

# **REPORT 2009**



INTERNATIONAL UNION OF THEORETICAL AND  
APPLIED MECHANICS

# REPORT 2009



Ecole Normale Supérieure de Cachan, France  
and  
University College Dublin, Ireland

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## Bureau: Officers and Members

The following members of the Bureau of IUTAM have been elected for the period 1 November 2008 to 31 October 2012:

### Officers

Professor T.J. Pedley (UK)	President
Professor L.B. Freund (USA)	Vice-President
Professor N. Olhoff (Denmark)	Treasurer
Professor F. Dias (France)	Secretary-General

### Members

Professor F.L. Chernousko (Russia)	(elected 2008)
Professor I. Goldhirsch (Israel)	(elected 2008)
Professor N.K. Gupta (India)	(elected 2008)
Professor A. Thess (Germany)	(elected 2008)

## Secretariat

IUTAM-Secretariat, Centre de Mathématiques et de Leurs Applications,  
Ecole Normale Supérieure de Cachan, 94235 Cachan, France  
Telephone: +33 1 47 40 59 00, Telefax: +33 1 47 40 59 01  
E-mail: frederic.dias@cmla.ens-cachan.fr  
Internet: <http://www.iutam.net>

## Past Officers

<i>Elected</i>	<i>President</i>	<i>Vice-President</i>	<i>Treasurer</i>	<i>Secretary</i>
1948	J. Péres (France)	R.V. Southwell (UK)	H.L. Dryden (USA)	J.M. Burgers (Netherlands)
1952	H.L. Dryden (USA)	J. Péres (France)	G. Temple (UK)	F.A. v. d. Dungen (Belgium)
1956	F.K.G. Odqvist (Sweden)	H.L. Dryden (USA)	G. Temple (UK)	M. Roy (France)
1960	G. Temple (UK)	F.K.G. Odqvist (Sweden)	W.T. Koiter (Netherlands)	M. Roy (France)
1964	M. Roy (France)	G. Temple (UK)	W.T. Koiter (Netherlands)	H. Görtler (Germany)
1968	W.T. Koiter (Netherlands)	M. Roy (France)	H. Görtler (Germany)	F.I. Niordson (Denmark)
1972	H. Görtler (Germany)	W.T. Koiter (Netherlands)	D.C. Drucker (USA)	F.I. Niordson (Denmark)

1976	F.I. Niordson (Denmark)	H. Görtler (Germany)	D.C. Drucker (USA)	J. Hult (Sweden)
1980	D.C. Drucker (USA)	F.I. Niordson (Denmark)	E. Becker (Germany)	J. Hult (Sweden)
1984	J. Lighthill (UK)	D.C. Drucker (USA)	L.v. Wijngaarden (Netherlands)	W. Schiehlen (Germany)
1988	P. Germain (France)	J. Lighthill (UK)	L.v. Wijngaarden (Netherlands)	W. Schiehlen (Germany)
1992	L.v. Wijngaarden (Netherlands)	P. Germain (France)	B.A. Boley (USA)	F. Ziegler (Austria)
1996	W. Schiehlen (Germany)	L.v. Wijngaarden (Netherlands)	L.B. Freund (USA)	M.A. Hayes (Ireland)
2000	H.K. Moffatt (UK)	W. Schiehlen (Germany)	L.B. Freund (USA)	D.H. van Campen (Netherlands)
2004	L.B. Freund (USA)	H.K. Moffatt (UK)	J. Engelbrecht (Estonia)	D.H. van Campen (Netherlands)

## Past Congress Presidents

<i>Nr.</i>	<i>Year</i>	<i>Place</i>	<i>Congress-President</i>
1	1924	Delft, The Netherlands	C.B. Biezeno
2	1926	Zürich, Switzerland	E. Meissner
3	1930	Stockholm, Sweden	A.F. Enström
4	1934	Cambridge, UK	C.E. Inglis
5	1938	Cambridge, USA	K.T. Compton
6	1946	Paris, France	H. Villat
7	1948	London, UK	R.V. Southwell
8	1952	Istanbul, Turkey	K. Erim
9	1956	Brussels, Belgium	F.H. van den Dungen
10	1960	Stresa, Italy	G. Colonnetti
11	1964	Munich, Germany	H. Görtler
12	1968	Stanford, USA	N.J. Hoff
13	1972	Moscow, USSR	N.I. Muskhelishvili
14	1976	Delft, The Netherlands	W.T. Koiter
15	1980	Toronto, Canada	F.P.J. Rimrott
16	1984	Lyngby, Denmark	F. Niordson
17	1988	Grenoble, France	P. Germain and M. Piau
18	1992	Haifa, Israel	J. Singer
19	1996	Kyoto, Japan	T. Tatsumi
20	2000	Chicago, USA	H. Aref
21	2004	Warsaw, Poland	W. Gutkowski
22	2008	Adelaide, Australia	E. Tuck



## **Adhering Organizations**

### **Argentina (1959)**

Asociación Argentina de Mecánica Computacional  
Güemes 3450, 3000 Santa Fe  
President/Chair: Dr. S. R. (Sergio) Idelsohn  
Contact: Dr. S. R. (Sergio) Idelsohn  
Representatives in IUTAM: Dr. S. R. (Sergio) Idelsohn

### **Australia (1964)**

The Australian National Committee for Mechanical Sciences of the Australian Academy of Sciences  
GPO Box 783, Canberra City, ACT 2601  
President/Chair: Dr. J.P. (Jim) Denier  
Contact: Dr. J.P. (Jim) Denier  
Representatives in IUTAM: Dr. J.P. (Jim) Denier, Prof.S. (Scott) Sloan

### **Austria (1951)**

Austrian National Committee for Theoretical and Applied Mechanics of the Austrian Academy of Sciences  
Dr.-Ignaz-Seipel-Platz 2, A-1010 Wien  
President/Chair: Prof. H. (Hans) Troger  
Contact: Prof. A. (Alfred) Kluwick  
Representatives in IUTAM: Prof. A. (Alfred) Kluwick

### **Belgium (1949)**

The National Committee for Theoretical and Applied Mechanics of the Royal Academies for Science and Arts of Belgium  
Hertogsstraat 1 rue Ducale, B-1000 Brussels  
President/Chair: Prof. J. (Joris) Degrieck  
Contact: Prof. Y. (Yvan) Baudoin  
Representatives in IUTAM: Prof. P. (Philippe) Boulanger, Prof. E. (Erik) Dick, Prof.D. (Dirk) Vandepitte

### **Brazil (1982)**

Associação Brasileira de Engenharia e Ciências Mecânicas – ABCM  
Avenida Rio Branco 124/18° andar, 20040-001 Rio de Janeiro  
President/Chair: Prof. V. (Valder) Steffen Jr.  
Contact: Prof. L. (Luiz) Bevilacqua, Prof. J.A.P. (José) Aranha  
Representatives in IUTAM: Prof. J.A.P. (José) Aranha, Prof. L. (Luiz) Bevilacqua

**Bulgaria (1969)**

Bulgarian National Committee on Theoretical and Applied Mechanics of the Bulgarian Academy of Sciences

1, 15 novembre str., BG-1040 Sofia

President/Chair: Prof. A. (Anguel) Baltov

Secretary: Dr. E. (Evtim) Ttoshev

Contact: Prof. A. (Anguel) Baltov

Representatives in IUTAM: Prof. A. (Anguel) Baltov

**Canada (1963)**

The National Research Council of Canada,

Montreal Road, Ottawa, Canada K1A 0R6

National Committee for IUTAM

President/Chair: Prof. S.B. (Stuart) Savage

Contact: Prof. J.W. (Jean) Zu

Representatives in IUTAM: Prof. J.M. (Maciej) Floryan, Prof. S.B. (Stuart) Savage,

Prof. S. (Suresh) Shrivastava, Prof. J.W. (Jean) Zu

**Chile (1996)**

The Chile National Committee on Theoretical and Applied Mechanics Academia Chilena de Ciencias

Almirante Montt 454, Santiago, Chile

President/Chair: Dr. F. (Francisco) Rothhammer Engel

Secretary: Dr. T. (Tito) Ureta Aravena

Contact: Prof. F. (Fernando) Lund

Representatives in IUTAM: Prof. F. (Fernando) Lund

**China (1980)**

The Chinese Society of Theoretical and Applied Mechanics

15 Zhong Guan Cun Road, Beijing 100080

President/Chair: Prof. J (Jiachun) Li

Secretary: Prof. J.-X. (Jianxiang) Wang

Contact: Prof. J.-X. (Jianxiang) Wang

Representatives in IUTAM: Prof. Y. (Yi-long) Bai, Prof. J (Jiachun) Li, Prof. W. (Wei)

Yang, Prof. Z. (Zhemin) Zheng

**China-Hong Kong (1996)**

The Hong Kong Society of Theoretical and Applied Mechanics (HKSTAM)

Department of Mechanical Engineering, The University of Hong Kong, Pokfulam Road, HK

President/Chair: Dr. Jane WZ Lu

Secretary: Dr. Jeff Jianfeng Wang

Contact: Dr. Jeff Jianfeng Wang

Representatives in IUTAM: Prof. T.X. (Tongxi) Yu

**China-Taipei (1980)**

The Society of Theoretical and Applied Mechanics

Center for Construction Materials and Technology, National Yunlin University of Science and Technology, Yunlin 64002, Taiwan (R.O.C.)

President/Chair: Prof. W.-C. (Wei-Chung) Yang

Secretary: Prof. C.-H. (Cho-Liang ) Tsai

Contact: Prof. C.-C. (Chien-Ching) Ma

Representatives in IUTAM: Prof. C.-C. (Chien-Ching) Ma, Prof. W.-C. (Wei-Chung) Wang

**Croatia (1994)**

Croatian Society of Mechanics

Ivana Lucica 5, HR-10000 Zagreb, Croatia.

President/Chair: Prof. F. (Zdravko) Virag

Contact: Prof. G. (Goran) Turkalj

Representatives in IUTAM: Prof. G. (Goran) Turkalj

**Czech Republic (1993/1949)**

The National Committee of Theoretical and Applied Mechanics

Academy of Sciences of the Czech Republic, Institute of Thermomechanics,

Dolejšková 5, CZ-18200 Prague 8

President/Chair: Prof. M. (Miloslav) Okrouhlík

Secretary: Dr. J. (Jiri) Naprstek

Contact: Prof. M. (Miloslav) Okrouhlík

Representatives in IUTAM: Prof. M. (Miloslav) Okrouhlík

**Denmark (1949)**

National Committee for Theoretical & Applied Mechanics,

The Royal Danish Academy of Sciences and Letters, H.C. Andersens Boulevard 35, DK-1553 Copenhagen V.

President/Chair: Prof. T. (Tom) Fenchel

Secretary: Prof. H. (Henrik) Breuning-Madsen

Contact: Prof. N. (Niels) Olhoff

Representatives in IUTAM: Prof. N. (Niels) Olhoff, Prof. J.N. (Jens Nørkær) Sørensen

**Egypt (1976)**

Academy of Scientific Research and Technology

Egyptian Committee of Theoretical and Applied Mechanics 101 Kasr El Eini Street, Cairo, Egypt.

President/Chair: Prof. M.K. (Mohamed) Ismail

Secretary General: Prof. Z.Z. Momeh

Contact: Prof. M.K. (Mohamed) Ismail

Representatives in IUTAM: Prof. M.K. (Mohamed) Ismail

**Estonia (1992)**

Estonian Committee for Mechanics,  
Akadeemia tee 21, EE-12618 Tallinn  
President/Chair: Prof. A. (Andrus) Salupere  
Contact: Prof. A. (Andrus) Salupere  
Representatives in IUTAM: Prof. A. (Andrus) Salupere

**Finland (1952)**

The Finnish National Committee on Mechanics  
Helsinki University of Technology, Attent. Prof. Rolf Stenberg, P.O.Box 1100, FIN-02015 TKK, Finland  
President/Chair: Prof. J. (Juha) Paavola  
Secretary: Prof. R. (Rolf) Stenberg  
Contact: Prof. J. (Juha) Paavola  
Representatives in IUTAM: Prof. J. (Juha) Paavola, Prof. R. (Rolf) Stenberg

**France (1949)**

Comité National Français de Mécanique, Académie des Sciences  
23, quai Conti, F-75006 Paris  
President/Chair: Prof. S. (Sébastien) Candel  
Secretary: Prof. F. (Frédéric) Dias  
Contact: Prof. S. (Sébastien) Candel  
Representatives in IUTAM: Prof. A. (Ahmed) Benallal, Prof. S. (Sébastien) Candel, Prof. F. (François) Charru, Prof. A. (Alain) Molinari

**Georgia (2000)**

National Committee of Theoretical and Applied Mechanics  
I. Vekua Institute of Applied Mathematics of Tbilisi State University, 2 University Str., Tbilisi 0143  
Co-Chairmen: Prof. G. (George) Jaiani, Prof. D. (Demuri) Danelia  
President/Chair: Prof. G. (George) Jaiani  
Secretary-General: Prof. G. (Gela) Kipiani  
Contact: Prof. G. (George) Jaiani  
Representatives in IUTAM: Prof. G. (George) Jaiani

**Germany (1950)**

Deutsches Komitee für Mechanik (DEKOMECH)  
Hamburg University of Technology, Institute of Modelling and Computation,  
Denickestraße 17, D-21073 Hamburg  
President/Chair: Dr. R. Kienzler  
Secretary: Prof. O. (Otto) von Estorff  
Contact: Prof. P. (Peter) Eberhard  
Representatives in IUTAM: Prof. P. (Peter) Eberhard, Dr. R. Kienzler, Prof. M. (Martin) Oberlack, Prof. A. (André) Thess

**Greece (1979)**

Hellenic Society for Theoretical and Applied Mechanics  
National Technical University of Athens, Mechanics Division, Zographou, GR-15773,  
Greece

President/Chair: Prof. J.T. (John) Katsikadelis

Secretary: Prof. H.G. (Haralambos) Georgiadis

Representatives in IUTAM: Prof. J.T. (John) Katsikadelis

**Hungary (1948)**

Hungarian National Committee for IUTAM  
Department of Structural Mechanics, Budapest University of Technology and  
Economics, Műegyetem rkp. 3, H-1521 Budapest

President/Chair: Prof. S. (Sandor) Kaliszky

Secretary: Prof. G. (Gábor) Stépán

Contact: Prof. S. (Sandor) Kaliszky

Representatives in IUTAM: Prof. S. (Sandor) Kaliszky

**India (1950)**

National Committee for Theoretical and Applied Mechanics of the Indian National  
Science Academy

Bahadur Shah Zafar Marg, New Delhi - 110 002

President/Chair: Prof. D.V. Singh

Contact: Dr. B. (Brotati) Chattopadhyay

Representatives in IUTAM: Prof. G. (Gautam) Biswas, Prof. N. (Narinder) Gupta, Prof.  
T. (Tarun) Kant, Prof. D. Singh

**Ireland (1984)**

Irish National Committee for Mathematical Sciences  
Royal Irish Academy, 19 Dawson Street, Dublin 2

President/Chair: Prof. R. (Richard ) Timoney

Secretary: Prof. R. (Rachel ) Quinlan

Contact: Prof. M. (Michael) Gilchrist

Representatives in IUTAM: Prof. M. (Michael) Gilchrist

**Israel (1950)**

The Israel Society of Theoretical and Applied Mechanics  
Faculty of Mechanical Engineering, Technion-Israel Institute of Technology, Haifa  
32000

President/Chair: Prof. M.B. (Miles) Rubin

Contact: Prof. I. (Isaac) Goldhirsch

Representatives in IUTAM: Prof. I. (Isaac) Goldhirsch, Prof. M.B. (Miles) Rubin

**Italy (1949)**

Associazione Italiana di Meccanica Teorica ed Applicata

Piazza Leonardo da Vinci 32, I-20133 Milano

President/Chair: Prof. G. (Giuseppe) Rega

Secretary: Prof. A. (Angelo) Morro

Contact: Prof. P. (Paolo) Podio-Guidugli

Representatives in IUTAM: Prof. G. (Giulio) Maier, Prof. A. (Angelo) Morro,

Prof. P. (Paolo) Podio-Guidugli, Prof. G. (Giuseppe) Rega

**Japan (1951)**

The National Committee for Theoretical and Applied Mechanics

Science Council of Japan, 7- 22-34 Roppongi, Minato-ku, Tokyo 106-8555

President/Chair: Prof. T. (Toshio) Kobayashi

Contact: Prof. K. (Koji) Uetani

Representatives in IUTAM: Prof. T. (Toshio) Kobayashi, Prof. K. (Koji) Uetani, Prof. E.

(Eiichi) Watanabe, Prof. T. (Tsutomu) Kambe

**Korea, Republic of (1989)**

Korean Society of Theoretical and Applied Mechanics

Department of Aerospace Engineering, Seoul National University, Seoul 151-742

President/Chair: Prof. J.Y. (Jung Yul) Yoo

Secretary: Prof. S.J. (Seung Jo) Kim

Contact: Prof. J.Y. (Jung Yul) Yoo

Representatives in IUTAM: Prof. J.Y. (Jung Yul) Yoo

**Latvia (1992)**

Latvian National Committee for Mechanics

Latvian Academy of Sciences, Akademijas laukums 1, Riga LV-1524

President/Chair: Prof. V. (Vitauts) Tamuzs

Contact: Prof. V. (Vitauts) Tamuzs

Representatives in IUTAM: Prof. V. (Vitauts) Tamuzs

**Mexico (2008)**

Mexican Academy of Sciences

Km 23.5 Carretera Federal México-Cuernavaca, "Casa Tlalpan", Av. Cipreses s/n Col.

San Andrés Totoltepec, Tlalpan, 14400 Mexico

Representatives in IUTAM: Prof. E. (Eduardo) Ramos

**Netherlands (1952)**

Netherlands Mechanics Committee

c/o Eindhoven University of Technology, Department of Mechanical Engineering,  
P.O. Box 513, NL 5600 MB Eindhoven.

President/Chair: Prof. D.H. (Dick) van Campen

Contact: Prof. D.H. (Dick) van Campen

Representatives in IUTAM: Prof. R. (René) de Borst, Prof. D.H. (Dick) van Campen,  
Prof. A.A. (Anton) van Steenhoven

**New Zealand (1979)**

The Royal Society of New Zealand, Committee on Mathematical & Information  
Sciences

P.O. Box 598, Wellington

President: Dr N.(Neville) Jordan

Contact: Dr. J. (Jez) Weston

Representatives in IUTAM: Dr. G. (Graham) Weir

**Norway (1949)**

National Committee on Theoretical and Applied Mechanics

Norwegian Acad. Sciences and Letters, Dept. of Maths, University of Oslo,

P.O.Box 1053, Blindern, N-0316 Oslo 3

President/Chair: Prof. J. (John) Grue

Contact: Prof. J. (John) Grue

Representatives in IUTAM: Prof. J. (John) Grue

**Poland (1952)**

Committee for Mechanics of the Polish Academy of Sciences

ul. Swietokrzyska 21, PL-00 049 Warszawa

President/Chair: Prof. W. (Witold) Gutkowski

Contact: Prof. G. (Gwidon) Szefer

Representatives in IUTAM: Prof. W. (Witold) Gutkowski, Prof. G. (Gwidon) Szefer

**Portugal (1968)**

Portuguese Society of Theoretical, Applied and Computational Mechanics

Laboratorio Nacional de Engenharia Civil, Avenida do Brasil 101, 1700-066 Lisboa

President/Chair: Prof. C.A. (Carlos) Mota Soares

Contact: Prof. C.A.B. (Carlos) Pina, Prof. D.R.Z. (Dinar) Camotim

Representatives in IUTAM: Prof. D.R.Z. (Dinar) Camotim

**Romania (1956)**

Romanian Academy, Department of Mathematics, Romanian National Committee of Theoretical and Applied Mechanics  
Calea Victoriei 125, 71102 Bucharest, Romania  
President/Chair: Prof. H. (Horia) Ene  
Secretary: Prof. V. (Vasile ) Brinzanescu  
Representatives in IUTAM: Prof. H. (Horia) Ene

**Russia (1992/1956)**

Russian National Committee on Theoretical and Applied Mechanics  
Prospekt Vernadskogo 101 : 1 , Moscow 119526  
President/Chair: Prof. G.G. (Gorimir) Chernyi  
Secretary: Prof. G.K. (Gleb) Mikhailov  
Contact: Prof. G.K. (Gleb) Mikhailov  
Representatives in IUTAM: Prof. F.L. (Felix) Chernousko, Prof. G.G. (Gorimir) Chernyi, Prof. G.K. (Gleb) Mikhailov, Prof. N.F. (Nikita) Morozov

**Saudi Arabia (1988)**

King Abdullaziz City for Science and Technology  
Directorate of Technology and International Cooperation, P.O. Box 6086, Riyadh 11442  
President/Chair: Dr. M.I. (Mohammed ibn Ibrahim) Al-Suwaiyel  
Contact: Mr. F.S. (Fahad) Huraib  
Representatives in IUTAM: Dr. M.I. (Mohammed ibn Ibrahim) Al-Suwaiyel

**Serbia (2006/1952)**

Serbian Society of Mechanics  
Kneza Milosa 9/1, 11000 Belgrade  
President/Chair: Prof. S. (Stevan) Maksimovic  
Secretary: Prof. B. (Borislav) Gajic  
Contact: Prof. T. (Tomislav) Igic  
Representatives in IUTAM: Prof. S. (Stevan) Maksimovic

**Slovakia (1993)**

The Slovak Society for Mechanics  
Council of Scientific Societies, Stefánikova 49, SK-811 04 Bratislava  
President/Chair: Prof. J. (Jan) Sladek  
Contact: Prof. J. (Jan) Sladek  
Representatives in IUTAM: Prof. J. (Jan) Sladek



**Slovenia (1994)**

Slovene Mechanics Society, Faculty of Mechanical Engineering  
University of Maribor, Smetanova 17, 2000 Maribor  
President/Chair: Prof. L. (Leopold) Skerget  
Secretary: Prof. J. (Jure) Marn  
Contact: Prof. J. (Jure) Marn  
Representatives in IUTAM: Prof. L. (Leopold) Skerget

**South Africa (1994)**

National Research Foundation (NRF), South African Association for Theoretical and Applied Mechanics (SAAM)  
South African ICSU Secretariat, P.O. Box 2600, Pretoria 0001  
President/Chair: Prof. C.G. (Charl) du Toit  
Contact: Prof. C.G. (Charl) du Toit  
Representatives in IUTAM: Prof. K. (Kok) Schalk

**Spain (1950)**

Instituto Nacional de Tecnica Aeroespacial  
Carretera de Ajalvir km. 4,00, Torrejón de Ardoz, 28850 Madrid  
Contact: Mr. A. (Angel) Moratilla  
Representatives in IUTAM: Mr. A. (Angel) Moratilla

**Sweden (1950)**

Swedish National Committee for Mechanics  
Malmö University , 205 06 Malmö  
President/Chair: Prof. P. (Per ) Ståhle  
Secretary: Prof. S. (Staffan) Lundström  
Contact: Prof. D. (Dan) Henningson, Prof. B. (Bengt) Lundberg  
Representatives in IUTAM: Prof. D. (Dan) Henningson, Prof. B. (Bengt) Lundberg, Prof. S. (Staffan) Lundström

**Switzerland (1950)**

Board of the Federal Institutes of Technology  
(Rat der Eidgenössischen Technischen Hochschulen)  
ETH-Zentrum, CH-8092 Zürich  
President/Chair: Dr. F. (Fritz) Schiesser  
Contact: Prof. P.A. (Peter) Monkewitz  
Representatives in IUTAM: Prof. J. (Jürg) Dual, Prof. P.A. (Peter) Monkewitz

**Turkey (1977)**

Turkish National Committee of Theoretical and Applied Mechanics  
Istanbul Teknik Üniversitesi, Fen-Edebiyat Fakültesi, Maslak 80626 Istanbul  
President/Chair: Prof. Y. (Yalcin) Aköz  
Secretary: Prof. M.A. (Mehmet Ali) Tasdemir  
Contact: Prof. E.S. (Erdogan) Suhubi  
Representatives in IUTAM: Prof. E.S. (Erdogan) Suhubi

**UK (1948)**

The Royal Society, UK Panel for IUTAM  
6 Carlton House Terrace, London SW1Y 5AG  
President/Chair: Prof. B.L. (Bhushan) Karihaloo  
Secretary: Prof. N. (Nigel) Peake  
Contact: Prof. N.A. (Norman) Fleck  
Representatives in IUTAM: Prof. N.A. (Norman) Fleck, Prof. B.L. (Bhushan) Karihaloo,  
Prof. N. (Nigel) Peake, Prof. T.J. (Timothy) Pedley

**Ukraine (1995)**

National Committee of Ukraine on Theoretical and Applied Mechanics  
S.P.Timoshenko Institute of Mechanics, 3 Nesterov Str., Kyiv 03680  
President/Chair: Prof. A.N. (Alexandr) Guz  
Secretary: Prof. J.J. (Jeremiah) Rushchitsky  
Contact: Prof. J.J. (Jeremiah) Rushchitsky  
Representatives in IUTAM: Prof. A.N. (Alexandr) Guz

**USA (1949)**

The U.S. National Committee on Theoretical and Applied Mechanics  
The National Academies, 500 Fifth Street NW, Washington, DC 20001  
President/Chair: Prof. T. J. R. (Thomas) Hughes  
Secretary: Prof. C.T. (Carl) Herakovich  
Contact: Prof. C.T. (Carl) Herakovich  
Representatives in IUTAM: Prof. N. (Nadine) Aubry, Prof. C.T. (Carl) Herakovich, Prof.  
S. (Stelios) Kyriakides, Prof. Z. (Zhigang) Suo, Prof. L. (Lance) Collins

**Viet Nam (1990)**

Vietnamese Association of Mechanics (VAM)  
Hoi Co Hoc Vietnam, 264 Doi Can, Hanoi  
President/Chair: Prof. N. (Nguyen) Hoa Thinh  
Secretary: Prof. D. (Dinh) Van Phong  
Contact: Prof. D. (Dinh) Van Phong  
Representatives in IUTAM: Prof. N. (Nguyen) Hoa Thinh

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## Affiliated Organizations

### **CISM (1970)**

International Centre for Mechanical Sciences  
Palazzo del Torso, Piazza Garibaldi, I-33100 Udine, Italy  
Rectors of CISM: Prof. Giulio Maier (Resident Rector),  
Prof. Jean Salençon and Prof. Wilhelm Schneider  
President/Chair: Prof. A.V. (Vinicio) Turello  
Secretary: Prof. B.A. (Bernhard) Schrefler  
Contact: Prof. B.A. (Bernhard) Schrefler  
Representative of CISM in IUTAM: Prof. B.A. (Bernhard) Schrefler  
Representative of IUTAM in CISM: Prof. H.K. (Keith) Moffatt

### **ICHMT (1972)**

International Centre for Heat and Mass Transfer  
Mechanical Engineering Dept., Middle East Technical University,  
06531 Ankara, Turkey  
President/Chair: G.F. (Geoffrey) Hewitt  
Secretary: Prof. F. (Faruk) Arinc  
Contact: Prof. F. (Faruk) Arinc  
Representative of ICHMT in IUTAM: Prof. F. (Faruk) Arinc  
Representative of IUTAM in ICHMT: Dr. R. (Rudolf) Dvorák

### **ICR (1974)**

International Committee on Rheology  
President/Chair: Prof. G.G. Fuller  
Secretary: Prof. M.H. (Manfred) Wagner  
Contact: Prof. M. (Masato) Abe  
Representative of ICR in IUTAM: Prof. L.G. (Gary) Leal  
Representative of IUTAM in ICR: Prof. F. (Frithiof) Niordson

### **IAVSD (1977)**

International Association for Vehicle System Dynamics  
Prof. Michael Valásek, Department of Mechanics, Faculty of Mechanical Engineering,  
Czech International University in Prague, Kalovo Nanesti 13,  
121 35 Praha 2, Czech Republic  
President/Chair: Prof. H. (Hans) True  
Secretary: Prof. M. (Michael) Valásek  
Contact: Prof. M. (Michael) Valásek  
Representative of IAVSD in IUTAM: Prof. M. (Mats) Berg  
Representative of IUTAM in IAVSD: Prof. W. (Werner) Schiehlen

**EUROMECH (1978)**

European Mechanics Society

University of Padova, Faculty of Engineering, Dipartimento di Costruzioni e Trasporti,  
35131 Padova, Italy

President/Chair: Prof. P. (Patrick) Huerre

Secretary: Prof. B.A. (Bernhard) Schrefler

Contact: Prof. B.A. (Bernhard) Schrefler

Representative of EUROMECH in IUTAM: Prof. P. (Patrick) Huerre

Representative of IUTAM in EUROMECH: Prof. T.J. (Timothy) Pedley

**ISIMM (1978)**

International Society for the Interaction of Mechanics and Mathematics

Prof. A. (Adriano) Montanaro Università degli Studi di Padova

Via Belzoni 7 35131 Padova Italy

President/Chair: Prof. L. (Lev) Truskinovsky

Secretary: Prof. D. (Davide) Bigoni

Contact: Prof. A. (Adriano) Montanaro

Representative of ISIMM in IUTAM: Prof. M.A. (Michael) Hayes

Representative of IUTAM in ISIMM: Prof. G. (Gérard) Itooss

**ICF (1978)**

International Congress on Fracture

Prof. T. Yokobori, School of Science and Engineering, Teikyo University,  
Toyosatodai 1-1, Utsunomiya, 320, Japan

President/Chair: Prof. A. (Alberto) Carpinteri

Secretary: Prof. A.T. (A.T.) Yokobori Jr.

