EUROMECH
European Mechanics Society
Newsletter 17
October 2000

President's Introduction

This Newsletter contains information about the Elections to the Council for 2001, under the auspices of the Advisory Board of EUROMECH. This Board offers the membership a choice of candidates for five seats on the Council, four of the seats for a 6-year tenure, and one for a 3-year tenure. The choice of candidates reflects both the need for some continuity with the present Council and an opportunity to involve new members. All candidates have written a short curriculum vitae to present themselves. I should say that it is most gratifying to find that there is a panel of such distinguished scientists prepared to give time and effort to the work of the EUROMECH Council for six years.

May I now ask members to use their voting rights and send back the ballot sheet by return of mail.

Members should know that the Council is keen not simply to preserve our programme of well-known and widely imitated Colloquia, but to extend it across all areas of mechanics and all parts of Europe. This cannot be a process driven entirely by the Council. We need proposals for Colloquia in new scientific areas from the membership of EUROMECH. The Council will consider, in April 2001, proposals for Colloquia to be held in 2002 and, for those who need more planning time, in 2003. A PROPOSAL FORM and instructions accompany this Newsletter. Please consider how you could help mechanics in Europe by putting in a proposal and organising a Colloquium in 2002 or 2003. It is not an overly onerous or time-consuming task, and the results are often extremely rewarding on both the personal and scientific levels, as the organisers of more than 420 EUROMECH Colloquia can tell you!

Hans-Hermann Fernholz
President, EUROMECH

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Incompressible Flow and the Finite Element Method

P.M. Gresho, University of California, USA and R.L. Sani, University of Colorado, USA

This comprehensive reference work covers all the important details regarding the application of the finite element method to incompressible flows, addressing the theoretical background and the detailed development of appropriate numerical methods applied to the solution of a wide range of incompressible flows. For all the equations of principal interest, detailed discussion of both the continuous and discrete equations is presented, as well as explanations of how to properly march the time-dependent equations using smart implicit methods.

Together, this two volume work explains and emphasizes consistency in six areas:
- consistent mass matrix
- consistent pressure Poisson equation
- consistent penalty methods
- consistent normal direction
- consistent heat flux
- consistent forces

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"Written in an interesting, well-organised and very readable way, it also touches on some slightly controversial subjects, which adds flavour to the book."
Dan Givoli, Editor, IACMM Newsletter

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elastic energy and its release at different locations. Finally, the high lift capability of Gurney flaps and divergent trailing edges on airfoils was demonstrated to be further enhanced by an appropriate three-dimensional design of the trailing edge. This results in the elimination of the absolute instability in their wake and a subsequent drag reduction of the device.

The setting of the conference site and the informal atmosphere were conducive to much interesting discussion and fruitful exchanges between participants. The scientific talks were continued during an "open house" at the Hermann-Föttinger-Institut where participants had a chance to visit the laboratories. The objectives set out for the Colloquium have been met and it is suggested that another meeting on the same topic be held in a few years to assess the progress made in this research area.

A volume of abstracts has been prepared.

Addresses for EUROMECH Officers

President: Professor Dr.-Ing. Hans H. Fernholz, Hermann-Föttinger-Institut, Technische Universität Berlin, Straße des 17. Juni 135, D - 10623 Berlin, Germany. e-mail: fernholz@hbo.pi.tu-berlin.de Tel: +49 30 3142 3339. Fax: +49 30 3142 1101.

Secretary-General: Doc. Ing. Milošek Otrochlik, CSc., Head of Mechanics & Solids Department, Institute of Thermomechanics, Academy of Sciences of the Czech Republic, Dolanskova 5, 182 00 Prague 8, CZ. e-mail: ok@bivoj.it.cas.cz, miko@teknikum.uu.se Tel.: +42 2 688 5158 Fax: +42 2 838 4695

Treasurer: Professor Emil J. Hopfinger, LEGI/IMG, B.P. 53, 38041 Grenoble Cedex 09, France. e-mail: email.hopfinger@imag.ign.fr Tel.: +33 476 82 50 43. Fax: +33 476 82 52 71.

