



XXI INTERNATIONAL CONGRESS OF THEORETICAL AND APPLIED MECHANICS

*the President of The Congress held under patronage of
the Republic of Poland, Aleksander Kwaśniewski*

ICTAM04

Abstracts and CD-ROM Proceedings, p. 446

Edited by: W. Gutkowski, T. A. Kowalewski

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The International Congress of Theoretical and Applied Mechanics held in Warsaw, Poland is the twenty first congress of a series started eighty years ago in Delft, Netherlands. The idea of congresses devoted to mechanics, can be traced back to a conference devoted to the problems of fluid mechanics in Innsbruck, 1922. It was organized by four individuals, whose names, are and will, remain very well known to next generations of scientists, C. W. Oseen, T. Levi-Civite, T. von Kármán, and L. Prandtl. This conference was so fruitful, that the organizers decided to arrange similar meetings in the future, every four years, and to extend the scope of the future meetings to include solid mechanics.

From the meetings of the Congress Committee sprang the idea of a more permanent organization to look out for the world interests in the mechanical sciences. Thus, IUTAM, the International Union of Theoretical and Applied Mechanics, was formed on September 26, 1946. In 1947 IUTAM became a member of ICSU, the International Council of Scientific Unions, itself founded in 1931. The highest authority of IUTAM is the General Assembly, with delegates from the Adhering Organizations, each of which is affiliated with a national learned society in a given country.

Contemporary mechanics poses both the fundamental problems from the area of pure science, and its strong links with modern technology. It spreads over such areas of our knowledge as oceanography, physical chemistry, biology, medicine, geophysics and astrophysics. Hence, any conclusions deduced in the framework of mechanics, are likely to have a value for other fields. This ICTAM Congresses contributed to widely spreading the knowledge in our field of interest and the advancement of the mutual human understanding. James Clerk Maxwell put it in a short conclusion:

"The true seat of science is not in the volume of transactions, but in the living mind, and the advancement of science consists in the direction of the men's minds into a scientific channel".

One of these channels, the 21st International Congress of Theoretical and Applied Mechanics was invited to be held in Warsaw by the:

- **Polish National Committee of IUTAM**
- **Institute of Fundamental Technological Research of the Polish Academy of Sciences**
- **Warsaw University of Technology**

These words were written by the editors of the Abstracts and CD-ROM Proceedings and main organizer of the International Congress of Theoretical and Applied Mechanics: W. Gutkowski and T. A. Kowalewski and are the Introduction of the Proceedings.



Participants of the IUTAM General Assembly in Warsaw 2004.

The IUTAM General Assembly establishes a standing **Congress Committee** which is responsible for the organization of International Congresses of Theoretical and Applied Mechanics at regular intervals. The members of the Congress Committee are appointed by the General Assembly as scientists active in theoretical or applied mechanics and need not be members of the General Assembly. Rules of the procedure of the Congress Committee and its Executive Committee are given in the IUTAM Statutes.

The scientific program consists of plenary opening and closing lectures, sectional lectures, mini-symposia, and contributed papers presented in lecture and seminar presentation sessions. These are intended to cover all aspects of mechanics. This volume contains 1417 papers, having been drawn on from the oral and the seminar presentations of the congress. Each paper consists of a printed Short Abstract and an Extended Summary recorded on an enclosed CD-ROM. Obviously, the book that has to be available at the congress is based on papers that had to be submitted over half a year ahead. Therefore, the congress itself, in many cases, may deliver more recent data and evaluative work than had been possible to allude to in the publication.

All contributed papers were peer reviewed. Recommendations had been received from Pre-selection Committees of the National Committees of the nine countries: Canada, France, Germany, Japan, PR China, Poland, Russia, UK and USA. Moreover, recommendations had been received from the Chairs responsible for the Mini-Symposia and the Pre-nominated Sessions with classifications of the papers submitted within the topics of their Symposia/Sessions. Finally, the International Papers Committee paid careful attention to the above recommendations. Accordingly, of the 2086 eligible submissions 1574 contributions were invited by the IPC for their presentation. The total number of submitted and accepted papers represents a quite substantial enhancement relative to the previous congresses, providing evidence of vitality of the contemporary mechanics.