Contact: Prof. R.M. (Robert) McMeeking

Representative of ICF in IUTAM: Prof. R.M. (Robert) McMeeking

Representative of IUTAM in ICF: Prof. J.B. (Jean-Baptiste) Leblond

**ICM (1982)**

International Congress on Mechanical Behaviour of Materials,

Prof. F. Ellyin, Dept. of Mechanical Engineering, University of Alberta,  
Edmonton, Canada T6G 2G8

President/Chair: Prof. S.W. (Soo Woo) Nam

Secretary: Prof. T. (Toshihiko) Hoshide

Contact: Prof. S.W. (Soo Woo) Nam

Representative of ICM in IUTAM: Prof. S.W. (Soo Woo) Nam

Representative of IUTAM in ICM: Prof. S.R. (Sol) Bodner

**AFMC (1982)**

Asian Fluid Mechanics Committee

Institute of Mechanics, Chinese Academy of Sciences, No. 15,

North Sihuanxi Rd, Beijing, 100080, China

President/Chair: Prof. J (Jiachun) Li

Contact: Prof. J (Jiachun) Li

Representative of AFMC in IUTAM: Prof. J (Jiachun) Li

Representative of IUTAM in AFMC: Prof. H. (Heng) Zhou

**IACM (1984)**

International Association for Computational Mechanics

Prof. E. Oñate, International Center for Numerical Methods in Engineering,

Edificio C-1, Gran Capitán s/n, E-08034 Barcelona, Spain

President/Chair: Prof. E. (Eugenio) Oñate

Secretary: Dr. S. R. (Sergio) Idelsohn

Contact: Dr. S. R. (Sergio) Idelsohn

Representative of IACM in IUTAM: Prof. J.T. (John Tinsley) Oden

Representative of IUTAM in IACM: Prof. R. (Eduardo) de Arantes e Oliveira

**CACOFD (1992)**

Caribbean Congress of Fluid Dynamics

c/o The Department of Math and Computer Science, The University of the West Indies,

St. Augustine, Trinidad, West Indies

President/Chair: Prof. F. (F.) Malpica

Secretary: Dr. D. M. G. (Donna) Comissiong

Contact: Prof. H. (Harold) Ramkissoon

Representative of CACOFD in IUTAM: Prof. H. (Harold) Ramkissoon

Representative of IUTAM in CACOFD: Prof. D.D. (Daniel) Joseph

**IABEM (1994)**

International Association for Boundary Element Methods

Prof. M. Bonnet, CNRS et Ecole Polytechnique, Laboratoire de Mécanique des Solides,

Ecole Polytechnique, 91128 Palaiseau cedex, France

Secretary: Prof. R. Callego

President/Chair: Prof. M. (Marc) Bonnet

Contact: Prof. M. (Marc) Bonnet

Representative of IABEM in IUTAM: Prof. M. (Marc) Bonnet

Representative of IUTAM in IABEM: Prof. G.R. (Günther) Kuhn

**ISSMO (1996)**

International Society for Structural and Multidisciplinary Optimization

Prof. G. Rozvany, Department of Structural Mechanics,

Budapest University of Technology and Economics,

Muegyetem rkp. 3, Kmf 35, H-1521 Budapest, Hungary

President/Chair: Prof. K.K. (Kyung) Choi

Secretary: Prof. B.M. (Byung) Kwak

Contact: Prof. N. (Niels) Olhoff

Representative of ISSMO in IUTAM: Prof. G. (George) Rozvany

Representative of IUTAM in ISSMO: Prof. N. (Niels) Olhoff

**HYDROMAG (1996)**

International Association for Hydromagnetic Phenomena and Applications

Prof. S. Asai, Dept of Mat. Sciences, University of Nagoya,

Furo-cho, Chikusa-ku, Nagoya 464-0, Japan

President/Chair: Prof. R. (René) Moreau

Secretary: Prof. A. (André) Thess

Contact: Prof. A. (André) Thess

Representative of HYDROMAG in IUTAM: Prof. R. (René) Moreau

Representative of IUTAM in HYDROMAG: Prof. H.K. (Keith) Moffatt

**IIAV (1997)**

International Institute of Acoustics and Vibration

Prof M. J. Crocker. Dept. of Mechanical Engineering, Auburn University,

201 Ross Hall, Auburn, AL 36849 USA

President/Chair: Prof. F. (Franz) Ziegler

Secretary: N.J. (Nicole) Kessissoglou

Contact: Prof. M.J. (Malcolm) Crocker

Representative of IIAV in IUTAM: Prof. M.J. (Malcolm) Crocker

Representative of IUTAM in IIAV: Prof. J.D. (Jan) Achenbach

**ICA (1998)**

International Commission for Acoustics

President/Chair: Prof. S.N.Y. (Samir) Gerges

Secretary: Mrs. M. (Marion) Burgess

Contact: Mrs. M. (Marion) Burgess

Representative of ICA in IUTAM: Prof. S.N.Y. (Samir) Gerges

Representative of IUTAM in ICA: Prof. A. (Andrew) Norris

**ICTS (2002)**

International Congresses on Thermal Stresses

Prof. Richard B. Hetnarski, St. Raphael, Apt. 1209, 7117 Pelican Bay Blvd.,  
Naples, Fl 34108, USA

President/Chair: Prof. R.B. (Richard) Hetnarski

Secretary: Prof. T.R. (Theodore) Tauchert

Contact: Prof. R.B. (Richard) Hetnarski

Representative of ICTS in IUTAM: Prof. R.B. (Richard) Hetnarski

Representative of IUTAM in ICTS: Prof. M. (Masato) Abe

## Members of the General Assembly

<i>Member</i>	<i>Representative of</i>	<i>Remarks</i>
Prof. J. (Jan) Achenbach		Member-at-Large
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Prof. L. (Luiz) Bevilacqua	Brazil	
Prof. G. (Gautam) Biswas	India	
Prof. B. (Bruno) Boley		Member-at-Large
Prof. R. (René) de Borst	Netherlands	
Prof. P. (Philippe) Boulanger	Belgium	
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Prof. F. (Francois) Charru	France	
Prof. F.L. (Felix) Chernousko	Russia	Bureau member
Prof. G.G. (Gorimir) Chernyi	Russia	
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Prof. F. (Frédéric) Dias	France	Bureau member
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Prof. J. (Jürg) Dual	Switzerland	
Prof. P. (Peter) Eberhard	Germany	
Prof. H. (Horia) Ene	Romania	
Prof. N.A. (Norman) Fleck	UK	
Prof. M. (Maciej) Floryan	Canada	
Prof. B. (Ben) Freund	USA	Bureau member
Prof. M. (Michael) Gilchrist	Ireland	
Prof. I. (Isaac) Goldhirsch	Israel	
Prof. J. (John) Grue	Norway	
Prof. N. (Narinder) Gupta	India	Bureau member
Prof. W. (Witold) Gutkowski	Poland	
Prof. A.N. (Alexandr) Guz	Ukraine	
Prof. D. (Dan) Henningson	Sweden	
Prof. C.T. (Carl) Herakovich	USA	



<b>Member</b>	<b>Representative of</b>	<b>Remarks</b>
Prof. N.(Nguyen) Hoa Thinh	Viet Nam	
Prof. J. (Jan) Hult		Member-at-Large
Dr. S.R. (Sergio) Idelsohn	Argentina	
Prof. M.K. (Mohamed) Ismail	Egypt	
Prof. G. (George) Jaiani	Georgia	
Prof. S. (Sandor) Kaliszky	Hungary	
Prof. T. (Tutomu) Kambe	Japan	
Prof. T. (Tarun ) Kant	India	
Prof. B.L. (Bhushan) Karihaloo	UK	
Prof. J.T. (John) Katsikadelis	Greece	
Prof. R. (Reinhold) Kienzler	Germany	
Prof. A. (Alfred) Kluwick	Austria	
Prof. T. (Toshio) Kobayashi	Japan	
Prof. S.(Schalk) Kok	South Africa	
Prof. S. (Stelios) Kyriadikes	USA	
Prof. J. (Jiachun) Li	China	Representative of AFMC
Prof. F. (Fernando) Lund	Chile	
Prof. B. (Bengt) Lundberg	Sweden	
Prof. S. (Staffan) Lundstrom	Sweden	
Prof. C.-C. Ma	China-Taipei	
Prof. G. (Giulio) Maier	Italy	
Prof. S. (Stevan) Maksimovic	Serbia	
Prof. G.K. (Gleb) Mikhailov	Russia	
Prof. K. (Keith) Moffatt		Member-at-Large
Prof. A. (Alain) Molinari	France	
Prof. P.A. (Peter) Monkewitz	Switzerland	
Mr. A. (Angel) Moratilla	Spain	
Prof. N.F. (Nikita) Morozov	Russia	
Prof. A. (Angelo) Morro	Italy	
Prof. R. Narasimha		Member-at-Large
Prof. M. (Martin ) Oberlack	Germany	
Prof. M. (Miloslav) Okrouhlik	Czech Republic	
Prof. N. (Niels) Olhoff	Denmark	Bureau member Representative in ISSMO
Prof. J. (Juha) Paavola	Finland	
Prof. N. (Nigel) Peake	UK	
Prof. T.J. (Timothy) Pedley	UK	Bureau member
Prof. P. (Paolo) Podio-Guidugli	Italy	
Prof. E. (Eduardo ) Ramos	Mexico	
Prof. G. (Giuseppe) Rega	Italy	
Prof. M.B. (Miles) Rubin	Israel	
Prof. S.B. (Stuart) Savage	Canada	

<i>Member</i>	<i>Representative of</i>	<i>Remarks</i>
Prof. A. (Andrus) Salupere	Estonia	
Prof. W. (Werner) Schiehlen		Member-at-Large
Prof. S. (Suresh) Shrivastava	Canada	
Prof. D. Singh	India	
Prof. L. (Leopold) Skerget	Slovenia	
Prof. J. (Jan) Sladek	Slovakia	
Prof. S. (Scott) Sloan	Australia	
Prof.R. (Rolf) Stenberg	Finland	
Prof. Z. (Zhigang) Suo	USA	
Prof. A.A. (Anton) v. Steenhoven	Netherlands	
Prof. E.S. (Erdogan) Suhubi	Turkey	
Prof. G. (Gwidon) Szefer	Poland	
Prof. J.N. (Jens Nørkær) Sørensen	Denmark	
Prof. V. (Vitauts) Tamuzs	Latvia	
Prof. T. (Tomomasa) Tatsumi		Member-at-Large
Prof. A. (André) Thess	Germany	Bureau member
Prof. G. (Goran) Turkalj	Croatia	
Prof. K. (Koji) Uetani	Japan	
Prof. D. (Dirk) Vandepitte	Belgium	
Prof. W.-C. Wang	China-Taipei	
Prof. E. (Eiichi) Watanabe	Japan	
Prof. G. (Graham) Weir	New Zealand	
Prof. L. (Leen) van Wijngaarden		Member-at-Large
Prof. W. (Wei) Yang	China	Chair WP-7
Prof. J.Y. (Jung Yul) Yoo	Republic of Korea	
Prof. T.X. (Tongxi) Yu	China-Hong Kong	
Prof. Z. (Zhemin) Zheng	China	
Prof. J.W. (Jean) Zu	Canada	

## Observers to the General Assembly

<i>Name</i>	<i>Country</i>	<i>Representative of</i>
Prof. F. (Faruk) Arinc	Turkey	ICHMT
Prof. M. (Marc) Bonnet	France	IABEM
Prof. M.J. (Malcolm) Crocker	USA	IIAV
Prof. S.N.Y. (Samir) Gerges	Brazil	ICA
Prof. M. (Michael) Hayes	Ireland	ISIMM
Prof. R.B. (Richard) Hetnarski	USA	ICTS
Prof. P. (Patrick) Huerre	France	EUROMECH
Prof. G. (Gary) Leal	USA	ICR
Prof. L. (Jiachun) Li	China	AFMC
Prof. M. (Mats) Berg	Sweden	IAVSD
Prof. R.M. (Robert) McMeeking	USA	ICF Chair WP-4
Prof. R. (René) Moreau	France	HYDROMAG
Prof. S.W. (Soo Woo) Nam	Canada	ICM
Prof. J.T. (John Tinsley) Oden	USA	IACM
Prof. H. (Harold) Ramkissoon	West Indies	CACOFD
Prof. G. (George) Rozvany	Hungary	ISSMO
Prof. B.A. (Bernhard) Schrefler	Italy	CISM

## Members of the Congress Committee

\*Year indicates end of term

<i>Member</i>	<i>Country</i>	<i>Year*</i>	<i>Remarks</i>
Prof. H. (Hassan) Aref	USA	2012	Secretary of XCCC
Prof. N. (Nadine) Aubry	USA	2012	
Prof. L. (Leslie) Banks-Sills	Israel	2012	
Prof. D. (Dominique) Barthès-Biesel	France	2012	
Prof. M.P. (Martin) Bendsøe	Denmark	2012	Member of XCCC Representative of ISSMO
Prof. D.E. (Dimitri) Beskos	Greece	2010	
Prof. D.H. (Dick) van Campen	Netherlands	2012	Member of XCCC
Prof. A. (Alberto) Carpinteri	Italy	2012	
Prof. G.-D. (Gengdong) Cheng	China	2012	
Prof. F. (Frédéric) Dias	France	2012	
Prof. F. (Fernand) Ellyin	Canada	2010	Representative of ICM
Prof. I.G. (Irina) Goryacheva	Russia	2012	
Prof. N.K. (Narinder) Gupta	India	2012	
Prof. M.A. (Michael) Hayes	Ireland	2010	Representative of ISIMM
Prof. C.T. (Carl) Herakovich	USA	2010	
Prof. Y. (Yukio) Kaneda	Japan	2012	
Prof. A. (Alfred) Kluwick	Austria	2010	
Prof. T.A. (Tomasz) Kowalewski	Poland	2012	Member of XCCC
Prof. E.J. (Edwin) Kreuzer	Germany	2010	
Prof. S. (Stelios) Kyriakides	USA	2012	
Prof. P. (Pierre) Ladevèze	France	2012	
Prof. L.G. (Gary) Leal	USA	2012	Representative of ICR
Prof. J.B. (Jean-Baptiste) Leblond	France	2010	
Prof. J. (Jacques) Magnaudet	France	2012	
Prof. R.M. (Robert) McMeeking	USA	2012	
Prof. N.F. (Nikita) Morozov	Russia	2010	
Prof. R.W. (Ray) Ogden	UK	2012	
Prof. N. (Nigel) Peake	UK	2010	
Prof. T.J. (Timothy) Pedley	UK	2012	Member of XCCC
Prof. B.A. (Bernhard) Schrefler	Italy	2010	Member of XCCC Representative of CISM
Prof. A. (André) Thess	Germany	2012	
Prof. V. (Viggo) Tvergaard	Denmark	2012	
Prof. M.G. (Manuel) Velarde	Spain	2010	
Prof. G. (Genki) Yagawa	Japan	2010	

## Members of the Symposia Panels

In 1977 the Bureau of IUTAM set up two panels charged with the duty of scanning proposals made for IUTAM Symposia in the fields of fluid and solid mechanics. In 1992 that duty was extended to include scanning of proposals for IUTAM Summer Schools.

<b>Symposia Panel for Fluid Mechanics:</b>			
<i>Member</i>	<i>Country</i>	<i>Year*</i>	<i>Remarks</i>
Prof. D. (Dan) Henningson	Sweden	2010	
Prof. L.G. (Gary) Leal	USA	2012	Chair
Prof. N. (Nigel) Peake	UK	2012	
Prof. K. R. (Katepalli) Sreenivasan	Italy	2010	
Prof. M.A. (Michael) Stiasnie	Israel	2010	
<b>Symposia Panel for Solid Mechanics</b>			
<i>Member</i>	<i>Country</i>	<i>Year*</i>	<i>Remarks</i>
Prof. W. (Wolfgang) Ehlers	Germany	2012	
Prof. N.A. (Norman) Fleck	UK	2012	
Prof. H. (Huajian) Gao	USA	2012	
Prof. G. (Gábor) Stépan	Hungary	2010	
Prof. V. (Viggo) Tvergaard	Denmark	2012	Chair

\*Year indicates end of term

## Members of the Working Parties

Based on the assessment of IUTAM, the General Assembly agreed in Cambridge, UK (August 2002) to establish nine Working Parties.

A Working Party in a certain subfield of the mechanics is meant to structure the overlapping activities between IUTAM on the one hand and the relevant Affiliated Organizations and sister International Unions on the other. Also, Working Parties should identify important growth areas of the field.

More detailed background information on Working Parties, including their Terms of Reference, is given in the IUTAM Report on Working Parties.

A listing of the Working Parties and their current membership is given below.

**WP-1: Non-Newtonian Fluid Mechanics and Rheology**

Members: Prof. L.G. (Gary) Leal, USA (chair); Prof. A.N. (Antony) Beris;  
Prof. J. R. A. (Anthony) Pearson, UK; Prof. T. (Tam) Sridhar, Australia;  
Prof. D. (Dimitri) Vlassopoulos, Greece; Prof. H. (Hiroshi) Watanabe, Japan

**WP-2: Dynamical Systems and Mechatronics**

Members: Prof. F. (Friedrich) Pfeiffer, Germany (chair); Prof. F.L. (Felix) Chernousko,  
Russia; Prof. R.S. (Robin) Sharp, UK; Prof. M. (Masayoshi) Tomizuka, USA;  
Prof. H.Y. (Hiroshi) Yabuno, Japan

**WP-3: Mechanics of Materials**

Members: Prof. O. (Olivier) Allix, France (chair); Prof. C.T. (Carl) Herakovich, USA;  
Prof. T. (Tatsuo) Inoue, Japan; Prof. S. (Stelios) Kyriakides, USA; Prof. Y. (Yulong) Li,  
China

**WP-4: Materials Processing**

Members: Prof. R.M. (Robert) McMeeking, USA (chair); Prof. S. (Shigeo) Asai, Japan;  
Prof. Y. (Yves) Brechet, France; Prof. R. (René) Moreau, France;  
Prof. A. (André) Thess, Germany; Prof. C.L. (Charles) Tucker III, USA

**WP-5: Computational Fluid and Solid Mechanics**

(this WP acts as link between IUTAM and IACM)

Members: Prof. P. (Pierre) Ladevèze, France (chair); Prof. E. R. (Eduardo) de Arantes  
e Oliveira, Portugal; Prof. J. (Jacob) Fish, USA; Dr. S. R. (Sergio) Idelsohn, Argentina;  
Prof. J. T. (Tinsley) Oden, USA, Prof. M.W. (Mingwu) Yuan, China

**WP-6: Biomechanics**

Members: Dr. G.A. (Gerhard) Holzapfel, Austria (chair); Prof. D. (Dominique) Barthès-  
Biesel, France; Prof. J.E. (Joan) Bechtold, USA; Prof. R.W. (Ray) Ogden, UK;  
Prof. K. (Kazuo) Tanishita, Japan

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

Members: Prof. W. (Wei) Yang, China (chair); Prof. F. (Fernand) Ellyin, Canada;  
Prof. Y. (Yonggang) Huang, USA; Dr. G. (Graham) Weir, New Zealand

**WP-8: Geophysical and Environmental Mechanics**

Members: Prof. P.F. (Paul) Linden, USA; Prof. H. (Hervé) Le Treut, France;  
Prof. J.W. (John) Rudnicki, USA; Prof. J. Srinivasan, India; Dr. P. (Luis) Thomas,  
Argentina

**WP-9: Education in Mechanics and Capacity Building**

Members: Prof. H. (Hassan) Aref, USA (chair); Prof. L. (Luiz) Bevilacqua, Brazil;  
Dr. I. (Igle) Gledhill, South Africa; Prof. H. (Haiyan) Hu, China; Prof. H.K. (Keith)  
Moffatt; Prof. K.R. (Katepalli) Sreenivasan, Italy

## Donations in 2009

Donations given to IUTAM Symposia are recorded under the heading “Financial Support” of the Reports of Symposia and Summer Schools held in 2009.

## IUTAM Representation in ICSU and its Scientific Committees

<i>Acronym</i>	<i>Organization/Scientific Committee</i>	<i>Representative of IUTAM</i>
ICSU	International Council for Science	Prof. T. J. Pedley
COSPAR	Committee on Space Research	Prof. G. G. Chernyi
SCOPE	Scientific Committee on Problems of the Environment	Prof. P.F. Linden
SCOR	Scientific Committee on Oceanic Research	Prof. M. Stiassnie

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## **Reports of IUTAM Symposia held in 2009**

### **09-1 IUTAM Symposium on Dynamic Fracture and Fragmentation**

Austin, USA, March 8 – March 12, 2009

The IUTAM Symposium on Dynamic Fracture and Fragmentation was held at the AT & T Conference Center at the Campus of the University of Texas, Austin, Texas, during March 8-12, 2009. The Conference was Co-Chaired by Professor Krishnaswamy Ravi-Chandar, the University of Texas and Dr. Tracy Vogler, Sandia National Laboratory.

#### **a) Scientific Committee**

Krishnaswamy Ravi-Chandar, The University of Texas at Austin, USA  
Tracy Vogler, Sandia National Laboratories, Albuquerque, USA  
Gennady Kanel, Institute for High Energy Densities, Moscow, Russia  
Alain Molinari, Universite Paul Verlaine-Metz, France  
Jan Astrom, Center for Scientific Computing, Finland  
Shalom Eliezer, Department of Plasma Physics, Soreq NRC, Isreal  
Ares Rosakis, California Institute of Technology, Pasadena, USA  
Ben Freund, Brown University, Providence, USA

#### **b) Short summary of scientific progress achieved**

This symposium brought together leading physicists, engineering scientists and geophysicists, interested in fundamental aspects of fracture and fragmentation to a common forum for exchange of ideas. A large number of topics in fracture and fragmentation were covered during the four days of the Symposium. The speakers presented a state-of-the-art summary of the progress in various aspects of physical investigations, theoretical modeling and numerical simulations was described. In the area of dynamic fracture, experiments, models and simulations were discussed that spanned the range from atomistic, to the technological scale to the tectonic scale, dealing with earthquakes. Many of the discussions in this area focused on the effect of the nonlinear processes in the vicinity of the crack, the need for better elucidation and modeling of the material properties at the appropriate scale in this region, and on the need for developments of robust simulation methodologies. Fragmentation problems were also addressed at multiple length scales – from microscale particle breakup upon impact to scaling related to breakdown of comets. Various aspects of spall fracture in high-strain rate impact were also discussed. Another major topic covered was the application of the methods of fracture analysis to problems involving earthquakes. The collection of papers included in the proceedings will capture the essence of the meeting to a larger global audience.



**c) Countries represented and number of participants**

France (8), Israel (5), Japan (1), Russia (3), USA (38).

**d) Publication of Proceedings of the Symposium**

Thirty five of the authors have submitted their manuscripts to be published in the symposium volume; the review and processing of these manuscripts is nearly complete and these papers will first appear in a *Special Volume of the International Journal of Fracture* and then as a separate bound volume. This is currently in progress and is expected to be completed by March 2010.

**e) Financial supports**

In addition to the \$5000 support provided by the IUTAM, the US Air Force Office of Scientific Research provided \$5000 to support the symposium. This permitted the registration fees to be kept at \$400, pay for all the facilities, provide lunches to participants, pay for the bound volume of the Proceedings, and to support travel expenses for three young researchers and a few other selected participants. Springer will publish the Proceedings in 2010.

**f) Scientific program****Monday, March 9**

8:30am - 10:00am: *Session Chair: Tracy Vogler, Sandia National Laboratories*

The structure of the nonlinear elastic zone near the tip of a rapid brittle crack, Jay Fineberg, Eran Bouchbinder, and Ariel Livne, The Hebrew University of Jerusalem, Israel

How to extend linear elastic fracture mechanics to inhomogeneous media, Laurent Ponson, California Institute of Technology, USA and Daniel Bonamy, CEA Saclay, Gif sur Yvette, France

Fracture propagation in natural rubber sheets, Hepeng. Zhang, Johnathan Niemczura, Gene Denis, Krishnaswamy Ravi-Chandar, and Mike Marder, University of Texas at Austin, USA

10:30am - 12:00pm: *Session Chair: Jay Fineberg, The Hebrew University of Jerusalem*

On finite element method and meshfree methods for crack propagation, Ted Belytschko, Northwestern University, USA

Cracks propagation under impact, new tools for their modelling, Hubert Maigre and Alain Combescure, Université de Lyon, France

Effect of plasticity on dynamic frictional sliding along an interface between identical solids, Zheqiang Shi, University of Southern California, USA, Alan Needleman,

University of North Texas, USA, and Yehuda Ben-Zion, University of Southern California, USA.

*1:30pm - 3:00pm: Session Chair: Alan Needleman, University of North Texas*

A boundary integral method for a dynamic, transient mode I crack problem with viscoelastic cohesive zone, T. L. Leise, Amherst College, USA Jay Walton and Y. Gorb, Texas A&M University, USA

Experimental and analytical investigation of dynamic delamination of thin films, Philippe Geubelle, N. R. Sottos, P. Tran and M. Grady, University of Illinois, USA

Crack in a lattice waveguide, Leonid Slepyan, Tel Aviv University, Israel, A.B. Movchan, Liverpool University, U.K., and G.S. Mishuris, Aberystwyth University, U.K.