Journal Editor: Dr. John Finley Department of Aeronautics, Imperial College of Science, Technology and Medicine, Prince Consort Road, London SW7 2BY, UK. e-mail: aero.time@iac.ac.uk Tel.: +44 020 7594 5063. Fax: +44 020 7584 8120

Mechanics today, how far is it from the tower of Babel?

Professor Cyril Horsch
Institute of Thermomechanics, Academy of Sciences of the Czech Republic

Mechanics as an exact natural science is very young, having existed for not much more than 350 years. Today, in spite of this, it is considered by many physicists as completed, closed and therefore uninteresting. This undervaluation unfortunately leads to many inaccuracies and mistakes in the modern textbooks treating this subject.

No wonder that a susceptible student may be confused. Such a student once approached his schoolmates for help. "What really is equilibrium?" he asked. After a short consultation he got the answer: "It is a state of a system of forces and couples when the resultant force and the resultant couple of the system are simultaneously zero." Our student found this answer insufficient. As he understands Newton's third law, forces can act only between bodies. An abstract system of forces without bodies does not exist. In the student's opinion, equilibrium is rather a state of the body, which is at rest or in a state of uniform rectilinear motion in an inertial space. The answer of his schoolmates cannot be held as a definition. It expresses only the conditions for equilibrium, i.e., the forces and couples acting on a body in equilibrium must have zero resultant force and zero resultant couple, otherwise there would be no equilibrium. Nevertheless, it cannot be said that a body under the action of a system of forces and couples having zero resultant is in equilibrium. For instance, a uniformly rotating disc is not in equilibrium, because its particles are accelerated toward the center of rotation. The equilibrium of a body is stable, neutral or unstable. Without the body, these terms would have no sense.

"What is a force?" asked our student further. This time, the answer was immediate: "This is either the cause of the change of the velocity of motion of a body or the cause of its deformation." Although this definition of force can be found in several textbooks, our student was discontented again. He feels that the conjunction "either" should be omitted, because the deformation and acceleration can occur simultaneously. There exists also the possibility of forces acting statically between two rigid bodies. These cases are not covered by the proposed definition. Finally, the captain of a ship can also cause the change of its velocity, is he therefore a force?

"And what about time? What is the definition of time?" An embarrassed silence was the only answer. Of course, it is a very difficult question. Saint Augustine once wrote: "What is time? I know it, if I am not asked to explain it. Should I be obliged to explain it, I don't know."

1 The same definition can be found in Terminology for the theory of machines and mechanisms, Mechanism and Machine Theory, vol. 26, No. 5, p.476.
EUROMECH Colloquium 415

Shear-Flow Control

Chairpersons: H.H. Fernholz (Berlin), P. Huerre (Paris)

The colloquium took place at the Technical University of Berlin from July 24 to July 26, 2000. The colloquium was the third in a series of colloquia on the control of turbulent shear flows (EUROMECH Colloquia 328, 1994 and 361, 1997).

The meeting was attended by 49 scientists from 8 different countries. There were 32 oral presentations covering current research in the field of shear flow control. The time allotted to oral presentations was 20 minutes plus 5 minutes for discussion. After each session there was additional time for discussion. The content of each of the six sessions is outlined below:

Concepts of optimal and suboptimal control (session 1)

The three papers gathered in this session focussed on theoretical and numerical investigations of optimal and suboptimal control schemes, with applications to turbulent flow over a backward-facing step and to cross-flow vortices in three-dimensional boundary layers. The talks nicely reflected the current state of the art in the development of the most promising control strategies.

Control of laminar: transitional flows (session 2)

The eight papers making up this session were mainly concerned with control of instabilities in transitional boundary layers. Non-normality in both cross-stream and streamwise directions was confirmed to be an essential ingredient in the design of drag-reducing control algorithms based on linear system theory. The secondary instability of streaks was manipulated to effectively delay transition to turbulence. Further progress was reported on the properties of compliant walls and their ability to postpone transition. Finally, active cancellation of Tollmien-Schlichting instabilities was demonstrated to be feasible and the introduction of a strong periodic excitation was shown to lead to the reattachment of a separated shear layer.

Active control of flow over aerofoils (session 3)

The four presentations in this session were concerned with the control of reattachment and separation over airfoils using various devices such as synthetic jets, smart air-jet vortex generators and localised periodic forcing. These investigations clearly demonstrated the effectiveness of active control techniques in enhancing the stall and maximum lift performance of airfoils.

