
Reports of the IUTAM Working Parties

WP-1 - Non-Newtonian Fluid Mechanics and Rheology

No report submitted on WP-1.

WP-2 - Dynamical Systems and Mechatronics

No report submitted on WP-2.

WP-3 - Mechanics of Materials

A major re-alignment in the membership of WP-3 occurred after November 1, 2006. A new chair was elected by the General Assembly during its meeting at Brown University in August, 2006. Two new members of the Working Party have been approved by the Bureau. They are Olivier Allix (France) and Stelios Kyriakides (USA). Tatsuo Inoue (Japan) continues as a member of the WP-3. Additional members that will enhance the global representation are under consideration.

It is anticipated that the major activity of the Working Party during the coming year will focus on specific goals and its relationship with other Working Parties. In particular, there is apparent overlap with WP-4: Materials processing; WP-5: Computational fluid and Solid Mechanics; WP-6: Biomechanics; WP-7: Nano- and Micro-Scale Phenomena in Mechanics; WP-8; and Geophysical and Environmental Mechanics.

Report composed by Carl T. Herakovich, Chair of WP-3

WP-4 - Materials Processing

No report submitted on WP-4.

WP-5 - Computational Fluid and Solid Mechanics

The main computational mechanics event of 2006 was, on July 16-22, the 7th World Congress of the IACM (International Association for Computational Mechanics). This conference was a great success. About two thousand participants came, of whom 844 were from North America, 576 from Europe, 454 from Asia, 53 from South America, 18 from Australia and 9 from Africa (Cameroon: 2, Tunisia: 2, South Africa: 5). The 14 mini-symposia co-sponsored by IUTAM and IACM were officially designated by the organizers of the congress as sanctioned by the IUTAM through the cooperative

agreement between IACM and IUTAM. The next important meeting for the computational mechanics community will be the U.S. National Congress on Computational Mechanics, July 23-26, 2007 in San Francisco. Thus, the computational mechanics community has the opportunity to attend one international congress every year.

The 2006 meeting of WP5 took place on July 20th in Los Angeles during the 7th World Congress of IACM, with all the members but Y.K. Cheung present. Professor E. Arantes e Oliveira announced his retirement as chairman of WP5 and was cheerfully thanked for the great work he did.

The working party was pleased to see the success of its proposal to have mini-symposia co-sponsored by IUTAM and IACM. The members of WP5 would also like to see co-sponsored IUTAM-IACM symposia in which WP5 could intervene; the agreement process should be discussed with IUTAM and IACM.

Another question discussed in Los Angeles was what could be done to foster the scientific and technological development of the African continent, particularly Northern African countries and South Africa.

Report written by Pierre Ladevèze, Chairman of WP-5

WP-6 - Biomechanics

2006 was a very successful year for the community of Biomechanics and Biomechanical Engineering with numerous high level conferences, meetings and workshops including the highlight namely the “5th World Congress of Biomechanics” which took place at The Munich University of Applied Sciences in June 2006 (Chair: D Liepsch, Munich). Most of the IUTAM members involved in biomechanics were present at this Congress. The World Congress of Biomechanics with about 2000 participants was the biggest event which ever took place in the history of biomechanics.

Biomechanics is a worldwide growing area, and biology and biochemistry is getting more dominant thereby. Activities within biomechanics are well appreciated within the whole theoretical and applied mechanics community, and reach good evaluations. For example, the activities of the bioengineering division of the Japan Society of Mechanical Engineering have a very high score by the evaluation committee of societies. The number of workshops on biomechanics organized by people with a background in mechanics, engineering or mathematics is increasing, and new positions in academia (from the assistant level to the level of a full professor) and industry have been established worldwide in 2006. Particularly the number of graduate students and young researchers are increasing rapidly and the class rooms are filled with young enthusiastic people who disseminate a stimulating atmosphere.