*3:30pm - 5:30pm: Session Chair: Philippe Geubelle, University of Illinois*

Supersonic cracks in modes I to III, Michael Marder, University of Texas at Austin, USA, T.M. Guozden and E.A. Jagla, Centro Atómico Bariloche, Comisión Nacional de Energía Atómica, Argentina

Study of the influence of temperature and material microstructure on dynamic fracture, G. Norman, A. Kuksin, V. Stegailov and A. Yanilkin, Joint Institute for High Temperatures of Russian Academy of Sciences, Russia

Sphere impacts with particulate media targets at 0-1,200 m/s, William L. Cooper, Air Force Research Laboratory, Eglin AFB, USA, Allen Reed, Bradley, Naval Research Laboratory, Stennis Space Center, MS, USA and A. Breaux, Air Force Research Laboratory, Eglin AFB, USA

## **Tuesday, March 10**

*8:30am - 10:00am: Session Chair: Genri Norman, Russian Academy of Sciences*

A micromechanical constitutive model for dynamic damage and fracture of ductile materials, N. Jacques, LBMS, ENSIETA, France, C. Czarnota, LEMTA, GIP-INSIC, France, Sebastian Mercier and Alain Molinari, Université Paul Verlaine - Metz, France

Another approach to adiabatic shear failure, Daniel Rittel, Technion, Haifa, Israel

Impact damage in layered glass, Stephan Bless and Tiffany Chen, Institute for Advanced Technology, University of Texas at Austin, Austin, TX, USA

*10:30am - 12:00pm: Session Chair: Ted Belytschko, Northwestern University*

Experimental and numerical study on perforation with fragment formation, Tomasz Wierzbicki, Tore Borvik (Norwegian University of Science and Technology, Norway), and Xiaoping Teng, Massachusetts Institute of Technology, Cambridge, USA

Identification of deformation and fracture of structures subjected to underwater impulsive loads, Horacio. Espinosa, F. Latourte, and G.B. Olson, Northwestern University, Evanston, IL, USA

Micromechanisms of ductile fracturing of dh-36 steel plates under impulsive loads and influence of polyurea reinforcing, Sia Nemat-Nasser and M.R. Amini, University of California - San Diego, USA

*1:30pm - 3:00pm: Session Chair: Jay Walton, Texas A&M University*

Peridynamic approach to consistent treatment of deformation and fracture, Stewart. Silling, Sandia National Laboratories, USA, F. Bobaru University of Nebraska-Lincoln, USA, O. Weckner, and E. Askari, The Boeing Company, USA

Predicting dynamic fracture with peridynamics: stress intensity factors, adaptivity, and crack branching, Florin Bobaru, L.F. Alves, University of Nebraska-Lincoln, USA, Stewart Silling, Sandia National Laboratories, USA and E. Askari, The Boeing Company, Bellevue, USA

Elasticity with energy limiters for modeling dynamic failure propagation, Konstantin Volokh and P. Trapper, Israel Institute of Technology, Haifa, Israel

*3:30pm - 5:30pm: Session Chair: Nadia Lapusta, California Institute of Technology*

Rupture nucleation on an interface with a power-law relation between stress and displacement discontinuity, James R. Rice, Harvard University, USA and Koji Uenishi, Kobe University, Kobe, Japan

Rupture directionality and super-shear: elastic mismatch or damage induced retardation? Ares Rosakis, California Institute of Technology, USA, C.G. Sammis, H.S. Bhat, University of Southern California, USA, and R. L. Biegel, U. S. Patent and Trademark Office, USA

Mechanical and numerical modeling of earthquake dynamic rupture in seismology: recent progress and challenges, Jean-Pierre Vilotte, Institut de Physique du Globe de Paris, France, and Jean-Paul Ampuero, California Institute of Technology, USA

### **Wednesday, March 11**

*8:30am - 10:00am: Session Chair: Ares Rosakis, California Institute of Technology*

Mechanics and observations of evolving rock damage around earthquake faults, Yehuda Ben-Zion, University of Southern California, USA

Constitutive parameters for earthquake rupture dynamics, E. Fukuyama and K. Mizoguchi, National Research Institute for Earth Science and Disaster Prevention, Japan

Pulse-like and crack-like dynamic shear ruptures on frictional interfaces: experimental evidence and implications, Nadia Lapusta, X. Lu, and Ares Rosakis, California Institute of Technology, USA

*10:30am - 12:00pm: Session Chair: Genady Kanel, Russian Academy of Sciences*

DYNAMIC STRAIN LOCALIZATION AND FRAGMENTATION, Haitao Zhang and Krishnaswamy Ravi-Chandar, University of Texas at Austin, USA

On electromagnetic forming processes in finitely strained solids: theory and examples, Jesse D. Thomas, Sandia National Laboratories, USA, and Nicolas Triantafyllidis, University of Michigan, USA

Multiple necking in dynamic expansions of spheres: theory and experiments, N. Granier, CEA/VALDUC, Is sur Tille, France, S. Mercier, A. Molinari, F. Llorca and T. Grunenwald, University Paul Verlaine- Metz, France

*1:30pm - 3:00pm: Session Chair: Krishnaswamy Ravi-Chandar, The University of Texas at Austin*

Length scales and size distributions in dynamic fragmentation, Dennis Grady, Applied Research Associates, USA

A statistically informed view of dynamic instability and failure in materials, T.W. Wright, U.S. Army Research Laboratory, Aberdeen Proving Ground, USA, and K.T. Ramesh, Johns Hopkins University, USA

The processes of massive dynamic failure, K.T. Ramesh, Johns Hopkins University, USA

*3:30pm - 5:30pm: Session Chair: Alain Molinari, University Paul Verlaine- Metz*

Generic behaviours in impact fragmentation, N. Sator, H. Hietala, S. Mechkov and F. Sausset, Université Pierre et Marie Curie, Paris, France

A multi-scale model to describe damage in glass under impact loading, X. Brajer, R. Gy, (Saint-Gobain Recherche, Aubervilliers, France), F. Hild, and S. Roux, LMT-Cachan, ENS de Cachan / CNRS / Université Paris 6 / PRES UniverSud Paris, France

A multi-stage return algorithm for solving the classical damage component of constitutive models for rocks and rock-like media, Rebecca M. Brannon, University of Utah, USA

## **Thursday, March 12**

*8:30am - 10:00am: Session Chair: Francois Hild, LMT-Cachan, ENS de Cachan*

Large deformation and fragmentation in geologic and bound particulate materials, J.D. Clayton, U.S. Army Research Laboratory, Aberdeen Proving Ground, USA

Spall fracture: methodological aspects, mechanisms and governing factors, Gennady I. Kanel, Joint Institute for High Temperatures, Russian Academy of Sciences, Moscow, Russia

Dynamic fragmentation process in concrete under impact and spalling tests, Pascal Forquin and B. Erzar, Université Paul Verlaine de Metz, France

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*10:30am - 12:00pm: Session Chair: Tim Wright, U.S. Army Research Laboratory, Aberdeen Proving Ground*

Shock waves and spall in aluminum with helium bubbles, S. Eliezer, B. Glam, D. Moreno, L. Perelmutter, M. Sudai, Soreq Nuclear Research Center, Yavne, Israel, and D. Eliezer, Ben Gurion University Israel

The effect of grain boundary strength, toughness, and flaws on spall in silicon carbide, James W. Foulk III and Tracy J. Vogler, Sandia National Laboratories, USA

Influence of anisotropy (crystallographic and microstructural) on spallation in ZR, TA, HY-100 steel, and 1080 eutectoid steel, G.T. Gray III, N.K. Bourne (AWE, Aldermaston, Reading, UK), K.S. Vecchio, (University of California - San Diego, USA) and J.C.F. Millett, Los Alamos National Laboratory, USA

*1:30pm - 3:00pm: WRAP-UP DISCUSSIONS*

**Report compiled by Krishnaswamy Ravi-Chandar**

**09-2 IUTAM Symposium on Emerging Trends in Rotor Dynamics**

New Delhi, India, March 23 – March 26, 2009

**a) Scientific Committee**

Nicolo Bachschmid (Italy), D.H. van Campen (The Netherlands, IUTAM Representative), David Ewins (UK), Yukio Ishida (Japan), Chong-Won Lee (South Korea), Richard Markert (Germany), Agnes Muszynska (USA), Nalinaksh Vyas (India), Narinder K. Gupta (India) and K. Gupta (India, Chair)

**b) Short summary of scientific progress achieved**

Rotor dynamics is an important branch of dynamics that deals with behavior of rotating machines ranging from very large systems like the power plant rotors i.e., turbogenerators, to very small systems like a tiny dentist's drill, with variety of rotors such as the pumps, compressors, steam/gas turbines, motors, turbopumps etc. as used for example in process industry, falling in between. Speeds of these rotors vary in a large range from, may be a few hundred RPM to more than hundred thousand RPM. Complex system of rotating shaft(s) depending upon their specific requirements, are supported on different types of bearings e.g., the rolling element bearings, different kinds of fluid film bearings, foil and gas bearings, magnetic bearings etc. The present day rotors are much lighter, handle a large amount of energy and fluid mass, operate at much higher speeds, and therefore are most susceptible to vibration and instability problems. These have given rise to variety of interesting physical phenomena, some of which are fairly well understood today (for example the oil whirl/whip), while some are subject of continued investigation (fluid-structure interaction, various forms of instability, nonlinear and parametric effects, chaotic behaviour etc.). Research in rotor dynamics started more than one hundred years back. The progress of research in early years was slow. However, with the availability of larger computing power and the versatile measurement technologies, research in all aspects of rotor dynamics has accelerated over the past several decades. The demand from industry for light weight, high performance and reliable rotor-bearing systems is the driving force for research, and the new developments in the field of rotor dynamics.

Papers were presented on various important aspects of rotor dynamics, that could be broadly classified as:

- Modelling and general aspects

- Developments in bearings

- Turbomachine blades

- Vibration control strategies

- Nonlinear dynamics

### Fault diagnostics and condition monitoring

#### Cracked rotors

The symposium aimed at bringing together, leading researchers from all over the world to share their research experiences, and more importantly to set up the directions for future research in rotor dynamics.

Participants representing 21 countries (including India) shared their views and discussed the ‘Emerging Trends in Rotor Dynamics’. There was convergence of view that the future research has to be directed towards development of intelligent/smart rotor systems which will be extremely robust and ultra-reliable. This would require further research on diagnostic and prognostic aspects. To develop a better understanding of various phenomena in rotor systems, future research would require a highly interdisciplinary approach to account for the interactions of the rotor with the surrounding fluid medium and the support structure. Considerable electronics would be inbuilt into the next generation rotor systems; a new term ‘*rotortronics*’ was coined during discussion to represent such rotor systems as a class distinct from ‘*mechatronic*’ systems of today. No doubt, the long term requirements from industry will set the direction of future research, for example the development of micro rotors.

#### **c) Countries represented and number of participants**

There were 86 registered delegates from 21 countries. The breakup of 36 participants from 20 countries other than India is given below-  
Australia – 1, Austria – 1, Brazil – 1, China – 2, Czech Republic – 1, Denmark – 1, Egypt – 1, France – 1, Germany – 6, Greece – 1, Israel – 1, Italy – 3, Japan – 1, Korea – 1, Lithuania – 2, Poland – 3, Sweden – 1, Switzerland – 1, UK – 3 and USA – 4.  
In addition, there were 50 delegates from India representing Indian industry, academia, and R&D laboratories.

#### **d) Publication of the proceedings**

The proceedings comprising of 45 peer reviewed papers is in press. It is being published by Springer as an IUTAM Proceedings book series.

#### **e) Financial support**

Financial support was provided by the various agencies in India namely, the Council of Scientific and Industrial Research (CSIR), All India Council for Technical Education (AICTE), Indian Space Research Organization (ISRO), Bharat Heavy Electricals Ltd. (BHEL), the Triveni Engineering and Industries Ltd., Indian Institute of Technology (IIT) Kanpur, Altair Engineering India, and ANSYS India. Some financial support was

also provided by Indian Institute of Technology Delhi. IUTAM provided 5000 USD for partial support to some delegates, and Springer provided 850 Euro as subsidy.

## f) Scientific program

There were 31 keynote (invited) lectures and 32 poster papers :

### SESSION S-1 (General, Modelling, Analysis) 23/03/09 (10:30 - 13:00)

Session Chair & Co-Chair: Yukio Ishida & Horst Ecker

1. Rotordynamics Research: Current Interests and Future Directions (**R. Gordon Kirk**)
2. Optimized Life using Frequency and Time Domain Approaches (**J. S. Rao**)
3. Developments in Rotor Dynamical Modelling of Hydropower Rotors (**J-O. Aidanpää**, R. K. Gustavsson, N. L. P.Lundström, M. Karlsson, Y. Calleecharan, M.L. Nässelqvist, M.Karlberg)
4. Dynamic Modelling of Rotors: A Modal Approach (**G. Genta**)
5. Control-Oriented Approach to the Rotor Dynamics (**Zdzislaw Gosiewski**)
6. Evolution of Frequency-speed Diagram in Rotating Machinery (**Chong-Won Lee**)

### SESSION S-2 (General, Modelling, Analysis) 23/03/09 (14:15 - 16:00)

Session Chair & Co-Chair: Nicolo Bachschmid, C.A.Papadopoulos

7. On the Analysis of Rotor-Bearing-Foundation Systems (**Katia Lucchesi Cavalca**, Eduardo Paiva Okabe)
8. New Approach to the Analysis of Dynamic Behavior of Rotor Dynamics Systems of Water Turbine or Pump (**E. Malenovsky**, F. Pochyly, L. Pohanka)
9. Rotating Internal Damping in the Case of Composite Shafts (**G. Jacquet-Richardet**, E. Chatelet, T. Nouri-Baranger)
10. Experimental Decomposition of Vibration, Whirl and Waves in Rotating and Non-Rotating Parts (**Izhak Bucher**)

### SESSION S-3 (Turbomachine Blades) 23/03/09 (16:30 - 17:30)

Session Chair & Co-Chair: J.S.Rao, Georges Jacquet-Richardet

11. Modeling Geometric Mistuning of a Bladed Rotor : Modified Modal Domain Analysis (**Alok Sinha**, Yasharth Bhartiya )
12. Vibration of Rotating Bladed Discs: Coriolis, Mistuning and Robust Design (**D. J. Ewins**, Y.J. Chan)
13. Laser Measurements of Bladed Discs (**D. J. Ewins**, D. DiMaio)

### SESSION S-4 (Bearings) 24/03/09 (9:00 - 10:15)

Session Chair & Co-Chair: Jan Kicinski & Z. Gosiewski

14. Trends in Controllable Oil Film Bearings (**Ilmar F. Santos** )
15. Developments in Fluid Film Bearing Technology (**A. El -Shafei**)



16. Applications and Research Topics for Active Magnetic Bearings (**Gerhard Schweitzer**)

POSTER PAPER SESSION PS-1 (Modelling, Analysis, Bearings) 24/03/09,

Paper presentation (10:45 - 13:00); Display of posters (14:15 - 16:00):

Session Chair & Co-Chair: Richard Markert & Izhak Bucher

17. Active Vibration Control of Rotor-Shaft system using Electromagnetic Exciters (A.S.Das, **R.R.Elan**, M.Jagadish, V.Sridhar, J K Dutt, H.irretier, S.P. Singh, S. Neogy)
18. Dynamical Simulations of Rotor System with Oil-Leakage Fault (**Qingkai Han**, Siqin Jin and Bangchun Wen)
19. Numerical Model of the High Speed Rotors Supported on Variable Geometry Bearings (**Zbigniew Kozanecki**, Jan Kiciński)
20. Investigation of Dynamics of Asymmetric Rotor Through Extended Lagrangian Formalism (**Chandan Kumar** and Vikas Rastogi)
21. Multiple Smart Material Applications using SMA and MR Fluid Damper for Rotor Vibration Control (**T. S. Aravindhana** and K. Gupta)
22. Stability Analysis of a Spinning Rotor Mounted on a Precessing Platform (A Saha, R Ghosh, **Arghya Nandi**, Sumanta Neogy)
23. Response of Rotors Excited by Piezoelectrically Supported Magnetic Actuators (S. Bhaduri, **S. Neogy**, A. Nandi, A. Saha, R. Ghosh)
24. An Analytical Method for Plastic Gear Transmission Error (Gaurav Pandey, B. Venkatesham, **Mayank Tiwari**, Om Prakash)
25. Transient Vibration Analysis of Micro-Rotor Supported on Air Foil Bearing due to Shock Load Excitations (**Skylab Bhore**, A. K. Darpe)
26. Dynamic Analysis of Centrifugal Extractor (CE-125) Rotating Bowl (**V. Satish Kumar**, S. B. Koganti, A.Ravisankar)
27. A Simple Viscoelastic Model of Rotor-Shaft Systems (**J.K.Dutt**)
28. Rotor Dynamic Analysis using ANSYS (**M.Santosh**)
29. Experiments and Theoretical Dynamical Analysis of Finite Squeeze Film Damper with Magnetorheological Fluid (**M. N. Banda**, Y.R.Reddy, K. Gupta, R.K. Pandey)
30. Rotordynamic Analysis of Carbon Graphite Seals of a Steam Rotary Joint (H Hirani and **S. S. Goilkar**)
31. Influence of ER Fluid Lubrication on the Performance of a Rough Hole-Entry Hybrid Journal Bearing System (**J. S. Basavaraja**, S. C. Jain, S C. Sharma)
32. Effect of Unbalance on the Dynamic Response of a Flexible Rotor Supported on Porous (**S.K. Laha**, S. K. Kakoty)
33. Analysis of Capillary Compensated Hole-entry Hybrid Journal Bearing Operating With Micropolar Lubricant (**Suresh Verma**, K.D.Gupta, Vijaya Kumar)

SESSION S-5 (Non-Linear Rotor Dynamics) 24/03/09 (16:00 - 17:40)

Session Chair & Co-Chair: Gordon Kirk & K.L. Cavalca

34. A "Multiple Whirls" Phenomenon and Heuristic Problems in Rotor - Bearing

Systems ( **J. Kiciński** )

35. Accurate Analytical Determination of Electromagnetic Bearing Coefficients ( **C. Nataraj** )
36. Advanced Analysis and Optimization Of Nonlinear Resonance Vibrations In Gas-Turbine Structures With Friction and gaps ( **E.P. Petrov** )
37. Non-Parametric Identification of Rotor-Bearing System through Volterra-Wiener Theories ( **Nalinaksh S.Vyas**, Animesh Chatterjee )

SESSION S-6 (Controls) 25/03/09 (9:00 - 10:15).

Session Chair & Co-Chair: G. Genta & Aly El-Shafei

38. Beneficial Effects of Parametric Excitation in Rotor Systems ( **Horst Ecker** )
39. New Passive Control Methods for Reducing Vibrations of Rotors: Discontinuous Spring Characteristics and Ball Balancer ( **Yukio Ishida** )
40. Simulation and Experiment of a Rotor with Unilateral Contacts and Active Elements (Lucas Ginzinger, **Heinz Ulbrich** )

POSTER PAPER SESSION PS-2 (Condition Monitoring, Nonlinear Rotor Dynamics)

25/03/09, Paper presentation (10:45 - 13:00), Display of posters (14:15 - 16:00);

Session Chair & Co-Chair: Bob Randall & C. Nataraj

41. Emerging Trends in High Speed Balancing of Flexible Rotors ( **Atul Nath** )
42. Multi-Objective GA for the Identification of Cracks in Shaft ( **S K Singh**, R Tiwari, S. Talukdar )
43. Sensitivity Analysis of the Design Parameters of Electrodynamical Bearings ( **G. Genta**, X. De Lépine, F. Impinna, J. Girardello, N. Amati, A.Tonoli )
44. Vibration based Condition Monitoring of Rotating Machines: A Future Possibility? ( **Jyoti K. Sinha** )
45. Application of Full Spectrum Analysis for Rotor Fault Diagnosis (Tejas H. Patel and **Ashish K. Darpe** )
46. Rotor Crack Identification Using Modified Operating Deflection Shapes ( **G.N.D.S. Sudhakar**, A. S. Sekhar )
47. Rotor Fault Detection in Machines: Methods and Techniques ( **R. J. Lalwani**, L. J. Prabha, L. P. Priya )
48. Bearing Fault Identification Using Vibration and Noise Monitoring (N. Tandon, J.K. Dutt, **R.K. Saranu** )
49. Feature Selection for Bearing Fault Detection Based on Mutual Information (Karthik Kappaganthu, **C. Nataraj**, Biswanath Samanta )
50. Fault Diagnosis of Rolling Element Bearing Using Digital Filters and Wavelet Thresholding Techniques (Animesh Chatterjee and **Angello Innocent** )
51. ANN Based Fault Diagnosis of Rolling Element Bearing ( **Rakesh Kamra**, S. H. Upadhyay, P.K. Kankar, S. C. Jain, Satish C. Sharma and S. P.Harsha )
52. Hopf Bifurcation Analysis of Short Journal Bearings Considering Turbulent Effects ( **T.V.V.L. Narasimha Rao** )
53. Bifurcation Analysis of a Turbocharger Rotor Supported by Floating Ring Bearings

(**Aydin Boyaci**, Wolfgang Seemann, Carsten Proppe)

54. Modelling of Angular Ball Bearing for High-Speed, Applications (**Felix Fritz**, Alexander Basler, Wolfgang Seemann)
55. Nonlinear Dynamics and Chaos of an Unbalanced Flexible Rotor Supported by Deep Groove Ball Bearings with Radial Internal Clearance (**T. C. Gupta**, K. Gupta)
56. Vibration Analysis of High Speed Rolling Element Bearings Due To Race Defects (S.H. Upadhyay, S.C. Jain, S.P. Harsha)

SESSION EMT-1 (Discussions On Emerging Trends) 25/03/09 (16:00 - 18:30)

Session Chair: Gordon Kirk

SESSION S-7 (Fault Diagnosis, Condition Monitoring) 26/03/09 (9:00 - 10:15)

Session Chair: Heinz Ulbrich

57. A Mechanical Engine Simulator for Development of Aero Engine Failure Analysis Methods (**Robert Liebich**)
58. Research and Development in Diagnostics of Rotating Machinery ( **Vytautas Barzdaitis**)
59. Signal Processing Tools for Tracking the Size of a Spall in a Rolling Element Bearing (**B. Randall**)

SESSION S-8 (Fault & Parameter Identification, Cracked Rotors) 26/03/09 (10:45 -

12:50): Session Chair & Co-Chair: D.J. Ewins, Robert Liebich

60. Cracked Rotating Shafts: Typical Behaviours, Modelling and Diagnosis (**N. Bachschmid**, P. Pennacchi, E. Tanzi )
61. Cracked Continuous Rotors Vibrating on Nonlinear Bearings: Some Aspects on Future Trends (**C.A. Papadopoulos**, **A.C. Chasalevris**, P.G. Nikolakopoulos)
62. Fault Identification in Industrial Rotating Machinery: Theory and Applications (**P. Pennacchi**, A. Vania, N. Bachschmid)
63. Identification of Bearing Dynamic Parameters And Residual Unbalance From Rundown Data Of Rotor-Bearing System (**R Tiwari**, V. Chakravarthy)
64. Some Recent Studies On Cracked Rotors (**A.S. Sekhar**)

**Report prepared by K. Gupta**

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**09-3 IUTAM Symposium on Recent Advances of Acoustic Waves in Solids**  
Taipei, Taiwan, May 25 – May 28, 2009**a) Scientific Committee**

Tsung-Tsong Wu (Taiwan, Chair), Jan D. Achenbach (USA), Arthur G. Every (South Africa), Ken-Ya Hashimoto (Japan), Vincent Laude (France), Ioannis E. Psarobas (Greece), Chau-Shioug Yeh (Taiwan), Yook-Kong Yong (USA), Juri Engelbrecht (Estonia, IUTAM Representative).

**b) Short summary of scientific progress achieved**

The purpose of this symposium was to bring renowned scholars and leading researchers from the areas of acoustic waves in solids together to discuss the latest advances, in particular, the emerging topics such as phononic band gap materials and acoustic metamaterials, acoustic filters in mobile communications, waves and quantitative nondestructive evaluation of materials, and waves in complex media. In the last decade, possible applications of acoustic wave band gap materials, such as creation of a vibration free environment; designs of advanced acoustic frequency filters and array transducers, have sparked swift focus of attention on the analytical as well as experimental studies of phononic crystals. On the other hand, rapid growth of the mobile communication market has also attracted extensive research on the bulk and surface acoustic wave devices. Quite a few important results on the modeling and simulation of Film Bulk Acoustic Resonator (FBAR) and Layered SAW devices have been achieved in the last decade. In addition to the phononic crystals and wave electronics, to facilitate the needs in the quantitative nondestructive evaluation of materials, waves in general complex solids also regained much attention recently.

The symposium brought the leading experts from the above diverse areas of acoustic waves in solids. It succeeded in giving a good overview on the latest advances of the topics mentioned above. Possible interdisciplinary applications, for example, combination of phononic crystals with SAW filters, have been discussed in the symposium. Through the responses of the participants, the symposium was highly successful and the objectives were achieved.

**c) Countries represented and number of participants**

50 invited participants from 16 countries were participated in this Symposium: Austria (1), China (2), Estonia (3), France (6), Germany (1), Greece (1), Japan (3), Korea (2), South Africa (1), Singapore (1), Sweden (1), Switzerland (1), Spain (2), Taiwan (14), Ukraine (2), USA (9).

**d) Publication of Proceedings of the Symposium**

A volume of abstracts presented at the symposium had been prepared and distributed to all the participants. The proceedings will be published by Springer in the IUTAM book series in Spring 2010.

**e) Financial supports**

The following institutions have provided financial support for the Symposium: IUTAM; NSC (National Science Council, Taiwan); MOE (Ministry of Education, Taiwan); NARL (National Applied Research Laboratories, Taiwan); NTU (National Taiwan University).

**f) Scientific program**

**May 26, 2009**

**SESSION 1: Waves in General**

Mathias Fink. Time-reversed waves and Super-resolution.

T. C. T. Ting. Existence of Exceptional Body Waves and Subsonic Surface Waves in Monoclinic and Orthotropic Materials.

Jüri Engelbrecht, Arkadi Berezovski, and Mihhail Berezovski. Deformation Waves in Microstructured Materials: Theory and Numerics.

**SESSION 2: Waves and NDE (I)**

Jan D. Achenbach. The Velocity of Anti-Plane Surface Waves on a Body with Depth-Dependent Properties.

Masahiko Hirao and Hirotsugu Ogi. Resonance Ultrasound Microscopy for Imaging Young's Modulus of Solids.

Igor Solodov. Nonclassical Nonlinearity in Solids for Defect-Selective Imaging and NDE.

**SEMINAR SESSION**

Mahmoud I. Hussein. Band Structure Calculations by Modal Analysis.

Zhilin Hou, Badreddine Assouar. Band Gap in Phononic Crystal Thin Plate with/without Mirror Plane.

Daniel Torrent and José Sánchez-Dehesa. Radial Sonic Crystals.

Y. Achaoui, A. Khelif, S. Benchabane, and V. Laude. Polarization states in 2D phononic crystals and waveguides.

Tanel Peets. Dispersion Analysis of Wave Motion in Microstructured Solids.

Piotr Borejko. On the Role that Scholte Waves Play in Acoustic Propagation along a Fluid-Solid Interface.

A. A. Bondarenko, V. V. Meleshko, and A. N. Trofimchuk. Forced Motions in Rectangular Elastic Waveguide.

Storozhev Valeriy, Troyan Renata, Puzyrev Vladimir. Normal Waves in Anisotropic Cylinders of Sector Cross-Section.

Po-Shien Tung, Sheng-Wei Tang, Che-Hua Yang. Dispersion Behaviors of ASF Modes Propagating along Wedges Tips with Coatings.

Per-Åke Jansson. Scattering from A Rectangular Crack in A Cladding.

Ping-Hung Lee, and Shih-Kuang Yang. Defect Inspection of Complex Structure in Pipes by Guided Waves.

Yung-Yu Chen, Tsung-Tsong Wu, Tai-Hsu Chou, and Fu-Chun Huang. SAW Gas Sensor with Nanostructured Sensing Materials.

Ching-Chung Yin, Kang-Che Huang, and I-Han Chang. Acousto-optic Response of Nematic Liquid Crystals to Interface Acoustic Waves.

Ruyen Ro, Chia-Chi Sung, Ruyue Lee, Yuan-Feng Chiang. Design of IF Two-Track Surface Acoustic Wave Filters using (100) AlN/Diamond Structures.

Sean Wu, Zhi-Xun Lin, Ruyen Ro and Maw-Shung Lee. Acoustic Wave Properties of (100) AlN and ZnO Films.

Ping Wang, Jiajie Fang, Yihong Kang, Sheng Qin, Osung Kwan, and Da-Ming Zhu. Study Mechanical and Viscoelastic Properties of Polymer Solutions near A Solid-Fluid Interfaces Using Combined Quartz Crystal Microbalance and Atomic Force Microscopy.

### **SESSION 3: Phononic Crystals (I)**

A. G. Every, and A.A. Maznev. Guided Elastic Waves at Periodically Structured Surfaces and Interfaces.

José Sánchez-Dehesa and Daniel Torrent. Metafluids based on Sonic Crystals.

B. Djafari Rouhani, Y. Pennec and H. Larabi. Band Structure and phonon transport in a phononic crystal made of a periodic array of dots on a membrane.

Xiao-Zhou Zhou, Yue-Sheng Wang, and Chuanzeng Zhang. Material Parameters Determining the Band Gaps of Solid-Solid Phononic Crystals.

**May 27, 2009**

### **SESSION 4: Wave Electronics (I)**

Ken-ya Hashimoto, Nan Wu, Keisuke Kashiwa, Tatsuya Omori, Masatsune Yamaguchi, Osamu Takano, Sakae Meguro, Naoki Kasai, and Koichi Akahane. Phase-sensitive and Fast-Scanning Laser Probe System for RF SAW/BAW Devices.

Victor Plessky and Sanna Härmä. SAW-tags - new generation.

Ji Wang, Rongxing Wu, and Jianke Du. A Two-dimensional Analysis of Surface Acoustic Waves in Finite Piezoelectric Plates.

Junhui Hu and Satyanarayan Bhuyan. Wireless Drive of Piezoelectric Components.

### **SESSION 5: Waves and NDE (II)**

Arvi Ravasoo. Counterpropagating Ultrasonic Waves for Inhomogeneous Materials Characterization.

Sridhar Krishnaswamy. Ultrasonic Characterization of the Mechanical Properties of Thin Films and Coatings.

Do-Youn Kim, Joon-Hyun Lee, Younho Cho, Jaesun Lee, Jan D Achenbach. Evaluation of Corrosion in Carbon Steel Pipes by Laser-Generated Guided Wave.

Yung-Chun Lee, Shi Hoa Kuo, and Cheng-Hsien Chung. Measurement of Surface and Lamb Waves with Application on Acoustic Sensing and Non-Destructive Evaluation.

**May 28, 2009**

**SESSION 6: Phononic Crystals (II)**

C. T. Sun, H. H. Huang. Behavior of Wave Motion in An Acoustic Metamaterial with Anisotropic Mass Density.

Vincent Laude, Younes Achaoui, Sarah Benchabane, and Abdelkrim Khelif. Complex band structure of phononic crystals and the diffraction problem.

I. E. Psarobas. Versatile phononic slabs.

Abdelkrim Khelif, Abdelkrim Choujaa, Sarah Benchabane and Vincent Laude.