If we allow the variability in the force \( F \), then we may write \( F dt = d[m(t)v(t)] \). In the case of constant mass, we eventually obtain the well-known formula \( F = m\,dv/dt = m\,a \). Nevertheless, Newton does not use differentials and he does not suppose any change of force direction, although in applications he takes this change into account.

We see that the body need not be a "point mass" or "particle", as is found in many elementary textbooks on mechanics. The term "point mass" was severely criticized by G. Hamel. He considered this term to be an intellectual impurity. It applies to an infinite small particle with unlimited mass density. This is neither mathematically nor physically acceptable. Notwithstanding that we are able to apply, quite successfully, the mechanics of a point mass to the system of celestial bodies (which are certainly not infinitely small), the whole mechanics of the point mass is nothing else than an application of a sole theorem of motion of the center of mass. Surely, the mechanics of solids can be built up without this somewhat artificial conception of the point mass.

Similarly, the well-known Bernoulli equation cannot be found immediately in Daniel Bernoulli's Hydrodynamics (1738). It is hidden in the last but one chapter of the book. In his effort to catch his pioneering idea, the author does not trouble himself with the uniqueness of notions, and his sentences seem to be a little feverish. He takes tacitly the value of the gravitational acceleration as unity, as well as the density of fluid. Hence, these values do not appear in the equations, which therefore become dimensionally incorrect. The well-known Bernoulli equation in its contemporary form can be acquired from his book only after a witty intellectual effort, which is similar to the process of solving a riddle. As in a fairy-tale from Andersen, all people cry out that their emperor has a splendid suit, but our susceptible student, should he remain sincere, must declare that the emperor is nude.

The problem of confusing, ambiguous terminology can sometimes be very inconvenient, nevertheless it should not be overemphasized. Precision is not the same thing as clearness. Let us mention here the excellent statement of Sir Karl Popper: „One should never try to be more precise than the problem situation demands“.

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4 More details can be found in I. SABA: Die ursprünglichen Fassungen einiger Gesetze der Mechanik. Die Rechenbuch. vol. 45 (1908), No. 1, pp. 1-8.


Web Home Page

Curriculum Vitae for Council Candidates

Professor I. D. R. A. B. M. C. N. O. L. P. M. I.

Address: Department of Applied Mathematics, University of Melbourne

Position: Professor of Applied Mathematics, University of Melbourne

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The IUPAM (International Union of Pure and Applied Mathematics) is a non-governmental organization that promotes the development of mathematics and its applications. The IUPAM Prize is awarded to mathematicians for outstanding contributions to the field of mathematics.

The IUPAM Prize Committee is formed by the Council of IUPAM and is responsible for selecting the recipients of the IUPAM Prize. The criteria for selection include the importance and significance of the work, the impact it has had on the field of mathematics, and the potential for further development.

The Council of IUPAM is the governing body of the IUPAM, comprising representatives from various regions around the world. The Council is responsible for the strategic direction and policies of the Union.

The IUPAM Prize is awarded every two years, and the recipients are presented with a certificate and a monetary prize. The prize is intended to recognize and celebrate the achievements of outstanding mathematicians.

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Past winners of the IUPAM Prize include:

- Professor J. D. O. N. C. M. A. (1998)

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The IUPAM Prize Committee consists of:

- Chair: Professor J. D. O. N. C. M. A.
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The IUPAM Prize is awarded in odd-numbered years, and the next award will be presented at the IUPAM Congress in 2021.
ESMC was organised under the auspices of the European Mechanics Society (EUROMECH) and was chaired by Professor N. Jones.

The Local Organising Committee, chaired by Professor M. Potier-Ferry selected the Campus of the University of Metz for the Conference, which proved to be a good choice.

About 700 papers from 47 countries were accepted for this important event, mostly from Europe (10 papers or more were presented by France, 198, Russia, 60, Germany, 54, Poland, 47; Italy, 26; Ukraine, 26; Romania, 26; Morocco, 17; United Kingdom, 16; USA, 12). The number of participants was somewhat less: 630. However, this number shows an about 50% increase with respect to earlier manifestations of the European Solid Mechanics Community.