One specific example here mentioned was the 14th CISM-IUTAM Summer School on “Biomechanical Modelling at the Molecular, Cellular and Tissue Levels” held at the International Centre for Mechanical Sciences, Udine, Italy in September 2006 (Chair: GA Holzapfel, Graz University of Technology, Austria and Royal Institute of Technology (KTH), Sweden; Co-Chair: R Ogden, University of Glasgow, UK). The aim of the course was to present a state-of-the-art overview of biomechanical modelling at the molecular, cellular and tissue levels, with particular reference to nanostructures, cells, growth and remodelling, and the cardiovascular system. This included experimental, continuum mechanical and computational aspects. The course was overbooked and finally attended by 98 participants (91 PhD students and postdoctoral researchers and 7 Professors) in mechanical and civil engineering, applied mathematics, physics, biomedical engineering, bioengineering, and material sciences, representing 23 countries.

In the following selected events on Biomechanics are listed where IUTAM-members were involved. One category lists events devoted to Biomechanics, while another lists conferences, meetings and seminars which were not specifically devoted to biomechanics, but considered keynote or plenary lectures and MiniSymposia on Biomechanics. This category is here described in more detail.

Conferences, meetings and schools devoted to Biomechanics:

- *The 18th meeting of Bioengineering*, Bioengineering Division of the Japan Society of Mechanical Engineering, Niigata, Japan, January 13-14, 2006
- *The 29th Annual meeting of the Japan Society of Biorheology*, Fukuoka, Japan, June 15-16, 2006
- *2006 Summer Bioengineering Conference*, Amelia Island, FL, USA, June 21-25, 2006
- *5th World Congress of Biomechanics*, Munich, Germany, July 29 – August 4, 2006
- *14th CISM-IUTAM Summer School on Biomechanical Modelling at the Molecular, Cellular and Tissue Levels*, International Centre for Mechanical Sciences (CISM) in Udine, Italy, September 11-15, 2006
- *New Trends in Biomechanical Modelling: from Molecular Statistics to Continuum Mechanics*, hosted by the International Center of Mathematical Encounters, Castro Urdiales, Cantabria, Spain, September 25-29, 2006
- *Seminar on Computational Biomechanics*, organized by the SINTEF ICT and SINTEF Health Research, Trondheim, Norway, November 2, 2006

- *11th International Conference on Human Biomechanics 2006*, Hrotovice, Czech Republic, November 13-16, 2006
- *The 17th Biofrontier meeting, Bioengineering Division of the Japan Society of Mechanical Engineering*, Ueda, Japan, November 11-12, 2006
- *2nd GAMM Seminar on Continuum Biomechanics*, Freudenstadt-Lauterbad, Germany, November 22-24, 2006

Conferences, meetings and seminars which were not specifically devoted to biomechanics, but which considered plenary or keynote lectures and MiniSymposia and sessions on Biomechanics:

- *77th Annual Meeting of the Gesellschaft für Angewandte Mathematik und Mechanik (GAMM)*, Berlin, Germany, March 27-31, 2006
One Young Researcher's MiniSymposia on "Nano-to-macro characterization of hard and soft biological tissues: The contribution of applied mechanics and mathematics".

One section (4 sessions) was devoted to Biomechanics

- o Arterial wall and blood circuit mechanics (5 talks)
- o Soft tissue biomechanics (4 talks)
- o Bone mechanics, growth and remodelling (5 talks)
- o Modelling and moving biological systems (6 talks)

- *British Applied Mathematics Colloquium*, Keele University, April 24-27, 2006
MiniSymposium on "Nonlinear elasticity and nanotechnology in biomedical systems" – 6 talks (2 sessions)

Plenary lectures:

- o J Keener, University of Utah, USA, How cells make measurements
- o H Gao, Max Planck Institute, Stuttgart, Germany (now Brown University), Nanomechanics of biological materials
- o R Ogden, University of Glasgow, UK, Biomechanics of soft biological tissue: fibrous structure and arterial walls

- *3rd European Conference on Computational Mechanics. Solids, Structures and Coupled Problems in Engineering*, Lisbon, Portugal, June 5-9, 2006

Plenary lecture:

- o P Hunter, Auckland, New Zealand, Computational bioengineering

Keynote lectures:

- o GA Holzapfel, Graz University of Technology, Austria and KTH, Sweden, Mechanobiology: computation and clinical application
- o C Hellmich, TU Vienna, Austria, Computational micromechanics of biological materials: bone and wood