Omnidirectional band gap mirror for Surface Acoustic Wave.

**SESSION 7: Wave Electronics (II)**

Yook-Kong Yong, Mihir Patel, and Jianke Du. Novel High Frequency, Temperature Stable, Quartz Gyroscopes.

Ben Abbott, Kevin Gamble, Natalya Naumenko, Svetlana Malocha, and Marc Solal. COM Model Characterization for RF SAW Devices.

Chi-Yen Shen, Cheng-Liang Hsu, Rume-Tze Tsai, and Ming-Yau Su. Development of a Surface Acoustic Wave Sensor for Gas Detection.

Chien-Ching Ma, and Kuo-Chih Chuang. Three Dimensional Displacement Measurement of Transient Elastic Wave Propagation Using a Multidimensional Point-wise Fiber Bragg Grating Displacement Sensor System.

**SESSION 8: Phononic Crystals (III)**

Walter Steurer, Sofia Deloudi, and Daniel Sutter-Widmer. Phononic Quasicrystals.

Yukihiro Tanaka, Shin-ichiro Tamura, and Takuro Okada. Band structure of three-dimensional phononic crystals with an opal structure.

Chi-Kuang Sun. Bandgap Characteristics of a 3D Phononic Meta Material Composed of Ordered Quantum Dots.

Nicholas Boechler, Chiara Daraio, Raj Nariseti, Massimo Ruzzene, Michael J. Leamy. Analytical and Experimental Analysis of Bandgaps in Nonlinear One Dimensional Periodic Structures.

Tsung-Tsong Wu, Jin-Chen Hsu, and Jia-Hong Sun. Lamb Waves in Phononic-Crystal Plates: Numerical Studies and Experiments.

**Report composed by Tsung-Tsong Wu**

**09-4 IUTAM Symposium on Laminar-Turbulent Transition**

Stockholm, Sweden, June 23 – June 26, 2009

**a) Scientific Committee**

Prof. Dan Henningson (Chairman), Linné Flow Centre, KTH Mechanics, Sweden  
Prof. Patrick Huerre (IUTAM Representative), LadHyX, Ecole Polytechnique, France  
Dr. Danial Arnal, ONERA, France  
Prof. Bruno Eckhardt, Philipps Universität Marburg, Germany  
Prof. Rama Govindarajan, Jawaharlal Nehru Centre for Advanced Scientific Research, India  
Prof. Alessandro Bottaro, University of Genova, Italy  
Prof. Masaharu Matsubara, Shinshu University, Japan  
Prof. Tom Mullin, Manchester Centre for Nonlinear Dynamics, United Kingdom  
Prof. William Saric, Texas A&M University, U.S.A.

**b) Short summary of scientific progress achieved**

The origins of turbulent flow and the transition from laminar to turbulent flow are some of the most important unsolved problems of fluid mechanics and aerodynamics. Besides being a fundamental question of fluid mechanics, there are numerous applications relying on accurate information regarding transition location and the details of the subsequent turbulent flow. While considerable progress has been made in the understanding of laminar-turbulent transition over the last 30 years, the continuing increase in computer power as well as new theoretical developments are now revolutionizing the area.

The objectives of the Symposium are to deepen the fundamental knowledge of stability and laminar-turbulent transition by providing a forum for discussions between the leading scientists from Europe, Asia, and the Americas. An IUTAM Symposium is the ideal mechanism for bringing together such a group. The scope of the Symposium covers the broad area of flow instabilities and transition to turbulence.

Areas of emphasis include:

- Novel approaches to receptivity analysis and transition modeling.
- Non-normal effects and global modes.
- Stability of complex flows, such as non-Newtonian and miscible-interface flows.
- Transition in simple shear flows and its relation to properties of non-linear dynamical systems.
- Modern feedback control and design techniques applied to transition.
- Transition in high-speed flows.
- Direct and Large-Eddy Simulation of transition.
- Applied Laminar Flow Control.



**c) Countries represented and number of participants**

The 142 participants came from 21 different countries: Austria (1), Brazil (2), Canada (4), China (1), Czech Republic (1), Denmark (1), France (22), Germany (27), India (2), Ireland (3), Iran (1), Italy (4), Japan (10), The Netherlands (1), Russian Federation (10), Serbia and Montenegro (1), Spain (83), Sweden (18), Switzerland (82), United Kingdom (12), United States (16)

**d) Publication of Proceedings of the Symposium**

The proceedings containing 110 papers of presentations delivered during the Symposium have been published in the IUTAM book series: Seventh IUTAM Symposium on Laminar-Turbulent Transition, Stockholm, Sweden, 2009. Series: IUTAM Bookseries, Vol. 18. Philipp Schlatter and Dan S. Henningson (Eds.) 2010, XXIV, 608 p., Hardcover. ISBN: 978-90-481-3722-0

**e) Financial support**

We wish to thank the following sponsors for their contribution to the success of the Symposium:

- International Union of Theoretical and Applied Mechanics (IUTAM)
- Royal Institute of Technology (KTH) Stockholm
- Vetenskapsrådet (Sweden)
- Linné FLOW Centre
- Dantec Dynamics
- Cambridge University Press
- Springer

**f) Scientific program**

The symposium was held at KTH main campus in Stockholm (Sweden) during June 23-26, 2009. The scientific programme focused around the eight areas of emphasis mentioned above. Each of these areas was introduced by an invited lecture held by an international expert in that respective field. The normal conference programme consisted of oral and poster presentations given by the conference participants; a total of 8 invited talks (45 minutes), 68 oral presentations (17 minutes) and 39 poster presentations were delivered. The Symposium was held on the KTH Main Campus in the heart of Stockholm, the capital of Sweden. The beauty of Stockholm in the summer time just a few days after "Midsommar" and the sunny weather provided an excellent setting for this IUTAM Symposium.

**Report composed by Philipp Schlatter**

## **09-5 IUTAM Symposium on Vibration Analysis of Structures with Uncertainties**

Saint Petersburg, Russia, July 5 – July 9, 2009

### **a) Scientific Committee**

Alexander K. Belyaev (Chair) Institute of Problems in Mechanical Engineering, Russian Academy of Sciences, St. Petersburg, Russia.

Robin Langley (Co-Chair) University of Cambridge, United Kingdom.

Franz Ziegler (IUTAM Representative) Vienna University of Technology, Austria.

Antonio Carcaterra, University of Rome La Sapienza, Italy.

Yakov Ben-Haim, Technion-Israel Institute of Technology, Israel.

Christian Soize, Universite de Marne-la-Vallee, France.

Dirk Vandepitte, Katholieke Universiteit Leuven, Belgium.

Richard Weaver, University of Illinois at Urbana-Champaign, USA.

### **a) Short summary of scientific progress achieved**

The present symposium is aimed at achieving the knowledge coming from theoretical approaches, numerical simulation and modelling of the dynamic response of structures which have uncertain properties due to variability in the manufacturing and assembly processes, with automotive and aerospace structures forming prime examples. It is well-known that the difficulty in attempting to predict the response statistics of such structures is immense, due to the large number of physical variables which might be uncertain and the inevitable lack of data regarding the statistical distribution of these variables. The symposium participants represented this very active research area, with novel techniques being derived for high, low and mid frequency vibrations. It was demonstrated that the uncertainties saturate at high frequencies and the response statistics are independent of the details of the physical uncertainties. A number of presentations were concerned with using and extending methods originally developed both in phenomenological thermodynamics and in the fields of quantum mechanics and random matrix theory. At low frequencies, much new work was focused on parametric uncertainty modeling (probabilistic models, interval analysis, and fuzzy descriptions) and on methods of propagating this uncertainty through a large dynamic model in an efficient way. At mid frequencies the problem is mixed and various hybrid schemes were proposed. A comprehensive solution to the problem in whole frequency range required expertise in many areas (namely, benchmark study of probabilistic and non-probabilistic approaches, Statistical Energy Analysis - related methods, random matrix and random wave approaches, interval and info-gap analysis, statistical thermodynamics, fundamental uncertainty modeling, large scale computation) and this IUTAM symposium presented a unique opportunity for bringing together the outstanding international experts in these fields.

The full time (45 min) was allocated to each of 12 keynote lectures and 20 min for each of the other 24 presentations. In addition to this, the attendees had plenty of opportunities for fruitful discussions during and after the sessions.

The summary of the scientific progress achieved at the symposium is as follows:

- researchers from a range of different disciplines and industrial focuses were brought together
- the attendees obtained an opportunity to review and compare the modeling approaches as well as the present analytical and simulation capabilities at low, mid and high frequencies
- open problems and research issues were identified and intensively discussed
- international collaboration was stimulated
- a number of intensive and fruitful discussions took place after each presentation and each session.

### **c) Countries represented and number of participants**

The symposium was attended by 37 delegates from 13 countries: Austria (3), Belgium (2), France (3), Germany (3), Israel (1), Italy (3), Japan (1), Malaysia (1), Norway (1), Russia (6), UK (10), Ukraine (1) and USA (2).

### **d) Publication of Proceedings of the Symposium**

All 36 presentations at the Symposium will be published by Springer-Verlag in the IUTAM Symposium Series in 2010.

### **e) Financial supports**

The IUTAM grant and the financial support by the Russian Foundation for Basic Research are gratefully acknowledged.

### **f) Scientific program**

**Monday, July 6**

**Non-probabilistic and related approaches**

#### **9.30 - 10.30: Opening ceremony**

Opening address by the Symposium Chairs (A. Belyaev and R. Langley)

Opening address by the IUTAM Representative (F. Ziegler)

State Polytechnic University of St. Petersburg, Lecture by D.G. Arsenjev

#### **11.00 - 12.30: Key-Note Lectures Session 1.1** Chair Franz Ziegler

**11.00 - 11.45 Yakov Ben-Haim** (Technion - Israel Institute of Technology, Haifa, Israel), Scott Cogan (Universite de Franche-Comte, Besancon France) Up-Dating a Linear System with Model Uncertainty: An Info-Gap Approach

**11.45 - 12.30 Dirk Vandepitte**, David Moens (K.U.Leuven, Department of Mechanical Engineering, Heverlee, Belgium) Quantification of Uncertain and Variable Model Parameters in Non-Deterministic Analysis

**12.30 - 13.00: Discussion to Session 1.1**

**14.00 - 15.30: Key-Note Lectures Session 1.2** Chair Yakov Ben-Haim

**14.00 - 14.45 Franz Ziegler**, Rudolf Heuer (Vienna University of Technology, Austria) Vibrations of layered structures with fuzzy core stiffness/fuzzy interlayer slip

**14.45- 15.30 Michael Hanss**, Jan Herrmann, Thomas Haag (University of Stuttgart, Germany) Vibration Analysis of Fluid-Filled Piping Systems with Epistemic Uncertainties

**16.00 - 17.20: Session 1.3** Chair Dirk Vandepitte

**16.00 - 16.20 Franck Massa**, Bertrand Lallemand, **Thierry Tison** (Universite Valenciennes, France) Fuzzy vibration analysis and optimization of engineering structures

**16.20 - 16.40 David Moens**, Maarten De Munck, Dirk Vandepitte (K.U.Leuven, Department of Mechanical Engineering, Heverlee, Belgium) Numerical dynamic analysis of uncertain mechanical structures based on interval fields

**16.40 - 17.00 Vladik Kreinovich** (University of Texas at El Paso, USA) From Interval Computations to Constraint-Related Set Computations: Towards Faster Estimation of Statistics and ODEs under Interval and p-Box Uncertainty

**17.00 - 17.20 Dmitry G. Arseniev**, **Vladimir M. Ivanov**, Nikolai A. Berkovskiy (State Polytechnic University of St. Petersburg, Russia) About semi-statistical method of numerical solution of integral equations and its applications

**17.20 - 18.00: Discussion to Sessions 1.2 & 1.3**

**Tuesday July 7**

**SEA related methods and wave propagation**

**9.00 - 10.30 Session 2.1 Key-Note Lectures** Chair Alexander Belyaev

**9.00 - 9.45 Robin S Langley** (Cambridge University, United Kingdom) Universal eigenvalue statistics and vibration response prediction

**9.45 - 10.30 Alain Le Bot** (Ecole Centrale de Lyon, France) Statistical Energy Analysis and the second principle of thermodynamics

**11.00 - 12.20. Session 2.2** Chair Antonio Carcaterra

**11.00 - 11.20 Phil J. Shorter** (ESI Group, San Diego, USA) Modeling noise and vibration transmission in complex systems

**11.20 - 11.40 Rolf H. Lande** (Det Norske Veritas, Hovik, Norway), Robin S. Langley (Cambridge University, United Kingdom) A power absorbing matrix for the hybrid FEA-SEA approach to vibroacoustic analysis of complex uncertain structures.

**11.40 - 12.00 Christian Cabos** (Germanischer Lloyd, Hamburg, Germany) Hermann G. Matthies (Technical University Braunschweig, Germany) NoiseFEM - A validated energy finite element method for structure borne sound prediction

**12.00 - 12.20 Gregor Tanner**, Stefano Giani (University of Nottingham, UK) Wave Transport in Complex Vibro-Acoustic Structures in the High-Frequency Limit

**12.20 - 13.00: Discussion to Sessions 2.1 & 2.2****14.00 - 15.30: Session 2.3 Key-Note Lectures** Chair Robin Langley

**14.00 - 14.45 Alexander K. Belyaev** (Institute of Problems in Mechanical Engineering, Russian Academy of Sciences, Russia) Benchmark study of three approaches to propagation of harmonic waves in randomly heterogeneous elastic media

**14.45 - 15.30 Antonio Carcaterra** (University of Rome La Sapienza, Italy) Minimum-variance-response and irreversible energy confinement

**16.00 - 17.20: Session 2.4** Chair Gerhard Schuëller

**16.00 - 16.20 Eric Savin** (Aeroelasticity and Structural Dynamics, ONERA Chatillon cedex, France) High-frequency vibrational power flows in randomly heterogeneous structures

**16.20 - 16.40 Antonio Culla** (Universita di Roma "La Sapienza", Italy), Walter d'Ambrogio (Università dell'Aquila, Italy), Annalisa Fregolent (Universita di Roma "La Sapienza", Italy) Uncertainty Propagation in SEA using Sensitivity Analysis and Design of Experiments

**16.40 - 17.00 Vitaly A. Kuzkin**, Anton M. Krivtsov (State Polytechnic University of St. Petersburg, Russia) Thermo-Mechanical Effects in Crystals

**17.00 - 17.20 Luke Humphry** (Cambridge University, United Kingdom) Predicting shock response in uncertain structures using the hybrid method

**17.20 - 18.00: Discussion to Sessions 2.3 & 2.4**

**Wednesday July 8**  
**Probabilistic Methods, Session 1**

**9.00 - 10.30. Session 3.1. Key-Note Lectures** Chair Stewart McWilliam

**9.00 - 9.45 Gerhard I. Schuëller** (University of Innsbruck, Austria) Uncertainty quantification and reliability estimation in linear dynamics

**9.45 - 10.30 Giovanni Falsone**, D. Settineri (Universita di Messina, Italy) Time domain analysis of structures with stochastic material properties

**11.00 - 12.20: Session 3.2.** Chair Michael Hanss

**11.00 - 11.20 Christophe Lecomte** (Cambridge University, United Kingdom) Vibration Analysis of an Ensemble of Structures using a Theory of Stochastic Linear Systems

**11.20 - 11.40 Yoshihiro Kanno** (University of Tokyo, Japan), Izuru Takewaki (Kyoto University, Japan) Dynamic Steady-State Analysis of Structures under Uncertain Harmonic Loads via Semidefinite Program

**11.40 - 12.00 Sergey M. Ermakov** (St. Petersburg State University, Russia) Stochastic Computation Methods in Multidimensional Problems

**12.00 - 12.20 Julian F. Dunne**, S. Riefelyna (University of Sussex, Brighton, United Kingdom) Structural Uncertainty Identification using Vibration Mode Shape Information

**12.20 - 13.00: Discussion to Sessions 3.1 & 3.2**

**Thursday July 9**  
**Probabilistic Methods, Session 2 + Applications**

**9.00 - 10.30: Session 4.1 Key-Note Lectures** Chair Giovanni Falsone

**9.00 - 9.45 Helmut J. Pradlwarter** (University of Innsbruck, Austria) A procedure to assess the reliability of uncertain linear structures subjected to dynamic excitation

**9.45 - 10.30 Stewart McWilliam** (University of Nottingham Malaysia Campus, Semenyih, Malaysia) Uncertain MEMS resonators

**11.00 - 12.20: Session 4.2** Chair Helmut Pradlwarter

**11.00 - 11.20 Sondipon Adhikari** and L Pastur (Swansea University, United Kingdom) Extremely strong convergence of eigenvalue-density of linear stochastic dynamical systems

**11.20 - 11.40 Prasanth B. Nair** (University of Southampton, United Kingdom) Stochastic subspace projection schemes for dynamic analysis of uncertain systems

- 11.40 - 12.00 Tore Butlin**, Robin Langley (Cambridge University, United Kingdom) An efficient model of a periodic structure with localised non-linearities
- 12.00 - 12.20 Stephen Cooke**, Robin Langley (Cambridge University, United Kingdom) Computing boundary layer wavenumber-frequency spectra using computational fluid dynamics

**12.20 - 13.00: Discussion to Sessions 4.1 & 4.2**

**14.00 - 15.30: Session 4.3** Chair Alain Le Bot

### **Applications**

- 14.00 - 14.20 Katrin Ellermann** (Hamburg University of Technology, Germany) Analysis of offshore systems in random waves
- 14.20 - 14.40 Paul V. Krot** (Iron and Steel Institute, National Academy of Science of Ukraine, Dnepropetrovsk, Ukraine) Statistical Dynamics of the Rolling Mills
- 14.40 - 15.00 Y. J. Chan**, David J. Ewins (Imperial College London, United Kingdom) The application of robust design strategies on managing the uncertainty and variability issues of the blade mistuning problem
- 15.00 - 15.20 Regis Cottureau**, Hachmi Ben Dhia, Didier Clouteau (Ecole Centrale Paris, France) Localized modeling of uncertainty in the Arlequin framework

**15.20 - 15.40. Discussion to Sessions 4.1**

**16.00 - 17.30: Closing Ceremony. General Discussion**

**16.00 - 17.00: Open Discussion:** The Vibration Analysis of Structures with Uncertainties. Present and Future.

**17.00 - 17.30: Closing Ceremony**

Young Scientist's Award

Closing address by the Symposium Scientific Committee

Closing address by the IUTAM Representative (F. Ziegler)

**Report composed by Alexander K. Belyaev**

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**09-6 IUTAM Symposium on Wall-bounded Turbulent Flows on Rough Walls**

Cambridge, UK, July 7 – July 9, 2009

**a) Scientific Committee**

Tim Nickels, Cambridge University (Chairman)  
Ian Castro, University of Southampton  
Karen Flack, U.S. Naval Academy  
Javier Jimenez, Universidad Politecnica de Madrid  
John Kim, University of California, Los Angeles  
Alfred Kluwick, Technische Universität Wien (IUTAM representative)  
Per-Åge Krogstad, Norwegian University of Science and Technology  
Paolo Orlandi, University of Rome "La Sapienza"

**b) Short summary of scientific progress achieved**

The purpose of this symposium was to bring together the best researchers in the area of turbulent flows on rough walls so as to discuss the present state of theory, experiments and numerical studies. In particular topics for discussion concerned a number of issues still in dispute such as the extent to which roughness effects directly influence the outer layer statistics. Other related issues discussed concerned differences between nominally two-dimensional surface roughnesses (such as transverse bars) and the more common three-dimensional surfaces. Some agreement was reached to the effect that the two-dimensional cases that have received much study may be pathological in the sense that the flow behaviour is quite unique and, as such, not representative of the more general problem of rough wall flows. Other areas of interest concerned the effects of very large roughness elements in which the roughness can no longer be considered to be a small perturbation to a smooth wall flow, the effect of roughness on transition, the use of artificial roughness in numerical simulations and appropriate scaling parameters for predicting drag on rough surfaces. The level of open, frank and friendly discussion in the meeting was impressive and, as a result, the symposium achieved its aim of evaluating the present state of the field and encouraging efforts to reach broad consensus on important fundamental issues. The success was such that there was strong support for organising future meetings along the same lines.

**c) Countries represented and number of participants**

There were 44 participants at the meeting representing 11 countries. The countries represented were UK (12), India (1), Sweden (3), Australia (7), Germany (2), USA (12), Japan (1), Norway (1), Korea (1), Italy (2), Canada (2).



**d) Publication of the Proceedings of the Symposium**

A volume of abstracts presented at the symposium had been prepared and distributed to all the participants. The proceedings will be published by Springer in the IUTAM book series in Spring 2010.

**e) Financial supports**

Financial support for the running of the meeting was received from the IUTAM, Springer, BP UK and the Sir Arthur Marshall Institute of Aeronautics

**f) Scientific Program*****Tuesday 7th July 2009***

P1 Structures of the turbulent boundary layer over a rod-roughened wall, S.-H. Lee, J.H. Lee, H.J. Sung

A1 Turbulent flows over aligned and inclined square ribs, M. F. Tachie, M. Agelinchaab

A2 An experimental study of turbulent flow over transverse square bars, D. Pokrajac

A3 Boundary layer structure over a two-dimensional rough wall, M. P. Schultz, R. J. Volino, K.A. Flack

P2 Turbulence in pipe flows with small relative roughness, Alexander Smits, Sean C. C. Bailey, Rick L. Pepe

B1 Near-wall flow structures over 3d roughness in a turbulent channel flow, Jiarong Hong, Joseph Katz and Michael Shultz

B2 LDV measurement near a rough surface for a turbulent boundary layer, T. Kameda, S. Mochizuki and H. Osaka.

B3 POD analysis of near-wall region of a rough wall turbulent boundary layer, L. Djenidi, R. A. Antonia, M. Amielh and F. Anselmet

C1 Experimental study of a turbulent wall jet on a rough surface, N. Rostamy, D. J. Bergstrom, D. Sumner

C2 Turbulent flow over urban-type roughness using PIV, M. Amir and I.P. Castro

C3 A high reynolds number turbulent boundary layer with regular ('braille-type') roughness, J.P. Monty, M.S. Chong & J.J. Allen

***Wednesday 8th July 2009***

P3 On some aspects of turbulent flows over rough surfaces, R. A. Antonia

D1 Turbulent channel flow over model "dynamic" roughness, B. J. McKeon

D2 The effect of artificial roughness on the outer region of turbulent channels, O. Flores, J. Jimenez

D3 Roughness scaling parameters in the fully rough regime, K.A. Flack, M.P. Schultz

D4 Transition in rough channels, P. Orlandi

E1 Isotropic free-stream turbulence promotes anisotropy in a zero pressure gradient turbulent boundary layer, S. Torres-Nieves , J.R. Lebron , B. Brzek , R.B. Cal , C. Meneveau and L. Castillo

E2 Effect of isotropic free-stream turbulence in rough, favorable pressure gradient turbulent boundary layers, S. Torres-Nieves , J.R. Lebron , B. Brzek , H.S. Kang , R.B. Cal , C. Meneveau and L. Castillo

E3 Particulate impact and erosion in a turbulent serpentine channel, P.A. Durbin , Xin Huang

F1 A skin friction balance applied to rough wall experiments, Vladislav Efros & Per-Åge Krogstad

F3 On the behaviour of turbulent boundary layers over porous walls, C. Manes , D. Poggi, L. Ridolfi

G1 Modified hierarchy structure of rough-wall flows, J. Klewicki , F. Mehdi

G2 Analysis of instantaneous velocity vector in geostrophic turbulent ekman layer on a transitional rough surface, Noor Afzal

G3 Wall roughness effects: a second law analysis (SLA), H. Herwig , T. Wenterodt

#### ***Thursday 9th July 2009***

P4 Coherent structures in a turbulent flow over arrays of cubical obstacles, Stefano Leonardi, IanCastro

H1 Large roughness effects in channel flow, D. M. Birch , J. F. Morrison

H2 Very-rough-wall channel flows: a DNS study, Ian P. Castro and Stefano Leonardi

**Report composed by Timothy Nickels**

**09-7 IUTAM Symposium on Multiscale Modelling of Fatigue, Damage and Fracture in Smart Materials Systems**  
Freiberg, Germany, September 1-4, 2009

**a) Scientific Committee**

Kuna, M. (Freiberg, Chair), Gabbert, U. (Magdeburg), Huber, J. E. (Oxford), Mai, Y. W. (Sydney), McMeeking, R. M. (Santa Barbara), Rajapakse, N. (Burnaby), Shindo, Y. (Sendai), Yang, W. (Hangzhou, IUTAM representative)

**b) Short summary of scientific progress achieved**

Multi-functional materials as piezoelectric/ferroelectric ceramics, magnetostrictive and shape memory alloys are gaining increasing applications as sensors, actuators or smart composite materials systems for promising high tech areas. One primary problem is however, that these functional materials suffer from various mechanical and/or electro-magnetical degradation mechanisms as fatigue, damage and fracture. As a consequence of field coupling effects, fabrication processes and service loads, smart materials systems are exposed to high mechanical and/or electromagnetical field concentrations under internal and external loading. For this reason, the investigation of fatigue, damage and fracture plays a decisive role for the optimum design, reliability and durability of smart materials systems. Thus, the topic of the symposium represents an active research area in mechanics of materials. It has become clear that this scientific challenge can only be solved by

- a multi-scale modelling at several length scales from atomistic to macroscopic level,
- an interdisciplinary cooperation between solid mechanics, materials science and physics, all well represented in the symposium.

The following main topics have been addressed during the symposium by internationally leading experts:

- Development of computational methods for coupled electromechanical field analysis, especially extended, adaptive and multi-level finite element techniques in combination with boundary elements.
- Constitutive modelling of smart materials with coupled electric, magnetic, thermal and mechanical fields, especially of nonlinear dissipative hysteresis behaviour. Major trend is the development of micromechanical models. Especially for ferroelectric materials and shape memory alloys the simulation of microstructure (domain switching, martensitic transformation etc.) are of paramount concern.
- Further understanding and modelling of fracture and fatigue in piezoelectric and ferroelectric ceramics, especially the modelling of fracture process zone and of electric boundary conditions at crack faces. Applications of phase field simulation and configurational mechanics.

- Reliability and durability of sensors and actuators under in service loading by alternating mechanical, electrical and thermal fields. The role of interface cracks between layers and in thin films is addressed.
- Experimental methods to measure fracture strength and to investigate fatigue crack growth in ferroelectric materials under electromechanical loading. It has been pointed out that complicated theoretical predictions have to be contrasted and verified by skilful experiments.
- New ferroelectric materials, compounds and composites with enhanced strain capabilities.

#### **e) Countries represented and number of participants**

44 participants from 14 countries: Australia (1), Austria (3), Belgium (1), Canada (1), China (8), Great Britain (1), France (2), Germany (19), Israel (1), Italy (1), Japan (2), Slovakia (1), Ukraine (1), USA (2)

#### **d) Publication of Proceedings of the symposium**

The proceedings will be published in the Springer IUTAM book series in the summer of 2010.

#### **e) Financial supports**

The grant of IUTAM for this symposium is gratefully acknowledged. Furthermore, we thank the support of Technical University Bergakademie Freiberg.