The scientific programme consisted of one general lecture by Professor V. V. Bolotin, 8 plenary lectures, 20 general sessions and 13 minisymposia. The latter were introduced for the first time, as were poster presentations (about 200), which were coupled to the oral sessions. The Scientific Secretary, Professor L.S. Toth was in charge of the scientific programme. The minisymposia were organised on the basis of invitations to experts in the given fields who independently composed their sessions. The minisymposia were very homogeneous and at a high scientific level. The poster sessions were full of participants and provided an excellent framework for valuable discussions and contact making. They were introduced by the Session Chairmen during the oral part of the sessions.

The 4th EUROMECH-MECAMAT (Mechanics of Materials) Conference was organised in tandem with ESMC4, the chairpersons being Professors E. Geuzit (Nancy) and M. Clavel (Compiègne). It comprised 69 oral or poster sessions.

Two prizes of 500 EU were awarded by the Scientific Committee for young scientists under 35, the winners being Dr M. Bischoff (Germany) and Dr R. Rizzoni (Italy). (See page 2.)

The weather was very generous for the whole week. The banquet was also special, held in the Abbey des Prémontrés in Pont-à-Mousson.

Lists of certain organising committees are given below. We thank them all, also those not listed, for their excellent work in the realisation of ESMC4.

Laszlo S. Toth, Michel Potier-Ferry.
Professor Patrick Huerre

E-mail: huerre@ladhyx.polytechnique.fr

Patrick Huerre is Director of Research at the CNRS (French National Centre for Scientific Research) and Professor of Mechanics at the Ecole Polytechnique in Paris.

He received his Ph.D. in Aeronautical Sciences from Stanford University in 1976, and was a postdoctoral fellow in the department of Applied Mathematical Studies at the University of Leeds (UK) from 1975 to 1978. He then joined the department of Aerospace Engineering at the University of Southern California where he successively held the positions of Assistant, Associate and Full Professor until his return to France in 1989. He is the director and founder of the Hydrodynamics Laboratory (LadHyX) at the Ecole Polytechnique, a research group actively involved in theoretical, numerical and experimental investigations of instabilities and transition to turbulence.

Patrick Huerre's primary research interests are in the areas of hydrodynamic instabilities, nonlinear dynamical systems and aerodynamic sound generation with particular emphasis on the dynamics of large scale vortices in open shear flows such as mixing layers, jets, wakes and boundary layers.

Patrick Huerre was elected a Fellow of the American Physical Society in 1993. He received the Montyon Prize awarded by the French Academy of Sciences in 1972 and gave the Batchelor Lecture at the University of Cambridge in 1988.

Between 1994 and 1988 he was co-Chief Editor of the European Journal of Mechanics. He is presently Associate Editor of the Journal of Fluid Mechanics.

He has been a member of Euromech since its inception and is the co-Chairman of Euromech 415 on Shear Flow Control.

Professor Felix Darve

Institut National Polytechnique de Grenoble, France
Felix.Darve@hmg.inpg.fr

Engineer of Ecole Centrale Paris (1971)
Dr.-Ing. (1974), Dr. es Sciences (1978) Institut de Mecanique de Grenoble
Prof. INPG (1985)

Teaching area: solid mechanics, geomechanics

Research area: constitutive relations, bifurcations and instabilities of geomaterials (concrete, rocks, soils)

Participation and sessions organiser of several EUROMECH Colloquia and Conferences

Member of the advisory board of the Int. J. "Comp. and Geotech.", "Mat. And Struct.", "Granular Matter", "It. Geotech.
Editor of 13 books or congress proceedings
More than 100 papers in journals or extended proceedings

Director of the European network of laboratories ALERT Geomaterials

Expert (French Ministry of Research and Technology, Belgian FNRS, Italian Ministry of Universities and Research)

Felix Darve
I.N.P.G. Laboratoire Solids Solides Structures, B.P. 53 - 38041 Grenoble cedex 9
Solids Solids Structures Laboratory, A.L.E.R.T. Geomaterials, Director
tel. 33 (0)4 76 82 52 76
fax. 33 (0)4 76 82 70 00
URL: http://www.3S.hmg.inpg.fr
e-mail to: Felix.Darve@hmg.inpg.fr
mail to: Felix.Darve@inpg.fr
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