Proceedings contain the following **KEYNOTE Lecture - PAPERS:**

Plenary Lectures:

- * [*Interplay Between Air and Water*](#) written by *Leen van Wijngaarden (Netherlands)* - Opening lecture
- * [*Stochastic Dynamics of Engineering Systems*](#) written by *Kazimierz Sobczyk (Poland)* - Closing Lecture

Sectional Lectures:

- * *Multibody dynamics: bridging for multidisciplinary applications* written by *Jorge Ambrosio*
- * *Rapid formation of strong gradients and diffusion in the transport of scalar and vector fields* written by *Konrad Bajer*
- * *Near-critical point hydrodynamics and microgravity* written by *Daniel A. Beysens*
- * *Suspensions: From Micromechanics to Macroscopic Behavior* written by *John F. Brady*
- * *Nanoscale mechanics of biological materials* written by *Huajian Gao*
- * *Variational and multiscale methods in turbulence* written by *Thomas J. R. Hughes*
- * *Non-Newtonian fluid mechanics using molecular theory* written by *Roland Keunings*
- * *Nonlinear dynamics in ocean engineering* written by *Edwin Kreuzer*
- * *A bridge between the micro- and mesomechanics of laminates, fantasy or reality* written by *Pierre J. Ladeveze*
- * *Turbulence and large-eddy simulations* written by *Marcel Lesieur*
- * *Probability phenomena in perturbed dynamical systems* written by *Anatoly Neishtadt*
- * *Mechanics of rubberlike solids* written by *Raymond W. Ogden*
- * *Some issues in active vibration control of smart structures* written by *Andre Preumont*
- * *Ocean circulation and its influence on climate* written by *Peter B. Rhines*
- * *Microviscoelasticity of cells: cells as viscoplastic bodies* written by *Erich Sackmann*
- * *Electrokinetics & electrohydrodynamics in microfluids* written by *D. A. Saville*
- * *Problems in astrophysical fluid dynamics* written by *Edward Spiegel*
- * *Scaling in quasi-2D turbulence experiments in a rotating flow* written by *Harry L. Swinney*



Participants at ICTAM04 15 - 21 August 2004, Warsaw, Poland: Closing Plenary Lecture (left photo) and professors A. Tylikovski (Poland), K. (Stevanović) Hedrih (Serbia) and R. Hetnarski (USA) (right photo).

Mini symposia Lectures

- * [Smart materials and structures](#) written by *N. Sottos (USA), J. Holnicki-Szulc (Poland)*
- * [Tissue, cellular and molecular biomechanics](#) written by *P. Janmey (USA), D. Barthes-Biesel (France), A. Hoger (USA)*
- * [Mechanics of thin films and nanostructures](#) written by *K. Kim (USA), Z. Suo (USA), H. Jensen (Denmark)*
- * [Microfluids](#) written by *P. Tabeling (France), R. Adrian (USA), J. Santiago (USA)*
- * [Microgravity flow phenomena](#) written by *J. Legros (Belgium), G. Neitzel (USA), I. Alexander (USA)*
- * [Atmosphere and ocean dynamics](#) written by *J. Sommeria (France), M. McIntyre (UK)*

Topics involving both fluid mechanics and solid mechanics are:

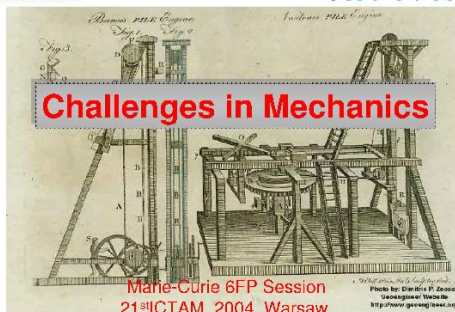
- * [Acoustics](#), Chiar: *T. Geers (USA), N. Peake (UK)*
- * [Chaos in fluid and solid mechanics](#), Chiar: *I. Mezic (USA), G. Rega (Italy)*
- * [Continuum mechanics](#), Chiar: *K. Rajagopal (USA), G. Saccomandi (Italy)*
- * [Fluid-structure interaction](#), Chiar: *J. Grue (Norway), M. Paidoussis (Canada)*
- * [Mechanics of foams and cellular materials](#), Chiar: *S. Hilgenfeldt (Netherlands), D. Weaire (Ireland)*
- * [Multiscale phenomena in mechanics](#), Chiar: *A. Carpinteri (Italy), C. Miehe (Germany)*
- * [Education in mechanics](#), Chiar: *R. Engel (USA), B. Karihaloo (UK)*

From Serbia and Montenegro the following papers were presented at ICTAM Congress and published in Abstracts and CD-ROM Proceedings and invited for new edition ICTAM04 Proceedings by Kluwer Academic Publishers:

- * [Homoclinic Orbits Layering in the Coupled Rotor Nonlinear Dynamics and Chaotic Clock Models: a Paradigm for Vibrations and Noise in Machines](#) written by *Katica (Stevanović) HEDRIH in session SM17_S1: Multibody dynamics*
- * [Quasi Rate - Independent Viscoplastic fcc – Polycrystals](#) written by *Milan Micunovic in session SM18_S1: Plasticity and viscoplasticity*

Marie-Curie 6FP Session Challenges in Mechanics (from <http://ictam04.ippt.gov.pl/>)

Human Resources and Mobility Marie Curie Actions



The M-C session was organized during 21st International Congress of Theoretical and Applied Mechanics (ICTAM04) to attract interest of young scientists to challenging problems of contemporary mechanics. It took place on Thursday, August 19, in auditorium 134. Over 200 participants attended the session prepared by Prof. K. Wilmanski (WIAS, Berlin).