#### **f) Scientific program**

##### **Tuesday, September 01**

##### **Fracture mechanics I** (session leader: T. Kitamura)

Leslie Banks-Sills, Yael Motola: *“Failure of piezoelectric ceramics”*

Gerold Schneider, A. Engert, H. Jelitto: *“What do we know about crack surface charges and the difference between intrinsic and extrinsic process during fracture in ferroelectric ceramics?”*

Yasuhide Shindo, Fumio Narita: *“Effects of electric field and poling on fatigue behavior of PZT ceramics with single-edge crack by three-point bending”*

Daining Fang, Yihui Zhang, Guanzhong Mao, Bin Liu: *“Electric field induced fatigue crack growth in ferroelectric ceramics”*

**Shape memory alloys I** (session leader: C. LExcellent)

Martin F.-X. Wagner, Christian Grossmann, Marcus Young, Gunther Eggeler: *“Localized deformation, mesoscopic phase interfaces and functional fatigue in pseudoelastic NiTi shape memory alloys”*

F. Auricchio, M. Conti, S. Morganti, A. Reali, U. Stefanelli: *“Shape-memory alloys: effective 3D modelling, computational aspects and biomedical device analysis”*

**Ferroelectrics I** (session leader: R. McMeeking)

Artem S. Semenov, Albrecht C. Liskowsky, Herbert Balke: *“Effective computational methods for the modeling of ferroelectroelastic hysteresis behavior”*

Stephan Roth, Peter Neumeister, Artem Semenov, Herbert Balke: *“Finite element simulation of the non-remnant straining ferroelectric material behaviour based on the electric scalar potential – convergence and stability”*

Li Yu, Shouwen Yu, Dietmar Gross: *“Constitutive behaviour of nano-particle ferroelectric ceramics”*

**Wednesday, September 02****Ferroelectrics II** (session leader: J. Huber)

Faxin Li: *“An optimization-based computational model for polycrystalline ferroelastics”*

Ralf Müller, David Schrade, Baixiang Xu, Dietmar Gross: *“Modelling of domain structure evolution in ferroelectric materials”*

Qun Li, Marco Enderlein, Meinhard Kuna: *“Microstructural FEM modeling of domain switching in tetragonal/rhombohedral ferroelectrics”*

Sven Klinkel, K. Linnemann: *“,A phenomenological constitutive model for piezoelectric ceramics and magnetostrictive materials”*

**Shape memory alloys II** (session leader: F. Auricchio)

Christian LExcellent, R. Laydi, V. Tallebot, P. Malecot: *“Prediction of the phase transformation zone around the crack tip of a shape memory alloy exhibiting an asymmetry between tension and compression”*

Thomas Antretter, Wolfgang Pranger, Thomas Waitz, Franz D. Fischer: *“Martensite morphologies in nanostructured NiTi shape memory alloys – energetic considerations”*

**Fracture Mechanics II** (session leader: L. Banks-Sills)

Duc Khoi Vu, Paul Steinmann: *“The concept of material forces and the coupled boundary-finite element method in electroelastostatics”*

Cun-Fa Gao, Yiu-Wing Mai: *“Stresses in an electrostrictive solid containing an elliptic cavity”*

Eric Béchet, Meinhard Kuna: *“Some numerical experiments about cracked piezoelectric media”*

Qing-Hua Qin, X.Q. He, J.S. Wang: *“Singularity analysis of electro-mechanical fields in angularly inhomogeneous piezoelectric composites wedges”*

**Thursday, September 03****Fracture Mechanics III** (session leader: Y. Shindo)

Jie Wang, Marc Kamlah: *“Three dimensional finite element modeling of nonlinear fracture of ferroelectric materials”*

L. Janski, P. Steinhorst, M. Kuna: *“Crack propagation simulations in piezoelectric structures with an efficient adaptive finite element tool”*

Volodymyr Loboda, S.V. Kozinov: *“Periodic set of interface cracks with limited electric permeability”*

Fulin Shang, Yabin Yan, Takayuki Kitamura: *“Interfacial delamination of PZT thin films”*

**Nano** (session leader: J. Schröder)

Karsten Albe, Paul Erhart: *“Modelling of point defects in ferroelectric materials”*

Takayuki Kitamura, Takashi Sumigawa, Taisuke Sueta: *“Mechanical behaviour of thin film comprised of sculptured nano-elements”*

**Actuators** (session leader: J. Rödel)

L.M. Gao, Ch. Zhang, Z. Zhong, C.-P. Fritzen, X. Jiang, H.-J. Christ, U. Pietsch: *“Propagation of SAW and PSAW in a Smart AlN/Diamond/ $\gamma$ -TiAl Structure”*

M.S. Senousy, R.K.N.D. Rajapakse, M. Gadala: *“Modeling of thermo-electromechanical response of PZT stack actuators used in fuel injectors”*

Ayech Benjeddou, Mohammad Al-Ajmi: *“Analytical homogenization of piezoceramic shear macro-fibre composites”*

Hannes Grünbichler, Raúl Bermejo, Peter Supancic, Robert Danzer: *“Influence of the load dependent material properties on the performance of multilayer piezoelectric actuators”*

## Friday, September 04

**Ferroelectrics III** (session leader: S. Yu)

Robert McMeeking, S.M.A. Jimenez: *“Models for actuation, failure and tearing of electroactive materials”*

Fei Fang, W. Yang, X. Luo: *“In-situ observations of multi-phase coexistence and polarization rotation under electric loadings for  $Pb(Mg_{1/3}Nb_{2/3})O_3$ - $PbTiO_3$  single crystals at the morphotropic phase boundary”*

Jörg Schröder, Marc-André Keip: *“Multiscale modeling of electromechanically coupled materials: homogenization procedure and computation of overall moduli”*

Kaushik Dayal, Kaushik Bhattacharya: *“A boundary element method coupled to phase field to compute ferroelectric domains in complex geometries”*

Jürgen Rödel, Kyle Webber, Emil Aulbach, Wook Jo, Thorsten Leist: *“Temperature-dependent ferroelasticity of ferroelectrics”*

Nien-Ti Tsou, Ingo Münch, John Huber: *“Low energy periodic microstructure in ferroelectric single crystals”*

**Report composed by Meinhard Kuna**

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**09-8 IUTAM ISIMM Symposium on Mathematical Modeling and Physical Instances of Granular Flows****a) Scientific Committee**

G. Capriz (Italy), R. Connelly (U.S.A.), J. D. Goddard (U.S.A., Chairman), J. T. Jenkins (U.S.A.), O. Sano (Japan), I. Vardoulakis\* (Greece), K. Wilmanski (Poland), C. Cercignani\* (Italy, IUTAM Rep.) - \* deceased

**b) Short summary of scientific progress achieved**

The Symposium was conducted under the auspices of the International Union of Theoretical and Applied Mechanics (IUTAM) and the International Society for the Interaction of Mechanics and Mathematics (ISIMM) in the scenic seaside city of Reggio Calabria, Italy. It was hosted by the Dipartimento di Meccanica e Materiali, Facolta' di Ingegneria, Università "Mediterranea" di Reggio Calabria. Participation in the Symposium was by invitation based on nomination and screening by the Scientific Committee. The group of forty-five invited participants includes both senior and younger investigators, some of whom attended as auditors. A conference web site was established (<http://mat520.unime.it/granular09/>). A total of forty-four full-length papers were presented along with six shorter talks. Those presenting full-length papers were invited to submit them for publication in the proceedings, either as abstracts, extended summaries of work appearing, or destined to appear, elsewhere, or as original research papers. For the latter, research communications as well as longer survey-type articles were solicited.

All papers submitted for publication in the Proceedings were subject to a rigorous review process by two to three referees each, appointed from amongst the participants by the undersigned editors, acting as a subcommittee of the Scientific Committee.

Referees were asked to provide anonymous evaluations according to the following criteria:

- 1.) relevance to the field of granular mechanics and physics, interpreted broadly as the continuum- and particle-level modeling of particulate systems dominated by pairwise interactions of a frictional-elastic, viscous, capillary or colloidal nature,
- 2.) scientific quality, and
- 3.) clarity and quality of exposition.

The review process, which lasted approximately two months, involved a generally vigorous and often spirited scientific exchange between referees and authors. In the opinion of the Editors, this has resulted in a collection of papers comparable to those published in special issues of the leading archival journals.



**c) Countries represented and number of participants**

56 participants from 15 countries: Australia (2), Austria (1), Denmark (1), France (6), Germany (4), Greece (1), India (4), Israel (1), Italy (12), Japan (4), the Netherlands (2), Poland (1), Switzerland (2), UK (4), USA (11)

**d) Publication of Proceedings of the symposium**

Arrangements have been made for publication of the proceedings as an AIP Conference Proceedings, now in the press: J. D. Goddard, and J. T. Jenkins, and P. Giovine (eds.), *Mathematical Modeling and Physical Instances of Granular Flows*, Proceedings of an IUTAM-ISIMM Conference, Reggio Calabria, Italy, 14-18 Sept. 2009, AIP Conference Proceedings, American Institute of Physics, New York, in the press, 2010.

**e) Financial supports**

The Symposium was made possible by financial support from the International Union of Theoretical and Applied Mechanics, the Gruppo Nazionale di Fisica Matematica of the Istituto Nazionale di Alta Matematica, the U.S. National Science Foundation, the Presidenza del Consiglio Regionale della Calabria, the Provincia di Reggio Calabria, the Università "Mediterranea", the Faculty of Engineering and the Department of Mechanics and Materials of Reggio Calabria. The organizers of the conference are duly grateful to all the sponsoring organizations.

**f) Scientific program****Visco-plasticity and micromechanics of rate-dependent flow**

D. Harris, "The Plastic Potential, Double-slip, Double-spin and Viscoplasticity"

H. Hayakawa, S.-H. Chong, and M. Otsuki, "Nonequilibrium liquid theory for sheared granular liquids"

J. T. Jenkins and D. Berzi, "Steady, Inclined Flow of a Mixture of Grains and Fluid over a Rigid Base"

J. T. Jenkins and L. La Ragione, "Microstructure and Particle-Phase Stress in a Dense Suspension"

D. Kadau, "From Powders to Collapsing Soil/Living Quicksand: Discrete Modeling and Experiment"

V. Kumaran, "The hard-particle model for a dense granular flow down an inclined plane"

C. Mineo and M. Torrisi, "On the hyperbolicity of a two-fluid model for debris flows"

- P. Richard, A. Valance, J.-F. Métayer, J. Crassous, M. Louge and R. Delannay, “Rheology of confined granular flows”
- A. D. Rosato, V. Ratnaswamy, D. J. Hornthrop, O. Dybenko, L. Kondic, “Temporal Dynamics in Density Relaxation”
- O. Sano, “Solid-fluid transition and the formation of ripples in vertically oscillated granular layers”
- H. Steeb, “Internal erosion in gas-flow weak conditions”
- J. Wakou and M. Isobe, “A New Approach based on Langevin type Equation for Driven Granular Gas under Gravity”

### **Elasto-plasticity and micromechanics of rate-independent flow**

*Non-polar continuum modeling, experiment, numerical simulation, statistical mechanics and statistical physics*

- E. H. B. Amar, D. Clamond, N. Fraysse, and J. Rajchenbach, “Response of a cohesionless packing to a point load”
- T. Aste, G. W. Delaney, and T. Di Matteo, “kGamma distributions in granular packs”
- R. Blumenfeld, “Stress transmission and incipient yield flow in dense granular materials”
- F. Froiio and J.-N. Roux, “Incremental response of a model granular material by stress probing with DEM simulations”
- I. Goldhirsch, “On the coarse-graining of grains”
- S. Luding, “Macroscopic stress from dynamic, rotating granular media”
- N. Mitarai and H. Nakanishi, “Simple Interaction Model for Partially Wet Granular Materials”
- A. V. Orpe, C. H. Rycroft, and A. A. Kudrolli, “Shear induced diffusion in dense granular flows”
- R. Pignatelli, “Equilibrium of granular clusters: influence of boundary curvature and contact properties”
- F. Radjai, V. Topin, V. Richefeu, C. Voivret, J.-Y. Delenne, E. Azéma, and S. El Youssofi, “Force transmission in cohesive granular media”
- J.-N. Roux and G. Combe, “How granular materials deform in quasistatic conditions”
- C. Song, P. Wang, H. A. Makse, “Theory of random packings”
- J. Sun and S. Sundaresan, “A plasticity model with microstructure evolution for quasistatic granular flows”

*Polar continuum modeling: experiment and numerical simulation*

- E. Bauer, “Modelling Limit States within the Framework of Hypoplasticity”
- W. Ehlers, “Homogenisation of Discrete Media towards Micropolar Continua: A Computational Approach”
- P. Giovine, “Remarks on Constitutive Laws for Dry Granular Materials”

J. D. Goddard, "Granular hypoplasticity with Cosserat effects"

V. Mehandia and P. R. Nott, "The stress in a slowly sheared granular column"

### **Segregation**

J.M.N.T. Gray, "Particle size segregation in granular avalanches: A brief review of recent progress"

M. Larcher and J. T. Jenkins, "Size Segregation in Dry Granular Flows of Binary Mixtures"

M. Shearer, L. B. H. May, N. Giffen, and K. E. Daniels, "The Gray-Thornton Model of Granular Segregation"

B. Yohannes and K. M. Hill, "Preliminary investigations on the rheology and boundary stresses associated with granular mixtures"

### **Waves**

B. Albers, "Micro-Macro Transition and Linear Wave Propagation in Three-Component Compacted Granular Materials"

N. P. Kruyt, "Three-dimensional lattice-based dispersion relations for granular materials"

N. Vriend and M. L. Hunt, "The waveguide theory for booming sand dunes"

S.-Y. Wang, E. B. Herbold, and V. F. Nesterenko, "Wave Propagation in Strongly Nonlinear Two-Mass Chains"

### **Abstracts**

A. Amoddeo, G. Lombardo, R. Barberi, "An Advanced Numerical Method to Describe Order Dynamics in Nematics"

A. Di Renzo and F. P. Di Maio, "Mixing equilibrium in two-density fluidized beds by DEM"

L. Fiorino, "Plane Waves in Porous Media"

C. G. Johnson and J. M. N. T. Gray, "Granular jets and hydraulic jumps on an inclined plane"

H. Nishimori, A. Katsuki, H. Sakamoto, and H. Niiya, "Coupled ODEs Model for the Dynamics of Dunes"

A. Valance, A. O. El Moctar, P. Dupont, I. Cantat and J.T. Jenkins, "Saltating Particles in a Turbulent Boundary Layer"

**Report composed by Joe Goddard**

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## Report of the IUTAM Spring/Summer Schools held in 2009

### Report on the IUTAM Spring School on Fluid Mechanics and Geophysics of Environmental Hazards

IMS, Singapore, 18 April - 2 May, 2009.

<http://www.ims.nus.edu.sg/Programs/09fluidss/index.htm>

#### Introduction

This Spring School was the main ingredient of an initiative funded by a €30k grant from ICSU under the ICSU Grants Programme 2008. This proposal had been formulated by IUTAM as the Lead Applicant, with support from IUGG, the ICSU Regional Office for Asia and the Pacific Region (ROAP), and the Royal Society; it fell within two of ICSU's priority areas: (i) Capacity Building, and (ii) Natural and Human-Induced Environmental Hazards and Disasters. The School was hosted by the Institute for Mathematical Science (IMS) of the National University of Singapore, which provided further valuable financial and administrative support.

#### Purpose of the School.

This was defined as follows on the above webpage of the School:

Environmental hazards, such as tsunamis triggered by earthquakes, tropical cyclones, monsoon flooding, volcanic eruptions and landslides, are all too familiar in Asia and the Pacific region, and have been the cause of catastrophic disasters. These hazards are a consequence of mechanical processes in the earth, ocean and atmosphere, and in order to understand them and hence to develop well-informed strategies for the mitigation of future disasters, it is necessary to develop sound scientific theory based on geophysical observations and data, the principles of fluid and solid mechanics, and an appropriate combination of mathematical and computational analysis.

This School is intended to focus on fluid mechanical aspects, and is aimed at students who have already graduated in mathematics, physics or engineering, and who wish to undertake research in this broad area. It is intended to bring students rapidly to current research frontiers in the fluid mechanics of environmental hazards. The School will start with introductory and motivational lectures on the fundamentals of geophysical fluid dynamics, and on geophysical hazard and risk in atmosphere and ocean contexts, and will then focus on four specific environmental hazards:

- i. typhoons and tropical cyclones;
- ii. monsoons and flooding;
- iii. tsunamis;

- iv. pollution of atmosphere, ocean and the urban environment.

The School will include workshop activity in which groups of students will study key papers cited by the lecturers, and will be encouraged to identify and formulate new model problems that need to be solved in each of the above four areas. In this way, it is envisaged that the students will be fully involved in active and collaborative research.

The longer-term objective is to initiate a network of young scientists in countries of Asia and the Pacific Region who will be committed to work in this interdisciplinary area, and to launch a program of research addressing these problems.

### **Programme of lectures**

These were as follows (see the above webpage for abstracts of the nine courses):

#### ***Introductory and Motivational Tutorial Lectures:***

Keith Moffatt (Cambridge, UK) (3 lectures) : [\*Elements of Vortex Dynamics and Turbulence\*](#)

Tieh Yong Koh (Nanyang Technological University, Singapore) (3 lectures, prepared in collaboration with Paul Linden, UCSD): [\*Geophysical and Environmental Fluid Mechanics\*](#)

Gerd Tetzlaff (Universität Leipzig, Germany, nominated by IUGG) (2 lectures): [\*Extreme Rain and Wind Storms in Mid-Latitudes\*](#)

A. W. Jayawardena (International Centre for Water Hazard and Risk Management, Japan, nominated by IUGG) (3 lectures): [\*Hydro-Meteorological and Environmental Disasters\*](#)

#### ***Tutorials on Special Topics:***

Kerry Emanuel (MIT, USA) (3 lectures): [\*Tropical Cyclones\*](#)

Pavel Tkalich (National University of Singapore) (3 lectures): [\*Tsunamis\*](#)

Swadhin Behera (Japan Agency for Marine-Earth Science and Technology) (3 lectures, prepared in collaboration with T. Yamagata): [\*Dynamics of the Indian and Pacific Oceans\*](#)

Peter Haynes (Cambridge, UK) (3 lectures): [\*Transport of Pollutants in the Atmosphere\*](#)

Emily Shuckburgh (British Antarctic Survey, UK) (3 lectures): [\*Aspects of Climate Change\*](#)

In addition, the following two ‘outreach’ lectures, aimed at the wider public, were given at the National University of Singapore:

[The Scientific Basis of Climate Change](#) 23 Apr 2009, 6.30 - 7.30pm

Emily Shuckburgh (British Antarctic Survey, UK)

[Rattleback Reversals: a Prototype of Chiral Dynamics](#) 28 Apr 2009, 6.30 - 7.30pm

Keith Moffatt (University of Cambridge, UK)

### **Outreach Posters**

Three outreach posters, entitled Tsunami, Typhoon and Monsoon, had been prepared in December 2008 in both English and Chinese versions. The graphic design was by Dr Andrew Burbanks, Mathematics Department, Portsmouth University, and 1000 of each (6000 in all) were printed in A2 size, free of charge, by World Scientific. Each poster deliberately contains an inset of relevant ‘blackboard-style’ mathematics, in order to indicate the applicability of mathematics to analysis of the extreme events illustrated. These posters may be viewed on the School website. They were widely distributed early in January 2009 with the IMS Newsletter.

### **Recruitment of Students**

The School was advertised on the internet and through the agency of IUTAM and IUGG and also through the wide contacts of ROAP in Asia and the Pacific Region. The deadline for (electronic) applications was 31<sup>st</sup> January 2009. By that date, about 60 applications had been received, from which the target number of 40 were selected for funding. These were all graduate students (MSc or PhD) or young postdocs; they came from 14 countries of Asia and the Pacific Region: Australia, Indonesia, Philippines, Vietnam, Malaysia, China, Japan, Korea, Bangladesh, Pakistan, India, Sri Lanka, Georgia and Iran. Several additional (unfunded) students from Singapore were also registered for the course. The students were all extremely well motivated, and the attendance at lectures was consistently high. A number of additional senior members of the NUS faculty attended lectures of interest to them.

### **Student Projects**

As planned in the proposal, each lecturer was asked to propose a ‘mini-research project’ one month before the start of the School. The successful student applicants were asked to choose three projects and list them in order of preference. It was then possible to divide the 40+ students into 9 groups of four or five per group, assigned to the nine projects, and preliminary reading was suggested before the start of the School. The students worked on these projects, with guidance from the lecturers, in afternoon sessions during the first week of the School, and they made presentations of their results

during the afternoon sessions of the second week. Their reports of their investigations will soon be available on the School website.

The students were uniformly enthusiastic about this style of project work, which promoted an unusual degree of international collaborative activity, and opened up research projects for the students to pursue in more depth in the future.

### **Additional seminars**

Additional research seminars were scheduled for late afternoon each day. One of these was given by Harsh Gupta (Hyderabad), representing ICSU; another on '*Freak Waves*' by Frédéric Dias, Secretary-General of IUTAM, who visited the School from 23<sup>rd</sup> to 25<sup>th</sup> April. The remainder were given by local scientists involved in environmental hazard research (earthquakes, volcanoes, flooding, ...).

### **Field Trip**

A field trip to the Tropical Marine Science Institute (TMSI) on St John's Island (about 30 minutes by sea from Singapore marina) was arranged on Saturday 25<sup>th</sup> April. This provided opportunity for bonding, as well as welcome relaxation at the half-way stage of the School. Frédéric Dias gave a second seminar at TMSI.

### **Publication**

Publication of the lectures is planned for the IMS Lecture Notes Series (World Scientific). The delivery deadline is 31<sup>st</sup> December 2009, and publication is anticipated in 2010.

**Report composed by Keith Moffatt**

**Report on the IUTAM Summer School on Mechanics in Microfluidics**

Peking University, Beijing, Aug. 16-20, 2009

The aim of this course was to present recent advances in mechanics of microfluidics, and also some of those in physics, chemistry and biology.

The recent developments of microfluidics have revolutionized many fields of sciences and technologies, such as biotechnology and bioengineering with applications to genomics and proteomics; lab-on-chip-analysis; micro-quantity syntheses; on-line clinical diagnoses, etc. Increased demands for microfluidics will dramatically increase tools and analyses of mechanics and their applications to microsystems. Microfluidics deals with the transfer and control of small amount (nano or pico liter range) of fluids in microscale flow configurations, which makes the manipulation of cells and macro molecules become possible in the micro channels/reactors in integrated system. The matching between the length scales of the flow and the cells/micro-particles may affect directly the efficiencies of momentum and energy transfer of the motions. The small transverse length scale in microfluidic system produces very small Reynolds number with high velocity gradient and high viscous force, which is much different from the macro flows with higher inertia of fluid mass. Driving forces in microsystem may need to combine the hydrodynamic pressures and the electrokinetics force. These aforementioned phenomena are interesting topics in micro/nano fluidic researches. Development of proper models and theories becomes more and more important for the interpretation the interesting phenomena in micro flow and for the exploration of optimal design and fabrication of microfluidic systems.

The topics of the summer school presented research achievements in this field during recent years, with the lectures given by:

Chih Ming Ho, on "From Materials, Devices, Systems to Complex Systems"

Hong Kai Wu, on "PDMS microfluidics "

Xingyu Jiang, on "Micro/Nano-Scale Tools for Biochemical Analysis"

Patrick Tabeling, on "Physical aspects of microfluidics"

Laurent Pilon, on: "Interfacial Phenomena and Microfluidics in Aqueous Foams"

Yong Chen, "Integrated Cell-Material Sciences: Nanostructure and Microfluidic Toolbox"

Jeff Tza-Huei Wang, on "Microfluidics Mediated Single-Molecule and Single-Cell Analysis"

Bo Zheng, on "Droplets-Based Microfluidic Techniques"

Chunxiang Luo, on "Diffusion-based microenvironment control for bacterial migration"

Chunyang Xiong on "Microfluidics: Multi-functional Tools for Cell Mechanics"



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Yanyi Huang, on “Large scale integrated microfluidic chips”

The subjects of those lectures included:

- Size and surface effects in microfluidics and their influences on macro-parameters of fluid mechanics
- Action and coupling of hydrodynamic pressures and electrokinetic force fields in flow control of microfluidic system.
- Innovative pattern design and flowing analysis in the manipulation of cells, molecules and DNA/RNA.
- Measurement methodologies and techniques in microfluidic mechanics such as optical detection and micro particle image velocimetry
- Computational simulations of microfluidic mechanics with advanced models and algorithms.
- Mechanics related to the microfluidic applications of mixing, separation, filtering, sensing and actuating in MEMS and Nano devices.

The course attendance was about 120, from various institutes with different backgrounds such as biology, chemistry, physics and mechanics.

**Report composed by Jing Fang (PKU, China)**

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## **Reports of the IUTAM Working Parties**

### **WP-1 - Non-Newtonian Fluid Mechanics and Rheology**

No report has been submitted on WP-1.

### **WP-2 - Dynamical Systems and Mechatronics**

No report has been submitted on WP-2.

### **WP-3 - Mechanics of Materials**

No report has been submitted on WP-3.

### **WP-4 - Materials Processing**

This working party covers four main classes of materials: metals, semi-conductors, ceramics and polymers. In each field, the scientific activity is significant and the number of conferences and less formal seminars or colloquia is large. The approach is generally multidisciplinary, so that specialists in materials sciences collaborate with practitioners in fluid or solid mechanics. This has been a pragmatic trend for almost two decades, but, in the field of this WP, it is also a consequence of the development of numerical techniques, which make easier than before the integration of knowledge coming from different disciplines. In addition, international programs oriented towards applications play a significant role in establishing networks among complementary research groups and industries. It is clear that these trends will continue for the foreseeable future.

The polymer processing area is rich in theoretical and applied mechanics content. Topics such as simulation of non-Newtonian fluid flow, theoretical and applied rheology, and the modeling of structure development during crystallization present significant challenges and research opportunities for mechanicians. Research in polymer processing has traditionally centered on continuum mechanics, its relation to polymer physics, and on numerical simulation methods. However, in recent years other aspects of mechanics have begun to have an impact on the area. For instance, nonlinear dynamics is becoming an important tool for analyzing polymer mixing operations, which are now known to be an important application of chaotic advection. Technical meetings and workshops on polymer processing are sponsored by a number of groups worldwide. Some of these are societies that are dedicated to the subject: The Society of Rheology, the European Society of Rheology, the Japanese Society of Rheology, and the Polymer Processing Society. A few, less-formal groups sponsor important meetings, e.g. the Workshop on Numerical

Methods in Non-Newtonian Flow, and the Gordon Research Conference on Polymer Processing. Finally, polymer processing sessions and symposia, and opportunities to discuss polymer processing research in a broader setting, are provided by societies such as ASME, AIChE, and IUPAC, as well as IUTAM.

Ceramics processing presents many opportunities for work in theoretical and applied mechanics and this field is very active. The production and handling of green bodies provides many challenges to those working in the areas of mixing, rheology, viscoplasticity and shape forming. In sintering, problems related to stress coupled mass transport, viscoelasticity, microstructural evolution and high temperature plastic deformation have been tackled with a theoretical and applied mechanics approach. In addition, production methods such as machining and net shape forming have recently commanded the attention of researchers in the theoretical and applied mechanics field. Thus, the area of ceramics processing in connection with theoretical and applied mechanics is very active in terms of meetings and workshops. The theoretical and applied mechanics of the subject is addressed regularly in symposia and conference sessions in the meetings around the world of groups and societies primarily concerned with mechanics, such as IUTAM itself, EUROMECH, ASME Applied Mechanics Division, JSME, GAMM and other national organizations. In addition to these activities, organizations with a primary focus on materials science also mount symposia and conference sessions that contain a significant amount of theoretical and applied mechanics addressed towards ceramic processing. These groups include the American Ceramic Society, the European Ceramic Society and the Japanese Ceramic Society plus broadly based organizations such as the Materials Research Society. The wide variety of fora available for theoretical and applied mechanics research in ceramic processing promotes breadth and relevance in the field and ensures effective multidisciplinary approaches. Thus the ceramics area of materials processing in regard to theoretical and applied mechanics has momentum and is in a relatively healthy state.

The mechanics of metals processing is a very active area, with problems ranging from fluid flow of melts, solidification and crystallization, and shaping by forging, rolling and pressing all having important mechanics content. The field involves many meetings each year at a variety of venues, sponsored by materials societies such as TMS and MRS, as well as engineering bodies such as ASME and SAE. Progress is being enabled by significant developments in computational methods, and to that are added advances in experimental and characterization methods as well as steps forward in constitutive modeling. Overall, the area of the mechanics of metals processing is in a very healthy state, and is receiving renewed attention due to the interest in lighter weight structures driven by demands of energy efficiency. This has led to the expansion of activity in regard to low density, strong materials, with magnesium alloys being the prime example.

**Report written by Robert McMeeking, Chair of WP-4****WP-5 - Computational Fluid and Solid Mechanics**

The main computational event of 2009 was the US National Congress on Computational Mechanics – UNSCCM 10, Ohio, July 16-19 2009. It featured 77 mini-symposia with approximately 1200 presentations in different technical sessions. Some of major statistics of the Congress are provided below:

- Total registered attendees: 1203
  - Registered attendees from outside the US: 368
- (Student attendees: 403)

The next important meetings for the computational mechanics community will be the IV European Conference on Computational Mechanics – Solids, Structures and Coupled Problems in Engineering (ECCOMAS) – Paris – May 16-21, 2010 and the 9<sup>th</sup> World Congress on Computational Mechanics and 4<sup>th</sup> Asian Pacific Congress on Computational Mechanics – Sydney – 19-23 July 2010.

No meeting of WP5 has been arranged in 2009, the next one will be in 2010. Let then come back to some items developed previously. First, updated definition of “Computational Mechanics” on which WP5 follows, the one giving by Tinsley Oden: “Mechanics is the study of the motion of bodies under the action of forces. It encompasses virtually every phenomenon in the physical universe, from the deformation and flow of solids and fluids, to the motion of electrons around the nuclei of atoms. Computational mechanics is the science and technology concerned with the use of computational methods and devices to study problems of mechanics. It is more than a science, for it includes as this mission the prediction of physical events governed by the laws of mechanics. It is, thus, the principal tool of engineering. Within its domain are the study and prediction of events on all scales, from the atomic and molecular to the galactic. Computational mechanics is a remarkably rich, challenging and important discipline in engineering and applied science, which has enriched virtually every aspects of human existence”.

