geomaterials
coord I. Vardoulakis and S. Bonelli
i.vardoulakis@mechan.ntua.gr
stephane.bonelli@cemagref.fr

Please do not forget to submit your abstracts by email directly to the coordinators using the **abstract form** that can be downloaded from the Alert web site (http://alert.epfl.ch).
The deadline for abstract submission is April 30th 2009.
The 20th Alert Doctoral School 2009 will be devoted to **Failure in multiphase materials**, and will be organised by Prof. L. Laloui (EPFL, Lausanne), Prof. F. Collin (Université de Liège) and Prof. V. De Gennaro (ENPC, Paris).
As usual, the program of the school lasts three days, from 15th to 17th October.

Online registration to the workshop and to the school will be opened in May 2009 on the Alert website, and a notice will be posted in the next issue of the newsletter and through the Alert mailing list. Please do not forget to fill in your online registration form with all the requested data (date and time of arrival and departure, email, address and affiliation, etc.), in order to help us to fulfill your needs!!

Jean Salençon elected President of the french Academy of Sciences

After Albert Caquot, elected President in 1952, another member of the French civil engineering community, Jean Salençon, honorary "Ingénieur général des ponts et chaussées" and Emeritus Professor of Ecole Polytechnique and of Ecole nationale des ponts et chaussées, has just been elected President of French Academy of Sciences for 2009-2010. Jean Salençon was the President of the Scientific Committee of GRECO "Rhéologie des Géomatériaux", the French national predecessor of the present ALERT "Geomaterials", from 1986 to 1989. Jean Salençon has essentially focused his research on the determination of the strength capacities of industrial and civil engineering structures by taking into account the properties of the materials outside their elastic domain, such as plasticity and viscoelasticity. More recently his researches have been devoted to the area of earthquake engineering, in particular through the analysis of the stability of building and structure shallow foundations subjected to seismic loading. We address our warmest congratulations to Jean Salençon.

F.Darve, C. di Prisco, L. Laloui and B. Chareyre

ALERT Olek Zienkiewicz Course "Computational Geo-Mechanics"

Lecturers:
M.Pastor
(CEDEX and UPM)
P.Mira
(CEDEX and UPM)
J.A.Fernandez Merodo
(CEDEX URJC)
I.Herreros
(CEDEX and URJC)
M.Mabssout
(Tanger University)
D.Manzanal
(CEDEX and UPM)
L.Sanavia
(Università di Padova)
C.Tamagnini
(Università di Perugia)
R.Castellanza
(Politecnico di Milano)
René Chambon
(INP Grenoble)
Milan Jirasek
(Czech Technical Univ. in Prague)