Several participants interested to join round table discussion, and to propose subjects for discussion were invited by the M-C session organizers:

- Prof. Konrad Bajer, Warsaw University, e-mail: kbajer@fuw.edu.pl, Fluid Mechanics
- Prof. Piotr Doerffer, IMP PAN Gdansk, Polish Academy of Sciences, e-mail: doerffer@imp.gda.pl, Fluid Mechanics
- Prof. Stanislaw Drobniak, Czestochowa University of Technology, e-mail: drobniak@imc.pcz.czyst.pl, Fluid Mechanics
- Prof. Jan Holnicki-Szulc, IPPT PAN, Warsaw, email: holnicki@ippt.gov.pl, Solid Mechanics
- Prof. Henryk Kudela, Wroclaw University of Technology, e-mail: kudela@fluid.itcmp.pwr.wroc.pl, Fluid Mechanics
- Prof. Jacek Rolicki, Warsaw University of Technology, e-mail: jack@meil.pw.edu.pl, Fluid Mechanics
- Prof. Jan Slawianowski, IPPT PAN, Warsaw, email: jslawian@ippt.gov.pl, Solid Mechanics
- Prof. Krzysztof Wilmanski, WIAS, Berlin, email: wilmansk@wias-berlin.de, Solid Mechanics

1. NEW EUROPEAN PROGRAMMES

Jacek GIERLINSKI; Ministry of Science, Poland

"European Research Programmes and Technology Transfer" - Mrs M. MUTER; Polish Contact Point - "European Mobility Programme -Maria Curie"

2. CHALLENGES IN MECHANICS

Session 1: Modelling

Chairperson: Prof. K. WILMANSKI, WIAS-Berlin, Germany. Introduction by Chairperson and 7 contributed lectures:

- Dr. Bettina ALBERS, WIAS Berlin, Germany

Porous and granular materials, transport of pollutants, surface waves in multicomponent systems

- Prof. Dr. Romesh BATRA, Clifton C. Garvin Professor, Virginia Tech, USA

Computational solid mechanics, impact problems, metal forming, smart materials, functionally graded materials

- Prof. Dr. Wolfgang EHLERS, Head of the Institute for Mechanics, Stuttgart University, Germany

Mechanics of multicomponent systems, in particular: three-phasic in geotechnics, four-phasic in biomechanics

- Dr. Barbara GAMBIN, IPPT PAN, Warsaw, Poland

Functionally graded materials, piezoelectric materials, biomechanics, homogenization

- Prof. Dr. Gerard MAUGIN, Director of Lab. de modélisation en mécanique, Université Pierre et Marie-Curie, France

Nonlinear waves, coupled fields, large deformations of solids

- Prof. Dr. Andrew N. NORRIS, Rutgers University, USA
Acoustics, structural dynamics, composite and granular materials, elastodynamics (waves in layered media, scattering, geophysical and ultrasonic applications)
- Prof. Dr. Martin OSTOJA-STARZEWSKI, Canada Research Chair in Mechanics of Materials, McGill University, Canada
Stochastic (micro)mechanics (composite materials, granular materials, polycrystals, biomaterials), modelling and experiments

Session 2: Mathematical structure of mechanics

Chairperson: Prof. J. SŁAWIANOWSKI, IPPT PAN, Warsaw, Poland. Introduction by Chairperson

Session 3: Technical Fluid Mechanics

Chairperson: Prof. K. BAJER, Warsaw University, Poland

Introduction by Chairperson and 4 contributed lectures:

- Prof. Henryk KUDELA, Wrocław University of Technology, Poland
- Prof. Jacek ROKICKI, Warsaw University of Technology, Poland
- Prof. Stanisław DROBNIAK, Częstochowa University of Technology, Poland
- Prof. Piotr DOERFFER, IMP PAN, Gdansk, Poland

Session 4: Smart technologies

Chairperson: Prof. J. HOLNICKI – SZULC, IPPT PAN Warsaw, Poland

Introduction by Chairperson and contributed lecture:

- Prof. Wiesław OSTACHOWICZ, IMP PAN, Gdansk, Poland

3. DISCUSSION AND CONTRIBUTED PRESENTATIONS

Prof. Tian Yon Fan, Y.-W. Mai, Beijing, Institute of Technology, China

Prof. Leak Sharipova, Alexander B. Freidin, Institute of Mechanical Engineering Problems, RAS, St. Petersburg, Russia

On a model of heterogeneous deformation of elastic bodies by the mechanism of multiple appearance of new phase layers.

Prof. Vadim Polezaev, Institute for Problems in Mechanics RAS, Moscow, Russia

Prof. Katica Stevanović-Hedrih, Mechanical Engineering University of Niš, Niš, Serbia
Integrity of Dynamical Systems

M-C Session mediator: **Prof. K. Wilmanski**, WIAS Berlin