Among the few joint IACM/IUTAM pressing issues, one can display at least one: “Model verification and validation” which could be the topic of one of next ICTAM minisymposia.

For fostering the synergy between IACM and IUTAM, the WP has stopped on the idea to organize an IUTAM/IACM symposium following the IUTAM rules with some suggestions for the place, the date and the title. A decision should be done in 2010.

**Report written by Pierre Ladevèze, Chair of WP-5**

## WP-6 - Biomechanics

The year 2009 witnessed substantial activity in biomechanics, biomechanical engineering and bioengineering, as evidenced by the large number of conferences devoted to the area, and significant focus on biomechanics-related topics within more general mechanics and applied mathematics meetings.

A key ingredient of many presentations was the modeling aspect and the coupling between mechanics, biology, chemistry and electrophysiology. Furthermore computational aspects are essential to solve realistic problems of clinical interest. It is clear that computational methods have a key role in simulation of clinical interventions and patient-specific geometric modeling. Such computational modeling requires detailed information of in vivo material properties and the changes in those properties with age and disease. The field of computational biomechanics has come of age as a separate discipline and is enabling us to tackle multi-disciplinary problems of clinical importance. In particular, computational methods form a basis for translating between different length scales and between basic research and clinical application, so that biomechanics moves from the laboratory to the bedside. Computational biomechanical models need to prove their accuracy in terms of correlation with experimental data at the tissue, cellular and molecular levels, and movement in this direction has already been seen in the last year.

In the immediate future there is the forthcoming World Congress on Biomechanics, which takes place in Singapore, August 1-6, 2010. In addition, several conferences and (advanced) Summer Schools are scheduled for the second half of 2010, indicating the strength and vitality of the field, which continues to attract many new PhD students and scientists from other disciplines.

In the following, selected events on Biomechanics and biomechanically-related topics in 2009 are listed, including those where IUTAM members have been strongly involved. One category lists events devoted to Biomechanics, while another lists conferences and meetings which were not specifically devoted to biomechanics, but included plenary presentations, Minisymposia and special sessions on Biomechanics.

Conferences, meetings, workshops and schools devoted to Biomechanics:

- Third International Conference on Mechanics of Biomaterials & Tissues, Clearwater Beach, Florida, USA, December 13-17, 2009
- Australasian Biomechanics Conference 2009, Parklands – Gold Coast, November 30 – December 1, 2009
- SFB Workshop: Methods and Applications of Cardiac Electromechanical Models, Graz, Austria, October 28-31, 2009
- International Workshop on Continuum Mechanics of Biological Tissues, Centro Internacional de Encuentros Matemáticos, Castro Urdiales, Spain, September 20-23, 2009
- 4th International Congress on Computational Bioengineering (ICCB2009) and First European Symposium on Biomedical Integrative Research, Bertinoro (Forlì), Italy, September 16-18, 2009

- World Congress on Medical Physics and Biomedical Engineering (WC2009), Munich, Germany, September 7-12, 2009
- The Annual Meeting for the American Society of Biomechanics, State College, Pennsylvania, August 26-29, 2009
- International Society of Biomechanics in Sports Conference 2009, Limerick, August 17-21, 2009
- Summer School on New Trends in the Physics and Mechanics of Biological Systems, Les Houches School of Physics, France, July 6-31, 2009
- XXII Congress of the International Society of Biomechanics, Cape Town, South Africa, July 5-9, 2009
- 1st International Conference on Computational & Mathematical Biomedical Engineering (CMBE), Swansea, UK, June 29 – July 1, 2009
- 1st International Conference on Biodental Engineering, Porto, Portugal, June 26-27, 2009
- 2009 Summer Bioengineering Conference, Lake Tahoe, CA, USA, June 17-21, 2009
- 6th European Symposium of Vascular Biomaterials (ESVB 2009). Connecting Biomaterials to Arterial Structures. Strasbourg, France, May, 13-15, 2009
- The 4th International Symposium on Biomechanics in Vascular Biology and Cardiovascular Disease. Rotterdam, The Netherlands, April 16-17, 2009
- Fourth Asian Pacific Conference on Biomechanics, University of Canterbury, Christchurch, New Zealand, April 14-17, 2009
- Ontario Biomechanics Conference 2009, Barrie, Ontario, March 13-15, 2009

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

- 6th International Conference of the Croatian Society of Mechanics (ICCSM), Dubrovnik, Croatia, September 30 – October 2, 2009

Plenary presentation:

GA Holzapfel, Graz University of Technology, Austria, Recent advances in the analysis of evolving discontinuities in biological tissues

A special session on Biomechanics and Computational Biology (9 talks) was also included in the program.

- 7th European Solid Mechanics Conference (ESMC2009), Lisbon, Portugal, September 7-11, 2009

Plenary presentation:

M Doblare, University of Zaragoza, Spain, On Modeling Damage and Osseointegration Evolution in Bone Implant Surfaces

MiniSymposia:

Biomechanics of Human Locomotion; Organizers: M Silva, Portugal; J Alonso, Spain

Mechanics of Cellular Network-like (Bio)Materials; Organizers: PR Onck, University of Groningen, The Netherlands; ML Oyen, University of Cambridge, UK

Modeling of Biological Materials; Organizers: M Böl, TU Braunschweig, Germany; SPA Bordas, University of Glasgow, UK; GA Holzapfel, Graz University of Technology, Austria

- 10th International Conference on Computational Plasticity. Fundamentals and Applications (COMPLAS X), Barcelona, Spain, September 2-4, 2009

Plenary presentation:

JS Chen, UCLA, USA, Multiscale Modeling of DNA Molecules

GA Holzapfel, Graz University of Technology, Austria, Computational Mechanics of Multi-Layered Collageneous Soft Tissues: State of the Art and Challenges Ahead

E Nakamachi, Osaka Institute of Technology, Japan, Multi-Scale Analysis of Head Crash Injury by Employing Micro Blood Vessel and Nerve Cell Models

Invited sessions:

Computational Methods in Biomechanics and Mechanobiology; Organizer: GA Holzapfel, Graz University of Technology, Austria

- European Forum Alpbach – Technology Forum, Alpbach, Austria, August 27-29, 2009

MiniSymposium:

Biomedical and Pharmaceutical Engineering – Key Technologies of the 21st Century; Organizers: GA Holzapfel, Graz University of Technology, Austria; JG. Khinast, Graz University of Technology, Austria

- 8th European Conference on Numerical Mathematics and Advanced Applications (ENUMATH 2009), Uppsala, Sweden, June 29 – July 3, 2009

MiniSymposium:

Biomechanics; Organizers: A Klawonn, University Duisburg-Essen, Germany; GA Holzapfel, Graz University of Technology, Austria

- NAWI-Graz Workshop, Graz, Austria, June 26, 2009

Plenary presentation:

GA Holzapfel, Graz University of Technology, Austria, Biomechanics in the interdisciplinary context of bioengineering, biology, chemistry and medicine

- The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials, Blacksburg, VA, June 24-27, 2009

Special Symposia:

8th Symposium on Biological and Biologically Inspired Materials. Organizers: DR Katti, University of North Dakota; C Hellmich, Vienna University of Technology, Vienna

Materiomics-Materials Science of Biological Protein Materials. Organizer: M Buehler, MIT, USA

Mechanics of Biomembranes. Organizers: G Lykotrafitis, University of Connecticut, USA; J Li, University of Pennsylvania, USA; S Zhang, The Pennsylvania State University, USA

Molecular Mechanics. Organizer: I Puri, Virginia Tech, USA

Special topic sessions:

Sessions on Biodynamics, Biomaterials and Biomechanics; Organizers: S. Ross, Virginia Tech, USA; R De Vita, Virginia Tech, USA; J Socha, Virginia Tech, USA

- 17th UK National Conference on Computational Mechanics in Engineering (ACME-UK), Nottingham, UK, April 6-8, 2009

Plenary presentations:

GA Holzapfel, Graz University of Technology, Austria, Computational Biomechanics: Implications for Clinical Medicine

JM Huyghe, Eindhoven University of Technology, The Netherlands, Synergy Between Geo- and Biomechanics

A few talks on specific biomechanical topics were also included in the program.

- 80th Annual Meeting of the International Association of Applied Mathematics and Mechanics (GAMM), Gdańsk University of Technology, Poland, February 9-13, 2009

MiniSymposia:

Biomechanics and Organ Motion; Organizers: D Tejszerska, Silesian University of Technology, Poland; D Jasinska-Choromanska, Warsaw University of Technology

Computational Modeling of Biological Tissues in Physiological and Pathophysiological Conditions; Organizers: R Grytz, Ruhr-Universität Bochum, Germany; A Ehret, RWTH-Aachen, Germany

Session:

Biomechanics; Organizers: T Ricken, Universität Duisburg-Essen, Germany; LB Dworak, Medical University of Poznan, Poland

**Report composed by Gerhard Holzapfel, Chair of WP-6**

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

No report has been submitted on WP-7.

### **WP-8 - Geophysical and Environmental Mechanics**

No report has been submitted on WP-8.



## **WP-9 - Education in Mechanics and Capacity Building**

The working party has not been terribly active as an entity this past year, although individual members have taken various initiatives. In particular, Prof. L. Bevilacqua has initiated various discussions about coherent support for mechanics in South America. Dr. I. Gledhill has been involved with IUPAP's Working Group on Women in Physics. South Africa will be hosting the IUPAP International Conference on Women in Physics in April 2011. The Working Group was put together by IUPAP in response to ICSU's statement on Universal Access to Science. Prof. Haiyan Hu was involved in the 4th Forum of Mechanics Education of the Chinese Society of Theoretical and Applied Mechanics (CSTAM). The Forum had more than 300 domestic participants, and also good speakers from other countries. At the invitation of CSTAM Prof. Hu gave a plenary presentation "Mechanics Education for Research Engineers" at the 3rd National Congress of Mechanics in 2009. This was the first keynote lecture on mechanics education before 1700 Chinese scholars of mechanics. These efforts have highlighted the importance of mechanics education, at least regionally.

The main action that the Working Party has taken collectively was to submit a proposal for a minisymposium on education and capacity building for ICTAM2012. Unfortunately, this minisymposium proposal was not one of the six chosen for the congress, although it was recommended that the theme of education and capacity building should be emphasized at the congress.

**Report composed by Hassan Aref, Chair of WP-9**

## 2009 Treasurer's Report

Statement of Change in Fund Balance	USD
<b>Balance, 31 December 2008</b>	440,021
Net revenues minus expenses for 2009	-41,730
<b>Balance, 31 December 2009</b>	<b>398,291</b>
Statement of Cash Revenues Collected over Expenses Paid	
<b>Revenues collected during 2009:</b>	
Subscription dues	105,081
ICTAM 08 payment from Adelaide	26,190
Support of GA 2010 Meetings from Adelaide	7,023
Interest income	2,424
<b>Total</b>	<b>140,718</b>
<b>Expenses paid during 2009:</b>	
Symposia	37,534
IUTAM Summer School	5,000
Payment of ICSU Spring School Grant deposited in 2008	39,370
Travel, Bureau	15,105
Travel, Congress Committee Executive Committee	16,428
Travel, others	3,206
Contribution to ICSU	3,812
Administration & Website & Misc.	48,237
Auditor's fee	3,043
Bank fees	889
Pre-payment for GA 2010 Meetings	4,897
<b>Total</b>	<b>177,521</b>
<b>Revenues minus expenses for 2009</b>	<b>-36,803</b>
Gain (loss) from exchange of currency	-4,927
<b>Net revenues minus expenses for 2009</b>	<b>-41,730</b>

**Statement of IUTAM Bank Accounts**  
**(1 January 2009 through 31 December 2009)**

**Running Accounts**

<b>Bank</b>	<b>Balance 31 Dec. 08</b>	<b>Withdrawals 2009</b>	<b>Deposits 2009</b>	<b>Balance 31 Dec. 09</b>	<b>Currency</b>
Citizens Bank Providence 1009-367-2	42,645.87	-108,538.69 <sup>*)</sup>	65,892.82	0.00	<b>USD</b>
Citizens Bank Providence 1597-967-1	134,923.93	135,209.92 <sup>**)</sup>	285.99	0.00	<b>USD</b>
ABN-AMRO Bank Eindhoven 41.41.42.551	3,100.84	-3,826.84	726.00	0.00	<b>USD</b>
ABN-AMRO Bank Eindhoven 41.41.28.311	560.62	-564.37	0.00	-3.75	<b>EUR</b>
Spar Nord Bank Aalborg 383 88 37963	33,996.53	-70,446.99	224,497.60	188,047.14	<b>USD</b>
Spar Nord Bank Aalborg 383 88 37955	95,055.71	-78,047.45	14,125.90	31,134.16	<b>EUR</b>

<sup>\*)</sup> USD 107,133.07 transferred to Spar Nord Bank account 383 88 37963 on 13 Feb. 09 and Citizens Bank account 1009-367-2 closed.

<sup>\*\*)</sup> Transferred to Savings account with Citizens Bank on 10 July 09 and Citizens Bank account 1597-967-1 closed.

**Savings Accounts**

<b>Bank</b>	<b>Balance 31 Dec. 08</b>	<b>Withdrawals 2009</b>	<b>Deposits 2009</b>	<b>Balance 31 Dec. 09</b>	<b>Currency</b>
Citizens Bank Providence	88,563.68	60,148.82	136,558.75	164,973.61	<b>USD</b>
ABN-AMRO Bank Eindhoven	0	0	242.21	242.21	<b>EUR</b>

## IUTAM Bank Account Information

### Treasurer:

Professor N. Olhoff, Department of Mechanical Engineering, Aalborg University,  
Pontoppidanstraede 101, DK-9220 Aalborg East, Denmark

### Assistant Treasurer:

Professor L. B. Freund, Division of Engineering, Brown University, 182 Hope Street,  
Providence, RI 02912-9104 USA

### Running Accounts:

Spar Nord Bank, Post Office Box 162, DK-9100 Aalborg, Denmark, Account 383 88  
37955 (EUR), Account 383 88 37963 (USD)

## Subscription Due Paid in Membership Units

<b>Adhering Organization</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>
Argentina	–	–	–	–	–	–
Australia	3	3	3	3	3	3
Austria	1	1	1	1	1	1
Belgium	5	5	5	5	5	5
Brazil*	1	1	1	1	3	3
Bulgaria	1	–	–	–	–	–
Canada	8	8	8	8	8	8
Chile	1	1	1	1	1	–
China/Beijing	8	8	8	8	8	8
China/Hong Kong	1	1	1	1	1	1
China/Taipei	3	3	3	3	3	3
Croatia	1	1	1	–	1	1

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Czech Republic	1	1	1	1	1	–
Denmark	3	3	3	3	3	3
Egypt	1	1	1	–	–	–
Estonia	1	1	1	1	1	1
Finland	3	3	3	3	3	3
France	8	8	8	8	8	8
Georgia	–	–	1	1	1	–
Germany	8	8	8	8	8	8
Greece	1	1	1	–	–	–
Hungary	1	1	1	1	1	1
India	5	5	5	5	5	5
Ireland	1	1	1	1	1	1
Israel	3	3	3	3	3	3
Italy	8	8	8	8	8	8
Japan	8	8	8	8	8	8
Korea	1	1	1	–	–	–
Latvia	1	1	1	1	1	1
Netherlands	5	5	5	5	5	5
New Zealand	1	1	1	1	1	1
Norway	1	1	1	1	1	1
Poland	3	3	3	3	3	3
Portugal	1	1	1	1	–	–
Romania	1	1	1	1	1	1
Russia	8	8	8	8	8	8
Saudi Arabia	1	1	1	1	1	1
Serbia	1	1	1	1	1	1
Slovakia	1	1	1	1	1	–
Slovenia	1	1	1	1	1	1

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South Africa	1	1	1	1	1	1
Spain	1	1	1	1	–	1
Sweden	5	5	5	5	5	5
Switzerland	3	3	3	3	3	3
Turkey	1	1	1	1	1	1
Ukraine	1	1	1	1	1	–
United Kingdom	8	8	8	8	8	8
United States	12	12	12	12	12	12
Vietnam	1	1	1	1	1	1

Note: For any particular year, a dash (–) indicates that dues had not been paid as of 31 December 2009. Dues are expressed in membership units of 1, 3, 5, 8 or 12, corresponding to category of membership from I through V, respectively.

\* Brazil has decided to pay 3 units of dues from 08

## Reports on Affiliated Organizations

### AFMC (Asian Fluid Mechanics Committee)

The 13th Asian Congress on Fluid Mechanics is to be held in Dhaka on 17-21 December, 2010. A local organizing committee and an advisory committee of Bangladesh were established in 2009 with Professor A.K.M. Sadrul Islam of Bangladesh University of Engineering and Technology and Professor Fazle Hussain of Houston University as chairmen, respectively. Since the year of 2010 happens to be the 30 anniversary of ACFM, a special session will be arranged to celebrate the event. A number of mini-symposia are planned for the first time in the history of ACFM. More than 10 invited speakers, including 3 memorial lectures in honor of ACFM founders are selected to give talks on both classic hydrodynamics and frontiers in fluid mechanics. Right now, AFMC and LOC together are making common efforts to guarantee the success of the forthcoming congress in Bangladesh. The web of the congress <http://www.13thacfm/infor/> has been open to the public.

**Report composed by Jiachun Li and Heng Zhou**

### CACOFD (Caribbean Congress of Fluid Dynamics)

No report has been submitted on CACOFD.

### CISM (International Centre for Mechanical Sciences)

#### 1. Courses and Seminars

The regular programme of courses and seminars, planned by the Scientific Council at the Centre for 2009, took place in two Scientific Sessions, the Broglio Session (May-July 2009) and the Sobrero Session (September-October 2009). The topics, always at an advanced level, included different fields of mechanics and related sciences, both at a basic and applied level.

The Broglio Session

Numerical Modeling of Concrete Cracking  
Dynamical Inverse Problems: Theory and Application  
Mechanical Behaviour of Soils under Environmentally Induced Cyclic Loads  
Multiphase Microfluidics – The Diffuse Interface Model

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Electrokinetics and Electrohydrodynamics in Microsystems  
Mechanics and Electrodynamics of Magneto- and Electro-Elastic Materials

The Sobrero Session

Environmental Wind Engineering and Wind Energy Structures  
Asymptotic Methods in Fluid Mechanics: Survey and Recent Advances  
Cellular and Porous Materials in Structures and Processes

## 2. National Advanced Professional Training

A series of courses on Advanced Professional Training (APT) in the fields of structural and geotechnical engineering, environmental, surveying, industrial engineering and bioengineering were given in Italian.

## 3. Editorial Activities

The lectures of several courses held at CISM were published in book form and distributed by Springer Verlag Vienna-New York.

The following books were published in 2009:

G.A. Holzapfel – R.W. Ogden “Biomechanical Modelling at the Molecular, Cellular and Tissue Levels”

P. Wriggers – C. Carstensen “Mixed Finite Element Technologies”

L. Cortelezzi – I. Mezic “Analysis and Control of Mixing with Applications to Micro and Macro Flow Processes”

J.A.C. Ambrosio – P. Eberhard “Advanced Design of Mechanical Systems: from Analysis to Optimization”

Z. Waszczyszyn “Advances in Soft Computing in Engineering”

V.V. Silberschmidt “Computational and Experimental Mechanics in Advanced Materials”

J.R. Klepaczko – T. Lodygowski “Advances in Constitutive Relations Applied to Computer Codes”

The scientific International Journal "Mechanics Research Communications" (bimonthly) was founded in 1973 by CISM and Pergamon Press (Oxford-New York); at present is published by Elsevier. In 2009 its thirty-sixth volume appeared.

It contains peer-reviewed short communications of high standard and aims at providing fast means for communication of research results and exchange of ideas related to the wide domain of both theoretical and applied mechanics.

## 4. Scholarships

A number of scholarships, including free lodging and board or exemption from registration fee, was offered by CISM during the courses to participants who were not



supported by their home institutions, priority being given to young researchers coming from countries that contribute to CISM's operating resources.

## 5. International Participation

In 2009, 57 lecturers from 18 countries delivered lectures in the Broglio and Sobrero Sessions. The courses were attended by 251 participants coming from 32 countries.

**Report composed by Bernard Schrefler**

## **EUROMECH (European Mechanics Society)**

EUROMECH - European Mechanics Society is an international non-governmental non-profit scientific organization.

The objective of the Society is to engage in all activities intended to promote in Europe the development of mechanics as a branch of science and engineering.

The society is governed by the Council whose members are being elected according to rules set in Statutes.

### *EUROMECH meetings*

The EUROMECH Council has overall responsibility for EUROMECH Colloquia and EUROMECH Conferences.

EUROMECH Colloquia are informal meetings on specialized research topics. Participation is restricted to a small number of research workers actively engaged in the field of each Colloquium. The organization of each Colloquium, including the selection of participants for invitation, is entrusted to a Chairperson. Proceedings are not normally published. Those who are interested in taking part in a Colloquium should write to the appropriate Chairperson (Number, Title, Chairperson or Co-chairperson).

EUROMECH Conferences are broad in scientific scope. They comprise

- ❖ the European Solid Mechanics Conference,
- ❖ the European Fluid Mechanics Conference,
- ❖ the European Turbulence Conference,
- ❖ the European Non-linear Dynamics Conference and
- ❖ the European Mechanics of Materials Conference.

They are open to all those interested and are expected to have a number of participants between 150 and 600. The general purpose is to provide opportunities for scientists and engineers to meet and discuss current research. The responsibility for each series of

Conferences is delegated to a Standing Conference Committee. The organizational work is carried out by Local Organizing Committees (LOC). Those who are interested in taking part in one of the Conference should write to the Chairman or Secretary of the appropriate LOC.

*EUROMECH COLLOQUIA in 2009*

- 497. Recent Developments and New Directions in Thin-Film Flow, 6-10 July 2009, Edinburgh, UK
- 503. Non-linear Normal Modes, Dimension Reduction and Localization in Vibrating Systems, 27 September – 2 October 2009, Rome, Italy
- 504. Large Eddy Simulation for Aerodynamics and Aeroacoustics, 23 - 25 March 2009, Technische Universität München, Germany
- 506. CPNLS-09 Solitons in their roaring forties: coherence and persistence in non-linear waves, 6 - 10 January 2009, Observatory of Nice, France
- 507. Immersed boundary methods: current status and future research directions, co-sponsored by ERCOFTAC, 15 - 17 June 2009, Amsterdam, The Netherlands
- 508. Wind turbine wakes, 20 – 22 October 2009, Universidad Politécnica de Madrid, Spain
- 509. Vehicle aerodynamics, 24 - 26 March 2009, Tu Berlin, Germany
- 510. Mechanics of generalized continua: a hundred years after the Cosserats, 13 - 16 May 2009, UPMC-Paris, France
- 512 Small scale turbulence and related gradient, 26 - 29 October 2009 Accademia delle Scienze, Turin, Italy

*EUROMECH CONFERENCES in 2009*

12th EUROMECH European Turbulence Conference, 7-10 September 2009, Marburg, Germany

7th EUROMECH Solid Mechanics Conference, 7-10 September 2009, Lisbon, Portugal

For more details see [www.euomech.org](http://www.euomech.org) .

**Report composed by Bernhard Schrefler**

**HYDROMAG (International Association for Hydromagnetic Phenomena and Applications)**

HYDROMAG is an international association of scientists and engineers active in those fields of research which involve the flow of fluids in the presence of a magnetic fields, namely magnetohydrodynamics (MHD), electromagnetic processing of materials (EPM) and dynamics of magnetic fluids (MF). HYDROMAG promotes growth and visibility of the field of hydromagnetics and stimulates exchanges between its members throughout the world via conferences, workshops, summer schools and publications. Detailed information on HYDROMAG can be accessed under

<http://wcms1.rz.tu-ilmeneau.de/fakmb/hydromag.html>

This WWW-site contains information on membership, forthcoming conferences, the electronic HYDROMAG newsletter and a link to the German Ferrofluid Information Server, maintained by Prof. S. Odenbach (University of Dresden).

During the year 2009 several workshops and scientific meetings have been conducted involving the active participation of HYDROMAG and its members. A particularly important event was the International Conference on Electromagnetic Processing of Materials held in October 2009 in Dresden (Germany).

A group of European Scientists successfully established a network on EPM in frame of the COST-programme of the European Commission called "COST action P17 Electromagnetic Processing of Materials". The programme supports mutual visits of scientists. Detailed information can be obtained from

<http://www.cost.esf.org/index.php?id=412>

**Report composed by André Thess**

**IABEM (International Association for Boundary Element Methods)**

The preliminary stages of the organisation of a IABEM conference, to be held in Brescia, Italy, in Sept. 5-7, 2011, are under way (main organisers: Profs. Angelo Carini and Alberto Salvadori, University of Brescia).

**IACM (International Association for Computational Mechanics)**

No report has been submitted by IACM.

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## **IAVSD (International Association for Vehicle Systems Dynamics)**

IAVSD held its 21st International Symposium on Dynamics of Vehicles on Roads and Tracks (IAVSD'09), 17-21 August 2009 at KTH, Stockholm, Sweden.

There were 240 delegates from 30 countries and 39 accompanying persons.

There were 5 state-of-the-art presentations, 105 oral presentations and 75 poster presentations + display

The participants had the choice between 6 different technical excursions on Wednesday afternoon 19. August

**Report composed by Hans True**

## **ICA (International Commission for Acoustics)**

The ICA board elected at the ICA General Assembly in 2007 continues with the executive comprising Samir Gerges as President, Sonoko Kuwano as Vice President, Hugo Fastl as the Treasurer and Marion Burgess as Secretary General. The 2009 board meeting held in Ottawa at the time of a major international acoustics meeting was well attended and the day long meeting allowed for good discussion on many matters important to ICA at this time. In particular there was consideration of the governance and options for changes to the structure of the board. The Board has circulated a draft proposal to all the member societies and the modified version based on this consultation will be proposed for voting by the ICA membership at the General Assembly in Sydney in August 2010. The membership of the ICA has not been increasing while it is clear that the interest in acoustics is expanding. In many countries there is no specific acoustical society so the ICA is attempting to support the establishment of such organizations.

The Board continues with its task of obtaining greater acknowledgement of the role of acoustics with a view to seeking full membership of ICSU. The inclusion of the following international affiliates has increased the strength of the board: European Acoustics Association (EAA), IberoAmerican Federation of Acoustics (FIA), International Institute of Noise Control Engineering (I-INCE), International Institute of Acoustics and Vibration (IIAV), Western Pacific Acoustics Commission (WESPAC) and the International Congress on Ultrasonics (ICU). The Board has set up an International Conference Coordination Committee with a view to encouraging improved coordination of these international activities.

The major activity for the ICA is the congress held every 3 years. In 2010 this will be held in Sydney Australia and we look forward to the assistance of IUTAM in promoting this important activity. Despite the current international economic environment it is

anticipated that this event is both scientifically and financially viable. The General Assembly for the ICA is held during the time of this congress.

The ICA has also provided support to the following specialist symposia in 2009 and has offered support to a number of meetings in 2010:

#### 2010

- Musical Acoustics, ISMA 2010 August 25-29 (Sydney & Katoomba, Australia)
- Room Acoustics ISRA 2010 August 29-31 (Melbourne, Australia)
- Sustainability in Acoustics 2010 August 29-31 (Auckland NZ)
- 3rd Regional conference on noise, vibration and comfort (NVC) 2010 June 28-30 (Putrajaya, Malaysia)
- EAA EUROREGIO 2010 Sept 15-18 (Ljubljana, Slovenia)
- 23 meeting Brazilian Acoustical Society, Workshop on Architectural Acoustics 2010 May 18-21 (Salvador, Brazil)

#### 2009

- ICU 2009 – Ultrasonics, 2009 January 11-17 (Santiago, Chile)
- 34 Int Conference Acoustics High Tatras 2009 Sept 28-30 (High Tatras, Slovakia)
- Pacific Rim Underwater 2009 Sept 23-25 (Xi'an, China)
- Speech and Computer, SPECOM 2009 June 21-25 (St. Petersburg, Russia)
- Acoustics & Biomed Eng March 30-April 4 (Zakopane, Poland)
- Environmental Acoustics and Acoustical Sustainable Buildings 2009 September 23-25 (Cádiz, Spain)

The ICA acknowledges the ongoing collaboration with IUTAM and hopes that the IUTAM representative will participate at the 2010 ICA Board meetings and congress. We look forward to strengthening this link in the future.