- 5 separate MiniSymposia on biomechanics related topics:
 - o Biomechanical simulations
 - o Computational biomechanics
 - o Modeling in mechanobiology
 - o Multiscale mechanics of biological materials and other natural composites
 - o Soft tissue

- *12th MAFELAP-Conference*, Brunel University, West London, June 13-16, 2006
One MiniSymposium on “Computational multifield and multiscale methods in continuum biomechanics“

- *15th US National Congress of Theoretical and Applied Mechanics*, Boulder, 25-30 June 2006
Plenary lecture:
 - o S Kim, Purdue University, USA, Future research in biomechanics

- 7 separate MiniSymposia on biomechanics related topics:
 - o Biological and biologically inspired materials (8 talks)
 - o Applications of mechanics to biological problems (16 talks)
 - o Biomechanics of tissues (11 talks)
 - o Cell and molecular mechanics (12 talks)
 - o Ecologically friendly materials (5 talks)
 - o Mechanics issues in bioengineering (9 talks)
 - o Mechanics of materials from nature (7 talks)

- *13th International Symposium on Applications of Laser Techniques to Fluid Mechanics*, Lisbon, Portugal, 26-29 June, 2006
Keynote lecture:
 - o K Tanishita, Keio University, Japan, Transport phenomena in the cardiovascular system related to vascular diseases

- *International Symposium on Trends in the Applications of Mathematics to Mechanics*, Vienna, July 10-14, 2006
Plenary lecture:
 - o R Ogden, University of Glasgow, UK, Application of nonlinear elasticity theory to the biomechanics of soft biological tissues, with particular reference to arterial walls

- 2 sessions on Biological/Smart materials and Systems (6 talks)

- *13th International Heat Transfer Conference*, Sydney, August 13-18, 2006
Keynote lecture:
 - o K Tanishita, Keio University, Japan, Oxygen transfer in the cerebral tissue

- *43rd Annual Meeting of the Society of Engineering Science*, Penn State University, August 2006
 - o 2nd symposium on mechanics of soft materials and soft tissues (5 sessions, 20 talks)
 - o Modeling and characterization of biological materials and biomaterials (3 sessions, 12 talks)

- *6th European Solid Mechanics Conference*, Budapest, Hungary, August 28 – September 1, 2006
Plenary lecture:
 - o GA Holzapfel, Graz University of Technology, Austria and KTH, Sweden, Constitutive modeling of soft biological tissue: applications to arterial walls

One MiniSymposium on biomechanics (6 talks) and one session on biomechanics (8 talks)

- *IUTAM Symposium on Discretization Methods for Evolving Discontinuities*, Lyon, France, September 4-7, 2006
A few lectures were devoted to biomechanics related topics

- *19th Nordic Seminar on Computational Mechanics*, Lund University, Sweden, October 20-21, 2006
Keynote lecture:
 - o GA Holzapfel, Graz University of Technology, Austria and KTH, Sweden, Rupture analysis for human atherosclerotic plaques

Four sessions on biomechanics

Report composed by Gerhard A. Holzapfel, Chairman of WP-6

WP-7 - Nano- and Micro-Scale Phenomena in Mechanics

No report submitted on WP-7.

WP-8 - Geophysical and Environmental Mechanics

No report submitted on WP-8.

WP-9 - Education in Mechanics and Capacity Building

WP-9 looks after several important areas in education and capacity building that serve as IUTAM's "service interface" to the outside world and to other scientific communities.

The Working Party has been reconstituted with H. Aref as chair.

Prof. M. Hassan (Sudan) has left the WP due to the pressures of other business, and Dr. I. Gledhill (South Africa) has joined. Currently, Prof. Yilong Bai (China) is phasing out and will be succeeded by Prof. Haiyan Hu (China). The WP is looking to add a member with expertise on the issues of South America.

While the WP has been somewhat inactive during the past year due to a change in membership, it was clear from discussions at the GA in Providence that several of the initiatives IUTAM is contemplating (e.g., the notion of associate membership) would be in areas under the purview of this WP. It was felt that aligning IUTAM's and WP-9's activities with ICSU initiatives in education and outreach would be wise. In particular, the establishment of new regional offices for ICSU should inform IUTAM investments in the area of outreach.

Report composed by Hassan Aref, Chairman of WP-9