**Report composed by Samir Gerges and Marion Burgess**

### **ICF (International Congress on Fracture)**

ICF celebrated its 12th Quadrennial Conference in Ottawa (Canada), on July 12-17, 2009, under the chairmanship of Dr Mimoun El-Boujdaini, with more than 700 participants from 54 different Countries. On that occasion, Professor Alberto Carpinteri (Italy) became President of the Society, succeeding Professor Krishnaswamy Ravi-Chandar. ICF has recently launched an intense programme of Inter-Quadrennial Conferences. Three IQ Conferences have been already scheduled for 2010 in: Dresden (Germany), in collaboration with ESIS, Brisbane (Australia), in collaboration with WCEAM, Sendai (Japan). During the next year 2011 we will have further three IQ

Conferences in: Luxor (Egypt), Anaheim (USA), in collaboration with ASTM, Tripoli (Libya).

### **Report composed by Robert McMeeking**

## **ICHMT (International Centre for Heat and Mass Transfer)**

ICHMT organized three international symposia and sponsored six in 2009. Details of these meetings can be found on the web site, <http://www.ichmt.org>.

### Meetings Organized by ICHMT:

- THMT-09, the 6th Symposium on Turbulence, Heat and Mass Transfer”, September 14 - 19, 2009, in Rome, Italy. The symposium was Chaired by Professor Kemal Hanjalic, Roma Università La Sapienza, Italy. Co-Chairmen of the Symposium were Professor Y. Nagano, Nagoya Institute of Technology, Nagoya, Japan, and Professor F. Rispoli, University of Rome "La Sapienza", Italy.
- TURBINE-09, “International Symposium on Heat Transfer in Gas Turbine Systems”, August 9 - 14, 2009, in Antalya, Turkey. The symposium was Chaired by Professor Terry Simon and Richard J. Goldstein, both from University of Minnesota, USA.
- CONV-09, “International Symposium on Convective Heat and Mass Transfer in Sustainable Energy”, 26 April – 1 May, 2009, in Yasmine Hammamet, Tunisia. The symposium was Chaired by Dr. Mourad Rebay, University of Reims, France. Co-Chairman of the Symposium was Professor Rejeb Ben Maad, University of Tunis-ElManar, Tunisia.

### Meetings Co-Sponsored by ICHMT:

- UKHTC-2009, “The Eleventh UK National Heat Transfer Conference”, September 6 - 8, 2009, London, UK. The Symposium was chaired by Professor Adrian Briggs, Queen Mary, University of London, UK.
- NATO-ASI 09, “NATO Advanced Study Institute on Microsystems for Security - Fundamentals & Applications”, August 23 - September 4, 2009, Cesme, Izmir, Turkey. Co-Directors of the Symposium were Professor S. Kakac, TOBB University of Economics & Technology, Ankara, Turkey, and Professor B. Kosoy, Odessa State Academy of Refrigeration, Odessa, Ukraine.
- ISMF 2009, “6th International Symposium on Multiphase Flow, Heat Mass Transfer and Energy Conversion”, 11 - 15 July, 2009, Xi'an, China. The symposium was Chaired by Professor L.J. Guo, Jiaotong University, China. Co-Chairmen of the Symposium were Professor D. D. Joseph, USA, Professor Y. Matsumoto, Japan and M. Sommerfeld, Germany.
- ExHFT-7, “7th World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics”, 28 June - 03 July, 2009, Krakow, Poland. The symposium was Chaired by Professor Janusz S. Szmyd, AGH - University of Science and Technology, Krakow, Poland. Conference Co-Chairman was Professor Tomasz A. Kowalewski, IPPT PAN, Polish Academy of Sciences, Warsaw, Poland.

- Eurotherm-86, “Heat Exchanger Fouling and Cleaning - 2009”, 14 - 19 June, 2009, Pichl, Schladming, Austria. The symposium was Chaired by Professor Hans Müller-Steinhagen, University of Stuttgart, Germany. Co-Chairmen of the Symposium were Professor A. Paul Watkinson, The University of British Columbia, Canada, and Dr. Reza Malayeri, University of Stuttgart, Germany.
- MCS-6, “Sixth Mediterranean Combustion Symposium”, 07-11 June, 2009, Ajaccio, Corsica, France. Co-Chairmen of the Symposium were Dr. Federico Beretta, Istituto di Ricerche sulla Combustione Consiglio Nazionale delle Ricerche, Naples, Italy, Professor Nevin Selçuk, Middle East Technical University, Ankara, Turkey, Professor Mohy S. Mansour, Cairo University, Giza – Egypt, Professor Andrea d’Anna, University Federico II, Naples, Italy.

The organization of several future meetings have continued. These are:

- “3rd Micro & Nano Technology and Micro/Nanoscale Energy Conversion & Transport-2010”, 21 - 24 March, 2010, Seoul, Korea. Detailed information can be found on the symposium Web site: [http://mnt-mect.snu.ac.kr/seoulturbo/inc\\_html/](http://mnt-mect.snu.ac.kr/seoulturbo/inc_html/)
- RAD-10, “6th International Symposium on Radiative Transfer”, 13-19 June 2010, Antalya, Turkey. Detailed information can be found on the symposium Web site: <http://www.ichmt.org/rad-10/>
- ASME-ATI-UIT 2010, “Thermal and Environmental Issues in Energy Systems”, 16-19 May, 2010, Sorrento, Italy. Detailed information can be found on the symposium Web site: <http://www.ichmt.org/asme-ati-uit-10/content/view/27/38/>
- ThETA 3, “Third International Conference on Thermal Issues in Emerging Technologies Theory and Application”, 19 - 22 December 2010, Cairo, Egypt. Detailed information can be found on the symposium Web site: <http://www.thetaconf.org/>.

### **Report composed by Faruk Arinc**

### **ICM (International Congress on the Mechanical Behaviour of Materials)**

No report has been submitted by ICM.

### **ICR (International Committee on Rheology)**

The science of rheology is well-represented throughout the world. Our major, annual meetings in North America, Europe, and Asia continue to attract greater numbers of registrants. The recent Society of Rheology meeting in Madison, WI, in October 2009 set an attendance record for an Annual Meeting. Last year's International Congress on Rheology in Monterey attracted more than 1000 participants from around the globe, making it the largest such Congress on record. This healthy growth in the rheological community reflects the vital position of our science in addressing world-wide technological challenges in energy, the environment, and manufacturing.

As developing countries grow their economies, opportunities to establish societies of rheology and rheology user groups emerge. A principal purpose of the International Committee on Rheology (<http://www.icr.tu-berlin.de>) is to offer support to such activities. The Society of Rheology has also responded to this charge. At the Spring Meeting of the Executive Committee, a one-time amount of \$10,000 was offered to the ICR for the purpose of supporting its operations. Additionally, the Executive Committee voted to set aside a fund each year for the purpose of funding outreach activities that show the promise of establishing viable societies and groups of rheology throughout the world.

This past year has seen several important developments. This June saw the augural meeting of the Romanian Society of Rheology (SRR 2009) in Bran, Transylvania. This meeting brought together 36 participants from different parts of the country and included six invited lecturers from abroad (Ken Walters and Tim Phillips, UK; Manfred Wagner, Germany; Cris Gallegos, Spain; and Gareth McKinley and Gerry Fuller, USA). Organized by Professor Corneliu Balan of Bucharest, this new society brings Maria Lungu of Iasi as its President. SRR 2009 was voted into ICR membership in September.

India and Brazil represent two exciting opportunities for growth of the rheological community. Although the Indian Society of Rheology was established in 1984, the intervening years have seen this society become inactive. However, there is a resurgence of interest in rebuilding this society and it appears likely that a reconstitution of the Indian Society of Rheology may take place in the near future.

The Executive Committee also welcomed Professor Paulo Mendes of Rio de Janeiro as an observer to its meeting. Recent expansion of the Brazilian economy and important discoveries of oil in that country have lead to a subsequent increased need to rheological research and development. We look forward to learning more about the establishment of a Brazilian Society of Rheology at a meeting planned for July, 2010.

**Report composed by Gerald G. Fuller and Manfred H. Wagner**

### **ICTS (International Congresses on Thermal Stresses)**

The single most important event for ICTS in the year 2009 was 8th International Congress on Thermal Stresses that was held at the University of Illinois at Urbana-Champaign, Illinois, on June 1 to 4, 2009. The web page of the Congress was: [www.conferences.uiuc.edu/thermalstresses](http://www.conferences.uiuc.edu/thermalstresses)

.Most of the participants represented U.S.A., Russia, Japan, Poland, Ukraine, and India. In total, 146 pappapers were accepted for final presentation and published in the

Organizers of the 8th International Congress on Thermal Stresses:



General Chair: Martin Ostoja-Starzewski (U.S.A.)

Co-Chairs: Richard B. Hetnarski (U.S.A.), Pier Marzocca (U.S.A.) and Naotake Noda (Japan).

International Scientific Committee:

F. Ashida (Japan), J.R. Barber (U.S.A.), B.A. Boley (U.S.A.), C.-K. Chao (Taiwan), M.R. Eslami (Iran), D. Hasanyan (U.S.A.), K.P. Herrmann (Germany), R. Heuer (Austria), H.H. Hilton (U.S.A.), J. Ignaczak (Poland), H. Irschik (Austria), I. Jasiuk (U.S.A.), P. Jordan (U.S.A.), Yu.A. Rossikhin (Russia), J.J. Skrzypek (Poland), M.V. Shitikova (Russia), K.K. Tamma (U.S.A.), Y. Tanigawa (Japan), T.R. Tauchert (U.S.A.), A. Tylikowski (Poland), F. Ziegler (Austria).

Keynote lectures were presented by: G.A. Maugin (France), L.M. Brock (U.S.A.), W. Noll (U.S.A.), C.-K. Chao (Taiwan), A. Ganczarski and J. Skrzypek (Poland), Y. Ootao (Japan), P.M. Goldbart (U.S.A.), and D.G. Cahill (U.S.A.). A special June-July double issue of the Journal of Thermal Stresses was published with texts of invited lectures; the issue was distributed to all participants.

The 28-page Program of the Congress was published and distributed. The Proceedings of the Eighth International Congress on Thermal Stresses, were published in two volumes with total length of 612 pages, placed on a USB data stick, and distributed to all participants. The Editors: M. Ostoja-Starzewski and P. Marzocca. The Proceedings contain six-page abstracts of keynote lectures and four-page abstracts of lectures by regular attendees.

Nearly half of all the papers were submitted directly to special symposia, and these, with their respective organizers, were:

Professor Liviu Librescu Memorial Symposium, organized by Pier Marzocca and Marek-Jerzy Pindera.

Fracture and Deformations in Functional Materials and Structures, organized by S. Ueda, N. Noda, C.-F. Gao, and Z. Zhong.

Second Sound and Thermal Shock Phenomena, organized by Pedro Jordan.

\* \* \*

The preparations for the 9th International Congress on Thermal Stresses, TS 2011, are currently in full swing. The 9th Congress is being organized and will be chaired by Dr. Andras Szekeres, Hungarian Academy of Sciences and Budapest University of Technology and Economics, in Budapest, Hungary, on June 6 to 9, 2011. The web page of the 9th Congress is <http://ts2011.mm.bme.hu>

**Report composed by Richard Hetnarski**

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## **IIAV (International Institute of Acoustics and Vibration)**

Luis Bento Coelho (Portugal) assumed the position of IIAV president in July 2008 for a two-year term. Hans Boden (Sweden) will become president for a similar two-year term in July 2010. The thirteenth IIAV annual election was held in 2009 in which all members voted on candidates for five new director positions. The elected directors replaced the directors whose four-year terms had expired. The five directors elected are: Colin Hansen (Australia), Barry Gibbs (United Kingdom), Brian Mace (United Kingdom), Sergey Sorokin (Denmark) and Antonio Carvalho (Portugal). Three IIAV awards were made this year to recognize contributions in acoustics, noise and/or vibration. These were the Honorary Fellow award to Geoffrey Lilley (United Kingdom), and Fellow awards to Stephen Elliott (United Kingdom) and Chong-Won Lee (Korea.)

IIAV cooperates with scientific and engineering societies and institutes around the world and lists 36 such affiliated organisations on its website at [www.iiav.org](http://www.iiav.org). In 2009, four new formal agreements of cooperation were signed between IIAV and the Acoustical Society of China; the Canadian Acoustical Association; the Institute of Acoustics (United Kingdom); and the Institute of Sound and Vibration Research, Southampton University, (United Kingdom.)

The Sixteenth International Congress on Sound and Vibration (ICSV16), sponsored by IIAV, the Committee on Acoustics of the Polish Academy of Sciences, the Polish Acoustical Society, the AGH University of Science and Technology, and the Silesian University of Technology took place in Krakow, Poland, 5–9 July, 2009. ICSV16 was held in cooperation with the American Society of Mechanical Engineers International (ASME International), the Institution of Mechanical Engineers (IMEchE), and the European Acoustics Association (EAA). Almost 1000 abstracts from 60 different countries on all areas of acoustics, noise and vibration were submitted.

ICSV16 was the largest congress on acoustics, noise and vibration in the world in 2009. Despite the considerable economic problems around the globe and reductions in travel funding, over 750 participants and accompanying persons attended ICSV17. Students comprised almost 25 percent of the participants. The ICSV17 Organising Committee, helped by the International Scientific Committee, arranged for 46 special structured sessions in addition to the 55 regular sessions. The sessions were allotted 16 parallel rooms in the AGH University of Science and Technology. Seventy-five papers were presented by Polish authors. The next-largest group was made up of 60 papers from the United Kingdom. There was a large exhibition of 21 exhibitors and sponsors, including the Gold Sponsor, Bruel and Kjaer.

The ICSV16 Opening Ceremony was held in the Auditorium Maximum of Jagiellonian University. After the welcome speeches, delivered by Marek Pawelczyk, ICSV16 chair; Luis Bento Coelho, IIAV president; Malcolm Crocker, IIAV executive director; Zbigniew Engel, president of the Committee on Acoustics of the Polish Academy of

Sciences; Tomasz Szmuc, vice-rector of the AGH-UST; and Kazimierz Bujakowski, vice-president of the City of Krakow, there was a recital of piano music by Frederic Chopin. Finally, technical information about ICSV16 was given by Dariusz Bismor, secretary of the Local Organising Committee.

The ICSV16 Opening Ceremony was followed by a special session. First, the IIAV Honorary Fellowship and Fellowship awards were given, and then the new Honorary Fellow, Geoffrey Lilley, presented a lecture titled "Silent Flight of Owls." Six keynote lectures were presented during ICSV16 by engineers and scientists from around the globe. This year the keynote lectures were "Active Sound Control in Vehicles and in the Inner Ear" by Steve Elliott, Southampton, UK; "State of the Art Beam-forming Software and Hardware for Applications" by Samir Gerges, Florianopolis, Brazil, William D. Fonseca, and Robert P. Dougherty, Bellevue, USA; "Acoustic and Vibration Exposure and Comfort Inside Urban and Extra-urban Transportation Systems" by Luigi Maffei, Naples, Italy; "Machinery Diagnostics and Machinery Health Monitoring" by Robert Randall, Sydney, Australia; "Ultrasonic Imaging Using Multitone Nonlinear Coding" by Andrzej Nowicki and Janusz Wojcik, Warsaw, Poland; and "Transmission and Gearbox Noise and Vibration - Prediction and Control" by Jiri Tuma, Ostrava, Czech Republic.

The ICSV16 technical proceedings were made available to delegates at the congress itself on CD-ROM. The ICSV16 CD includes all abstracts and the full texts of all the accepted papers and is now available to all IIAV members on the IIAV website.

The International Journal of Acoustics and Vibration (IJAV), the refereed quarterly journal of IIAV, continues to receive a steady flow of good papers and to be published on schedule. The full papers of current and all back issues of IJAV are displayed on the IIAV website. In addition, hard copies of IJAV are airmailed to all IIAV members and to subscribing libraries all over the world. A new improved website was designed and implemented for IIAV in 2008. It is continually being updated and improved and is available at <http://www.iiav.org/> The website is now able to receive papers, reviewers' comments, revised papers and to handle on-line almost all functions in the publication process of its journal, IJAV, which makes the publication easier for everyone.

**Report composed by Malcolm J. Crocker (Executive Director IIAV)**

### **ISIMM (International Society for the Interaction of Mechanics and Mathematics)**

The International Society for the Interaction of Mechanics and Mathematics (ISIMM) is aimed to promote the interaction of mathematics and mechanics, see: <http://www.isimm.ing.unitn.it/>

The Executive Committee of the Society is composed by L. Truskinovsky (President), M. Pitteri (Vice President), D. Bigoni (Secretary/Treasurer), S. Antman, Ph. Boulanger,

A. Mielke, W. Müller, M. Padula, T. Ruggeri, D.L. Steigmann, L. Tartar, L. Turski, A. Visintin.

During the year 2009 the financial administration of the Society has been transferred to the CISM (International Centre for Mechanical Sciences, Udine, Italy) and this highly prestigious non-profit organization agreed to monitor the funds of the Society according to the ISIMM instructions.

The Society promotes the STAMM conference (International Symposium on Trends in Applications of Mathematics to Mechanics) that will take place this year in Berlin, August 30 - September 2, at the Akademie Berlin-Schmoeckwitz, see: <http://mech2.pi.tu-berlin.de/STAMM2010/index.htm>

During the next STAMM Conference, Professor J.L. Ericksen will be celebrated as the winner of the first edition of the ISIMM prize, assigned every two years by the ISIMM Executive Board Members, to scientists for their exceptional contribution towards building a link between Mathematics and Mechanics.

**Report composed by Davide Bigoni**

### **ISSMO (International Society for Structural and Multidisciplinary Optimization)**

ISSMO held its Eighth World Congress of Structural and Multidisciplinary Optimization on 1 – 5 June 2009 in Lisbon, Portugal. The Congress was attended by 407 participants (including 126 PhD students), and 40 countries were represented. The IPC had reviewed a total of 652 submitted abstracts, and the final program included 341 lecture presentations and 56 poster presentations. The lecture presentations were organized into 15 parallel sessions, and each of these was aligned with one of the 30 sub-topics of the congress. The proceedings of the Congress are published on CD-ROM (ISBN 978-989-20-1554-5, DL: ISBN 294350/09, eds. H.C. Rodrigues et al.) Two Executive Committee meetings and a General Assembly meeting were held in conjunction with the Congress. The next World Congress will be held in Shizuoka City, Japan, on 13 -17 June, 2011.

Please consult the website <http://www.issmo.net> for more details on ISSMO.

**Report composed by Niels Olhoff**

## Reports on ICSU and its Scientific Committees

### ICSU (International Council for Science)

By agreement of the Bureau, IUTAM was a supporting applicant for an IUGG proposal entitled Extreme Natural Hazards and Societal Implications (ENHANS), under the ICSU 2009 grants round (for which the submission deadline was 1 December 2009). The application was successful (see

[http://www.icsu.org/1\\_icsuinscience/GRANTS\\_1.html#2010](http://www.icsu.org/1_icsuinscience/GRANTS_1.html#2010)),

a grant of \$30k being awarded to IUGG. Three meetings are planned: in Foz do Iguassu, Brazil (August 2010); Pretoria, South Africa (January 2011); and Melbourne, Australia (June/July 2011). Insofar as this initiative follows closely on the IUTAM/IUGG initiative on Fluid Dynamics and Geophysics of Environmental Hazards, the Bureau has agreed that IUTAM will be represented by Professor Keith Moffatt at these meetings.

*Letter to IUTAM from Paul Cutler (ICSU)*

17 February 2010

Dear Professor Van Campen,

On behalf of ICSU's Committee on Scientific Planning and Review (CSPR), I thank you for preparing the final report for your Spring School on "Fluid mechanics and geophysics of environmental hazards" that was supported by the 2008 ICSU Grants Programme.

The final report serves two purposes for CSPR: it helps the committee assess the impact of the seed funding with respect to ICSU's overall strategic priorities, and it informs CSPR's deliberations on any refinements to the programme.

Your report was very helpful in both regards. In general, CSPR felt that your project successful in all key areas-broad participation, leveraging of additional funds, contributing to the advancement of priorities of ROAP, and developing outreach products such as the book that is mentioned in your report.

We thank you again for the time taken to carefully prepare your final report. Please watch for the announcement of the 2011 programme.

Yours sincerely

Paul Cutler  
Science Officer for Scientific Planning and Review, ICSU

**Report composed by Keith Moffatt**

## **ICSU-ROAP ( Regional Office for Asia and the Pacific )**

### **Report on the 3rd ICSU Regional Consultation for Asia and the Pacific**

at Penang Island, Malaysia; 13, 14 October 2009

After the opening ceremony of the ICSU Regional Consultation Meeting by the Malaysia Government, Keynote Address was given by Prof. Deliang Chen (Executive Director, ICSU) on “Global Activities of ICSU & Regional Offices”, and Overview of ICSU ROAP by Prof. Bruce McKellar (Chair of the Regional Committee for Asia and the Pacific). Activities of ICSU/ROAP were reported by Prof. Mohd Nordin Hasan (Director, ROAP).

The major themes were

- ROAP Priority Areas
  - (a) Hazards and Disasters
  - (b) Ecosystems
  - (c) Sustainable Energy
- Climate — Change
- Relations with Union Members
- Relations with National Members
- Experience of other ICSU regional offices
- Influencing Policies and Society

Main theme of the Consultation was the attention to the ROAP Priority Areas: Hazards & Disasters, Ecosystem, and Sustainable Energy. After keynote presentations, all the participants split onto three breakout groups which had the task of proposing highest priority steps for the implementation in the three priority areas.

First, the *reports of breakout groups* are given below. Next, *Report of an IUTAM activity* (Spring School 2009 Singapore) is described, which was reported by Tsutomu Kambe as a representative from IUTAM in the session of *Relations with Union Members*.

#### **1. Reports of breakout groups**

(a) Hazards and Disasters

Three top priorities of recommendations by the group (a) are

- Hazards and vulnerability mapping
- Case studies — Learning from the past and projecting to the future (earthquake/tsunami and typhoon)

- Capacity building for integrated disaster management (communities, institutions and local government)

(b) Ecosystems

Three recommendations by the group (b) are

- Evaluate impacts of various policies and practices on ecosystems, providing policy options.
- Research plan should give attention to biodiversity and land use as these two are missing at the moment.
- First step for the ROAP is to map what is currently going on. Mapping will help to identify knowledge gaps and summarize research knowledge and models in the Asia and the Pacific.

(c) Sustainable Energy

They recommended a concentration on the following forms of sustainable energy in the region:

- Wind energy • Biomass energy • Hydro-energy
- Conversion of waste to energy
- Solar energy by photovoltaic cells and thermal conversion

Recommendations by the group (c) are

- Resource mapping in the region for expertise and sources
- Preparation and characterization of advanced energy materials
- Capacity building

## **2. Report of Spring School held in Singapore (by T. Kambe)**

(see Report prepared by Keith Moffatt on page 62)

### **Report prepared by Tsutomu Kambe**

#### **COSPAR (Committee on Space Research)**

No report has been submitted by COSPAR.

#### **SCOPE (Scientific Committee on Problems of the Environment)**

No report has been submitted by SCOPE.

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## **SCOR (Scientific Committee on Oceanic Research)**

### **1. Background**

Recognition, that scientific questions about the ocean often require an interdisciplinary approach, led the International Council for Science (ICSU) to form the Scientific Committee on Oceanic Research (SCOR) in 1957.

SCOR activities focus on promoting international cooperation in planning and conducting oceanographic research, and solving methodological and conceptual problems that hinder research. Scientists from thirty-six nations participate in SCOR working groups and steering committees. Approximately 250 scientists participate in SCOR activities on a voluntary basis at any given time.

SCOR has been instrumental in the planning and coordination of large-scale ocean research projects for long-term complex activities. SCOR provides a mechanism to bring together international scientists for this purpose.

### **2. Thermodynamic Equation of Seawater 2010**

Note that SCOR working group 127 has a project web site: [www.TEOS-10.org](http://www.TEOS-10.org). This site provides links to papers describing a new thermodynamic formulation, TEOS-10, for the properties of seawater and to codes implementing this new approach.

### **3. SCOR Working Group 136 on Climatic Importance of the Greater Agulhas System**

This new group will identify key components of the circulation that deserves further study through physical/palaeo-observations and/or models, some of which may act as indices/proxies (through sustained observation) that can help describe the state of the Agulhas system on decadal to climate time scales.

The group will write a review paper for publication in a peer-reviewed journal, which will highlight the importance of the greater Agulhas system in terms of global climate, reviewing the existing levels of both understanding and uncertainty as to how changes in the system come about, how they affect climate, and vice versa. Finally, the group will facilitate collaboration between existing and planned observational and modeling studies in the greater Agulhas current system, to minimize the gaps in research, maximize scientific outcomes, and encourage estimates of the robustness of key findings (e.g. multiple model ensembles).

### **4. The 2010 SCOR General Meeting**

The 2010 SCOR general meeting will be held in Toulouse, France from September 13-17, 2010. The French SCOR Committee will hold a one-day symposium to showcase French ocean science activities.



**5. Further Information**

For additional information about SCOR activities, please enter the SCOR Web Site:

<http://www.scor-int.org>

**Report composed by Michael Stiassnie**

## Statutes

### Statuts de l'Union Internationale de Mécanique Théorique et Appliquée

I «L'Union Internationale de Mécanique Théorique et Appliquée» ci-après dénommée «l'Union» est une organisation scientifique à la fois internationale et non-gouvernementale.

II\* Les principaux objectifs de l'Union sont

- a) de constituer un lien entre les personnes et les organisations engagées dans le travail scientifique dans toutes les branches de la mécanique théorique et appliquée, par des recherches analytiques, numériques et expérimentales;
- b) d'organiser les congrès internationaux de mécanique théorique et appliquée par l'intermédiaire de son Comité permanent des Congrès (cf. Art. XII ci-après), et d'organiser d'autres réunions internationales sur des sujets relevant de la mécanique théorique et appliquée;
- c) de s'engager en d'autres activités visant à promouvoir le développement de la mécanique, aussi bien théorique qu'appliquée, en tant que branche de la science.

\*) *Article II adopté par l'Assemblée Générale de l'Union, le 18 août 2004 à Varsovie, Pologne*

III L'autorité suprême de l'Union est son Assemblée Générale.

Cette Assemblée détient le pouvoir de décider sur toute question affectant l'Union, notamment sur toute modification de ses Statuts. Sur des questions spécifiées, elle peut déléguer tout ou partie de ses pouvoirs à un ou à des organismes appropriés.

La composition de l'Assemblée Générale est régie par l'article VI ci-après. Les réunions de l'Assemblée Générale doivent se tenir aux dates fixées par le Bureau de l'Union (cf. Art. XI ci-après) ou sur la demande de 10 Membres au moins de cette Assemblée.

IV Dans toutes ses décisions, l'Assemblée Générale doit être guidée par la tradition de libre coopération scientifique internationale développée par les Congrès Internationaux de Mécanique Théorique et Appliquée. En poursuivant ses objectifs, l'Union respectera le principe général de non-discrimination et reconnaîtra le droit pour tout scientifique, partout dans le monde, d'adhérer ou de s'associer à une activité scientifique internationale sans rencontrer d'opposition pour motif de race,

de religion, de philosophie politique, d'origine ethnique, de citoyenneté, de langage ou de sexe.

V Dans les votes de l'Assemblée Générale, chaque membre ne dispose que d'une voix. Pour une modification des Statuts, la majorité requise est de deux tiers des votes exprimés.

Pour toute autre décision la majorité simple des votes exprimés est requise. Tout membre se trouvant dans l'impossibilité d'être présent à une réunion peut désigner, à l'avance et par lettre adressée au Secrétaire Général, un autre membre qu'il charge de voter en son nom.

Dans l'intervalle entre réunions de l'Assemblée Générale, un vote peut être émis par correspondance sur proposition formulée par le Bureau (cf. Art. XI ci-après). En pareil cas, le résultat du vote n'est valablement obtenu que si le nombre des participants effectifs n'est pas inférieur aux deux tiers du nombre total des membres de l'Assemblée Générale.

VI\*\* L'Assemblée Générale se compose des membres suivants avec droit de vote:

- a) des représentants des «organisations adhérentes» (cf. art. VIII);
- b) des membres du Bureau (cf. art. XI);
- c) des membres cooptés par l'Assemblée Générale de l'Union;

La durée de mandat d'un membre coopté est précisée, lors de son élection, par l'Assemblée Générale. La durée de mandat des membres du Bureau coïncide avec celle de leur appartenance au Bureau.

Les catégories suivantes d'observateurs sont invitées à participer, sans droit de vote, à l'Assemblée Générale de l'Union:

- i) des représentants des «organisations affiliées» (cf. art. X);
- ii) le Secrétaire du Comité de Congrès (cf. art. XII);
- iii) les présidents des «Symposia Panels»;
- iv) les présidents des «Working Parties»;
- v) des représentants des « organisations associées adhérentes » (cf. art. IX)
- vi) des représentants des pays candidats à l'adhésion;
- vii) s'il y a lieu, et sur décision de l'Assemblée Générale, des représentants de comités ou groupes de scientifiques.

\*\*\*) *Article VI adopté par l'Assemblée Générale de l'Union, le 27 août 2008 à Adélaïde, Australie*

VII L'Assemblée Générale doit veiller à une représentation adéquate de tout groupe de scientifiques poursuivant des recherches en mécanique théorique ou appliquée et non représenté par une organisation adhérente.

VIII Les organisations de scientifiques en mécanique théorique ou appliquée (ou les unions de telles organisations) qui représentent effectivement une activité scientifique indépendante dans un pays ou dans un territoire bien défini peuvent être admises dans l'Union par l'Assemblée Générale comme «organisations adhérentes» pourvu que leur dénomination exclue tout malentendu quant à la qualification du pays ou du territoire en cause.

En principe, une seule organisation pourra être admise pour chaque pays ou chaque territoire.

IX\*\*\* Des organisations de scientifiques en mécanique théorique ou appliquée qui représentent une activité scientifique indépendante dans un pays ou dans un territoire du monde en voie de développement et qui ne sont pas déjà représentées par des « organisations adhérentes » de l'Union peuvent, avec le soutien écrit d'une « organisation adhérente », être admises en tant qu' « organisations associées adhérentes » de l'Union. La dénomination de l'organisation adhérente proposée doit être sans ambiguïté et politiquement neutre afin d'exclure tout malentendu quant à la qualification du pays ou du territoire qui est représenté.

\*\*\*) *Article IX adopté par l'Assemblée Générale de l'Union, le 27 août 2008 à Adélaïde, Australie*

X\*\*\*\* Chaque «organisation adhérente» dispose d'un certain nombre de représentants dans l'Assemblée Générale et doit acquitter une cotisation annuelle à l'Union (cf. Art. XV ci-après). Chaque « organisation associée adhérente » dispose d'un représentant dans l'Assemblée Générale de l'Union sous la forme d'un observateur sans droit de vote, et doit acquitter une seule cotisation tous les quatre ans (cf. Art. XVI ci-après).

\*\*\*\*) *Article X adopté par l'Assemblée Générale de l'Union, le 27 août 2008 à Adélaïde, Australie*

XI Des organisations internationales dont les domaines principaux d'activité sont en étroite relation avec ceux de l'Union peuvent être admises par l'Assemblée Générale en qualité «d'organisations affiliées» à l'Union.

Chaque organisation affiliée a la faculté de désigner un observateur qui est invité à participer, sans droit de vote, à l'Assemblée Générale de l'Union. Le Bureau de l'Union (Article XI) a réciproquement la faculté de désigner un observateur, sans droit de vote, à l'organe ayant une responsabilité équivalente dans l'organisation affiliée.

L'organisation affiliée et l'Union sont tenues de s'informer mutuellement de toutes leurs activités importantes et des mesures affectant leur fonctionnement.

En préparant les rencontres scientifiques internationales qu'elles organisent, l'Union et chaque organisation affiliée sont tenues de prendre soigneusement en considération toutes les décisions déjà prises par l'Union et les organisations affiliées de manière à assurer la bonne coordination de toutes ces activités scientifiques.

Les organisations affiliées n'ont à payer aucune cotisation annuelle à l'Union.

XII\*\*\*\*\* Pour exécuter les décisions de l'Assemblée Générale et pour assurer entre ses sessions le travail de l'Union, l'Assemblée Générale élit les membres d'un Bureau pour une durée de quatre ans au plus. Le Bureau est composé d'un Comité Directeur (un Président, le précédent Président qui remplit la fonction de Vice-Président, un Secrétaire Général et un Trésorier) et de quatre autres personnes qui ont été membres de l'Assemblée Générale à un moment de la période précédant de quatre ans le moment de l'élection du Bureau.

Les membres, qui ne sont pas au Comité Directeur, ne peuvent recevoir plus de deux mandats consécutifs. Les membres du Bureau nouvellement élus entrent en fonction au premier novembre qui suit l'Assemblée Générale qui a procédé à leur élection.

Le Bureau doit se réunir au moins une fois par an. Tout membre du Bureau empêché de prendre part à une réunion de celui-ci peut désigner, par lettre adressée au Secrétaire Général, un autre membre de l'Assemblée Générale pour le remplacer.

C'est au Secrétaire Général que doivent être adressées toutes les questions concernant le fonctionnement de l'Union y compris ses relations avec les organisations adhérentes, affiliées ou autres.

Le domicile légal de l'Union se situe au domicile du Secrétaire Général.

Le Bureau a le droit de désigner un trésorier-assistant en tout pays où l'Union est titulaire d'un compte bancaire. Les trésoriers-assistants doivent être choisis parmi les membres de l'Assemblée Générale, mais non nécessairement parmi les membres du Bureau.

Le Bureau doit établir un budget prévisionnel pour l'année à venir, administrer les finances de l'Union et soumettre, chaque année, à l'Assemblée Générale un rapport financier.

Le Vice-Président doit normalement remplir les fonctions du Président pendant toute période où celui-ci se trouve empêché de les exercer.

Entre les réunions de l'Assemblée Générale, il incombe au Bureau de désigner un remplaçant temporaire pour remplir les fonctions du Vice-Président, du Secrétaire Général ou du Trésorier si cela s'avère nécessaire.

\*\*\*\*\*) *Article XII adopté par l'Assemblée Générale de l'Union, le 2 Septembre 1990 à Vienne, Autriche*

XIII L'Assemblée Générale désigne un Comité permanent des Congrès chargé d'organiser à intervalles réguliers les Congrès Internationaux de Mécanique Théorique et Appliquée (ICTAM).

- a) Le Président de l'Union préside aussi ce Comité des Congrès.
- b) Les Membres de ce Comité sont nommés par l'Assemblée Générale; ce sont des scientifiques actifs en mécanique théorique ou appliquée, n'appartenant pas nécessairement à l'Assemblée Générale.
- c) Le Comité des Congrès nomme un Secrétaire, sans précision de durée.
- d) Les règles de fonctionnement du Comité des Congrès sont soumises à l'approbation de l'Assemblée Générale.

XIV\*\*\*\*\* Les ressources financières de l'Union sont constituées par:

- a) les cotisations annuelles des «organisations adhérentes»;
- b) les cotisations des « organisations associées adhérentes » ;
- c) les dons et subventions que l'Union peut recevoir.

L'Union doit tenir une liste de ses bienfaiteurs où doivent être mentionnés pour chaque année les noms des personnes ou institutions qui ont accordé à l'Union des dons, des legs ou des subventions.

\*\*\*\*\*) *Article XIV adopté par l'Assemblée Générale de l'Union, le 27 août 2008 à Adélaïde, Australie*

XV Le nombre des représentants d'une «organisation adhérente» et le montant de la cotisation annuelle qu'elle doit acquitter sont définis dans le tableau suivant, par la catégorie à laquelle elle désire appartenir, et avec l'accord de l'Assemblée Générale.

Catégorie	Nombre de représentants	Nombre d'unités de la cotisation annuelle
I	1	1
II	2	3
III	3	5
IV	4	8
V	5	12

Le montant de l'unité de cotisation annuelle est fixé par l'Assemblée Générale, au moins une année précédente celle à laquelle cette cotisation devient exigible.

XVI\*\*\*\*\* La cotisation d'une « organisation associée adhérente » est établie pour couvrir une période de quatre ans, et le montant de ce paiement unique est égal à la cotisation annuelle de l'année en cours d'une « organisation adhérente » de catégorie I. L'admission en tant qu'« organisation associée adhérente » devient effective dès réception de cette cotisation par le Trésorier. Le statut de chaque « organisation associée adhérente » est réexaminé après les quatre premières années, ainsi qu'après les quatre années suivantes. La catégorie de Membre Associé est normalement limitée à un maximum de huit ans. La possibilité de demander l'admission en tant que Membre de la Catégorie I est offerte à tout moment à un Membre Associé.

\*\*\*\*\*) *Article XVI adopté par l'Assemblée Générale de l'Union, le 27 Août 2008 à Adélaïde, Australie.*

XVII\*\*\*\*\* Toute proposition de modification des Statuts, présentée ou par le Bureau ou par le Secrétaire Général, et ayant reçu l'appui d'au moins dix membres de l'Assemblée Générale ayant le droit de vote, devra être envoyée aux membres de l'Assemblée Générale avec l'ordre du jour de la réunion de l'Assemblée Générale. Le débat sur de telles propositions devra s'effectuer au cours de la première session et le vote au cours de la seconde (Article V).

\*\*\*\*\*) *Article XVII adopté par l'Assemblée Générale de l'Union, le 28 Août 1994 à Amsterdam, Pays-Bas.*

### **Règles de fonctionnement du Comité des Congrès de l'Union**

1. Le Comité des Congrès se réunit au moins une fois lors de chaque Congrès.
2. Le Comité des Congrès doit nommer un Comité Exécutif chargé de prendre en son nom toutes les décisions nécessaires pendant la période qui s'écoule entre deux réunions successives, et de lui en faire rapport à sa prochaine réunion. Le Comité Exécutif comprend le président, le secrétaire du Comité des Congrès, et un ou plusieurs membres désignés par le comité des Congrès.
3. L'organisation effective d'un Congrès est confiée à un Comité local d'Organisation, élu par le pays ou l'organisation qui invite, et ce Comité est également responsable de la publication des Comptes rendus du Congrès. Le Comité d'Organisation fera son rapport au Comité des Congrès soit au cours du Congrès qu'il organise, soit avant, s'il le juge préférable.
4. Le Comité d'Organisation devra obtenir l'approbation du Comité des Congrès (normalement par l'intermédiaire du Comité Exécutif) pour toutes les questions relevant de la politique générale du Comité des Congrès, en particulier pour celles qui concernent:

- 4.1. le but du Congrès;
  - 4.2. la sélection des communications pour le Congrès;
  - 4.3. le choix des conférences générales pour le Congrès;
  - 4.4. la désignation des présidents de sessions du Congrès;
  - 4.5. les principes généraux régissant les arrangements financiers du Congrès.
5. Le Comité d'Organisation percevra, de tous les membres du Congrès, une contribution (dont le montant sera proposé par le Comité du Congrès et approuvé par le Bureau) afin de couvrir les dépenses administratives du Comité du Congrès. Ces contributions seront reversées à l'IUTAM immédiatement après le Congrès.

### **Procédés pour l'élection du Bureau de l'IUTAM \***

1. Lors de l'Assemblée Générale (AG) précédant celle au cours de laquelle le nouveau Bureau doit être élu, un Comité Electoral (CE) doit être élu comprenant le Président de IUTAM (qui assure la présidence de ce Comité) et deux à quatre membres de l'AG, non-membres du Bureau en exercice.
2. A la suite de cette élection, le CE invite les membres avec droit de vote et observateurs de l'AG, spécifiés dans l'Article VI des Statuts sous les rubriques a), b), c), i) et ii), à faire connaître à son Président, dans des délais fixés, leurs suggestions de candidatures pour le Bureau, c'est-à-dire pour les charges de Président (P) de Secrétaire Général (S), de Trésorier (T) et pour quatre autres postes. Toutes ces suggestions doivent être traitées confidentiellement par le CE.
3. Prenant en compte toutes les suggestions reçues, le CE doit soumettre au Secrétaire Général les noms proposés comme candidats au Bureau: un seul nom pour les charges P,S,T et un ou plusieurs noms pour chacun des quatre autres postes (W,X,Y,Z). Le CE doit s'assurer que tous les candidats ainsi proposés sont prêts à accepter leur élection. Toutes ces propositions sont portées par le Secrétaire Général à la connaissance des membres de l'AG avant la première session de l'AG au cours de laquelle le nouveau Bureau doit être élu.
4. Lors de cette première session d'autres propositions de candidatures peuvent être proposées pour chacun des postes P, S, T, W, X, Y, Z. Aucun candidat ne peut être proposé pour plus d'un seul poste.
5. Avant la seconde session de l'AG au cours de laquelle le nouveau Bureau doit être élu, chaque proposition envisagée au point 4 ci dessus pour pouvoir être acceptée doit recevoir l'appui d'au moins dix membres de l'AG ayant le droit de vote au moyen d'une déclaration écrite et signée et faire l'objet d'un engagement écrit de la personne



proposée indiquant qu'elle est prête à accepter son élection. Toute proposition ne remplissant pas ces conditions sera retirée.

6. Pour chacun des postes P, S, T, W, X, Y, S, l'AG est appelé à désigner le titulaire par un vote mettant en compétition les candidats restants. S'il y a plusieurs candidats pour un poste, le vote doit avoir lieu au scrutin secret.

\*) Procédure adoptée par l'Assemblée Générale de l'Union, le 18 Août 2004 à Varsovie, Pologne

### **Procédure pour l'élection de membres cooptés par l'Assemblée Générale\***

1. La procédure s'applique à l'élection et à la réélection des membres cooptés par l'Assemblée Générale mentionnés à l'article VI c) des Statuts.
2. Les propositions émanant des membres de l'Assemblée Générale ayant le droit de vote en vue de l'élection des membres cooptés, doivent parvenir au Bureau au moins trois mois avant l'Assemblée Générale au cours de laquelle ces propositions sont prises par elle en considération, en règle générale celle qui se tient pendant le Congrès International de Mécanique Théorique et Appliquée. Toutes ces propositions doivent être traitées confidentiellement par le Bureau.
3. Après avoir pris en compte toutes les propositions ainsi reçues le Bureau présente à l'Assemblée Générale une liste de celles qui sont jugées pouvoir recevoir de la part de l'Assemblée Générale un soutien raisonnable, pourvu cependant que le nombre total des membres cooptés n'excède pas  $1/8$  environ du nombre total des membres ayant le droit de vote. La liste de ces propositions est communiquée à tous les membres de l'Assemblée Générale pendant la première session de la réunion de l'Assemblée au cours de laquelle doit avoir lieu le vote.
4. Une liste de propositions différente de celle présentée par le Bureau n'est recevable que si elle a recueilli le soutien d'au moins dix membres de l'Assemblée Générale avant la seconde session.
5. L'Assemblée Générale vote sur les listes de candidats qui font l'objet des paragraphes 3 et 4.

\*) Procédure adoptée par l'Assemblée Générale de l'Union, le 26 Août 1992 à Haïfa, Israël

## Statutes of the International Union of Theoretical and Applied Mechanics

I. "The International Union of Theoretical and Applied Mechanics" hereinafter called "the Union" is an international non-governmental scientific organization.

II\*. The principal objectives of the Union are

- a) to form a link between persons and organizations engaged in scientific work in all branches of theoretical and applied mechanics and related sciences, including analytical, computational and experimental investigations;
- b) to organize international congresses of theoretical and applied mechanics through a standing Congress Committee (Article XII), and to organize other international meetings for subjects falling within the field of theoretical and applied mechanics;
- c) to engage in other activities meant to promote development of mechanics, both theoretical and applied, as a branch of science.

*\*) Article II adopted by the General Assembly on August 18, 2004, in Warsaw, Poland*

III. The highest authority of the Union is its General Assembly.

The General Assembly has the power to decide all questions affecting the Union, including alterations of the Statutes. On specified questions it may delegate its power to appropriate bodies.

The composition of the General Assembly is regulated in Article VI. Meeting of the General Assembly will take place at times decided by the Bureau (Article XII) or on the request of at least 10 members of the General Assembly.

IV. In all its decisions the General Assembly shall be guided by the tradition of free international scientific cooperation, developed in the International Congresses for Theoretical and Applied Mechanics. In pursuing its objectives the Union shall observe the basic policy of non-discrimination and affirm the rights of scientists throughout the world to adhere to or to associate with international scientific activity without regard to race, religion, political philosophy, ethnic origin, citizenship, language or sex.

V. In voting every member of the General Assembly shall dispose of one vote. For an alteration of the Statutes the majority required is 2/3 of the votes brought forward. For all other decisions a simple majority of the votes brought forward is required. Any member who is unable to attend a meeting may by a letter to the Secretary General constitute another member of the General Assembly as proxy.

Between meetings of the General Assembly voting may be carried out by correspondence upon proposals made by the Bureau (Article XI); in this case decisions will be valid only provided the number of persons taking part in the vote is not less than  $2/3$  of the total membership of the General Assembly.

VI\*\*. The General Assembly is composed of

- a) representatives of the adhering organizations (Article VIII);
- b) members of the Bureau (Article XII);
- c) members-at-large. The term of a member-at-large shall be determined by the General Assembly at the time of the election.

The term of members of the Bureau shall coincide with their term of service on the Bureau.

The following categories of observers are invited to take part in the General Assembly without voting rights:

- i) representatives of affiliated organizations (Article XI);
- ii) Secretary of the Congress Committee (Article XIII);
- iii) chairmen of the Symposia Panels;
- iv) chairmen of the Working Parties;
- v) representatives of Adhering Associated Organisations (Article IX)
- vi) representatives of countries applying for membership;
- vii) representatives of committees and groups of scientists, if so decided by the General Assembly.

*\*\* Article VI adopted by the General Assembly on August 27, 2008, in Adelaide (Australia)*

VII. The General Assembly shall provide for an adequate representation of any group of scientists carrying out research in theoretical or applied mechanics and not represented by an adhering organization.

VIII. Organizations of scientists in theoretical or applied mechanics (or unions of such organizations) which effectively represent independent scientific activity in a country or in a definite territory can be admitted by the General Assembly as adhering organizations of the Union provided they can be listed under a name that will avoid any misunderstanding about the country or territory represented.

In general only one organization from each country or territory will be admitted.

IX.\*\*\* Organisations of scientists in theoretical or applied mechanics which represent independent scientific activity in a country or territory of the developing world and

which are not already represented by an adhering organisation of the Union may, with the written support of one adhering organisation, be admitted as an adhering associate organisation of the Union. The name of the proposed adhering organisation must be unambiguous and politically neutral in order to avoid misunderstanding about the country or territory being represented.

*\*\*\*) Article IX adopted by the General Assembly on August 27, 2008, in Adelaide (Australia)*

X.\*\*\*\* Each adhering organization shall have representatives in the General Assembly of the Union, and pay an annual subscription to the Union in accordance with Article XV. Each adhering associate organisation shall have one representative as a nonvoting observer in the General Assembly of the Union, and shall pay a single subscription once for each four-year period in accordance with Article XVI.

*\*\*\*\*) Article X adopted by the General Assembly on August 27, 2008, in Adelaide (Australia)*

XI. International organizations mainly occupied in fields closely related to that of the Union can be admitted by the General Assembly as affiliated organizations of the Union.

Each affiliated organization has the right to appoint an observer, who is invited to take part in the General Assembly without voting rights. The Bureau of the Union (Article X) has the reciprocal right to appoint a nonvoting observer to the corresponding council or other executive body of the affiliated organization.

The affiliated organization and the Union are mutually obliged to keep each other informed about all important activities of and organizational measures taken.

In organizing international scientific meetings the Union and each of the affiliated organizations are obliged to consider carefully all measures already taken by the Union and its affiliated organizations in order to coordinate such international scientific activities.

Affiliated organizations pay no annual dues to the Union.

XII\*\*\*\*. To execute the decisions of the General Assembly and to carry out work between meetings, the General Assembly elects members of a Bureau for a period of at most four years. The Bureau consists of the officers (President, the retiring President who serves as Vice-President, Secretary-General, and Treasurer) and four other persons who shall have been members of the General Assembly at some time within the four years preceding the time of election to the Bureau.

The maximum continuous period of service as a member of the Bureau, other than an officer, is limited to eight years. Newly elected members of the Bureau enter into office on the date of November 1, following the General Assembly at which they were elected.

The Bureau will meet at least every year. A member of the Bureau who is prevented from attending a meeting may by letter to the Secretary-General designate another member of the General Assembly as a replacement.

The Secretary-General will act as a permanent center for all matters affecting the Union, including relations with adhering, affiliated and other organizations.

The legal domicile of the Union shall be the place where the Secretary-General lives.

The Bureau is authorized to appoint Assistant-Treasurers in those countries where the Union has a bank account.

The Assistant-Treasurers must be members of the General Assembly but need not to be members of the Bureau.

The Bureau shall draft a budget for each coming year, and shall administer the finances. The Bureau shall submit an annual financial report to the General Assembly.

The Vice-President shall normally fulfill the duties of the President should the President become unable to discharge them.

Between meetings of the General Assembly the Bureau shall decide who shall undertake the duties of the Vice President, Secretary-General, or Treasurer should a temporary replacement be necessary.

\*\*\*\*\*) *Article XI adopted by the General Assembly on September 2, 1990, in Vienna (Austria)*

XIII. The General Assembly establishes a standing Congress Committee which is responsible for the organization of International Congresses of Theoretical and Applied Mechanics at regular intervals.

- a) The President of the Union shall also serve as President of the Congress Committee.
- b) 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.
- c) The Congress Committee appoints a Secretary, without stated terms of office.

d) The rules of procedure of the Congress Committee shall be approved by the General Assembly.

XIV.\*\*\*\*\* The financial means of the Union are formed by:

- a) the annual subscriptions of the adhering organizations;
- b) the subscriptions of the adhering associate organisations;
- c) gifts and grants.

The Union shall maintain a roll of benefactors on which shall be inscribed annually the names of those persons or institutions which have accorded gifts, legacies or other subventions to the Union.

\*\*\*\*\*) *Article XIV adopted by the General Assembly on August 27, 2008, in Adelaide (Australia)*

XV. The number of representatives of an adhering organization and the amount of the annual subscription to be paid by that organization will be regulated according to one of the following categories, as proposed by the adhering organization and after approval of the General Assembly of the Union:

Category	Number of representatives	Units of annual subscription
I	1	1
II	2	3
III	3	5
IV	4	8
V	5	12

Changes in the amount of the unit annual subscription will be decided by the General Assembly not less than one year in advance.

XVI.\*\*\*\*\* The subscription of an associate adhering organisation shall be set to cover a four-year period, and the level of this single payment shall be equal to the current annual subscription of a Category I adhering organisation. Admission as an associate adhering organisation shall be conditional on receipt of this subscription by the Treasurer. The status of each adhering associate organisation shall be reviewed after the initial four years and again after a further four years. Associate Membership shall normally be limited to a maximum of eight years. The option to apply for Category I Membership shall be open to an Associate Member at any time.

\*\*\*\*\*) *Article XVI adopted by the General Assembly on August 27, 2008, in Adelaide (Australia)*

XVII\*\*\*\*\*. Any proposal for alteration of the Statutes either prepared by the Bureau or supported by statements to the General-Secretary signed by at least ten

voting members of the General Assembly with voting rights, shall be sent to members of the General Assembly with the Agenda for a meeting of the General Assembly. Such proposals shall be discussed during the first session of that meeting and voted upon during the second session (Article V).

\*\*\*\*\*) *Article XV adopted by the General Assembly on August 28, 1994, in Amsterdam, Netherlands*

### **Rules of procedure for the Congress Committee of IUTAM**

1. The Congress Committee meets at least once at every Congress.
2. The Congress Committee may appoint an Executive Committee to take all necessary actions on its behalf in the period between two successive Congresses, and to report to it at its next meeting. The Executive Committee will consist of the president, the secretary and one or more members appointed by the Congress Committee.
3. The actual organization of a Congress is delegated to a local Organizing Committee, elected by the host-country or host-organization, which is also responsible for publication of its Proceedings. The Organizing Committee will report to the Congress Committee either during or, if it sees fit, before the Congress which it organizes.
4. The Organizing Committee will obtain the approval of the Congress Committee (normally through the Executive Committee) with regard to all matters affecting the general policy of the Congress Committee, in particular with regard to:
  - 4.1. the scope of the Congress;
  - 4.2. the screening of papers of the Congress;
  - 4.3. the selection of general lectures for the Congress;
  - 4.4. the appointment of chairmen of sessions of the Congress;
  - 4.5. the broad principles regarding financial arrangements for the Congress.
5. The Organizing Committee will levy a fee (the level to be recommended by the Congress Committee and approved by the Bureau) for administrative expenses of the Congress Committee, from all Congress members. This fee will be paid over to IUTAM after the Congress.

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**Procedure for election of the Bureau of IUTAM\***

1. At the General Assembly (GA) preceding the one at which the new Bureau is to be elected, an Electoral Committee (EC) shall be elected, consisting of the President of IUTAM (who shall act as Chairman of the EC) and two to four members of the GA who are not members of the current Bureau.
2. Following its election, the EC shall invite from those voting members and observers of the GA indicated under a), b), c), i) and ii) in Article VI of the Statutes, within a specified time limit, suggestions for candidates for the Bureau, viz. for the Offices of President (P), Secretary-General (S) and Treasurer (T), and for the four non-Officer positions. All suggestions shall be treated confidentially by the EC.
3. Taking account of all suggestions received, the EC shall submit to the Secretary-General nominations for candidates for election to the Bureau: one name for each of the Officer positions (P, S, T) and one or more names for each of the non-Officer positions (W, X, Y, Z). The EC will make sure that the candidates thus nominated are willing to accept an election. These nominations shall be conveyed by the Secretary-General to the GA in advance of the first session of the meeting of the GA at which the new Bureau is to be elected.
4. At this first session, additional candidates may be proposed by members of the GA for each and any of the positions P, S, T, W, X, Y, Z. No candidate may be proposed for more than one position.
5. Before the second session of the GA at which the new Bureau is to be elected, the proposals under clause 4 above shall be accepted if supported by statements to the Secretary-General each signed by at least ten (voting) members of the GA and by written confirmation that each nominee is willing to accept election; otherwise they shall be considered withdrawn.
6. The GA shall vote separately on the surviving nominations for each of the positions P, S, T, W, X, Y, Z. In any case in which there is more than one candidate for a position, the vote shall be by secret ballot.

\*) Procedure adopted by the General Assembly on August 18, 2004, in Warsaw, Poland

**Procedure for electing Members-at-Large of the General Assembly\***

1. This procedure shall apply for the election and re-election of the Members-at-Large of the General Assembly provided for in Article VI(c) of the Statutes.
2. Proposals, by members of the General Assembly with voting rights, for Members-at-Large must be received by the Bureau at least three months before the meeting of the



General Assembly at which proposals are to be considered, normally during the International Congresses of Theoretical and Applied Mechanics (ICTAM).

All proposals will be treated confidentially by the Bureau.

3. Taking into account all material received, the Bureau will present to the General Assembly such proposals as it deems will have at least a reasonable support by the General Assembly, provided however that the total number of Members-at-Large is not to exceed approximately one eighth ( $1/8$ ) of the total General Assembly membership with voting rights. Such proposals will be circulated to all members of the General Assembly during the first session of meeting of the Assembly at which the proposals are to be voted on.
4. Proposals not identical with those presented by the Bureau are considered to be withdrawn, unless they are sustained and supported by at least ten members of the General Assembly before its second session.
5. The General Assembly will vote on those candidates mentioned in the proposals of paragraphs 3 and 4.

\*) Procedure adopted by the General Assembly on August 26, 1992, in Haifa, Israel

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## List of Publications

Five categories of IUTAM publications can be distinguished:

**a) Annual Reports**

Since 1948, the Union has published a Report every year with detailed information on its activities. These Annual Reports are preserved at the IUTAM Archive at CISM, Udine, Italy.

The IUTAM Annual Reports over the last five years are available upon request from the IUTAM Secretariat and as pdf file on the IUTAM website.

**b) Newsletters**

At the meeting of the Bureau of IUTAM held in Warsaw in August 2001 it was agreed that the IUTAM Newsletter should be revived.

A primary purpose of the Newsletter, in conjunction with the IUTAM website, is to provide information concerning future activities of IUTAM, particularly its Symposia and Summer Schools, and concerning the International Congress of Theoretical and Applied Mechanics (ICTAM).

The Newsletter will also serve to keep members of IUTAM informed about any other current developments of concern to IUTAM.

The last IUTAM Newsletter is available from the IUTAM Secretariat. Pdf versions of IUTAM Newsletters are available from the IUTAM website.

**c) Proceedings of IUTAM Symposia**

These are only available by ordering directly from the publisher.

**d) Proceedings of the International Congresses on Theoretical and Applied Mechanics (ICTAM)**

These are only available by direct ordering from the publisher.

**e) Publications on the history of IUTAM**

**Proceedings of IUTAM Symposia**

The Proceedings of IUTAM Symposia published since 1995 are listed below. The names of the editors and of the publisher are given in every case. A complete listing of all published Proceedings can be found at the IUTAM website <http://www.iutam.net> or <http://www.iutam.org>.

**1995**

- 95-1 *IUTAM Symposium on Optimization of Mechanical Systems* (Stuttgart, Germany, 26-31 March 1995).  
The Proceedings of the Symposium, edited by D. Bestle and W. Schiehlen, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996. ISBN 0-7923-3830-8.
- 95-2 *IUTAM Symposium on Asymptotic Methods for Turbulent Shear Flows at High Reynolds Numbers* (Bochum, Germany, 28-30 June 1995).  
The Proceedings of the Symposium, edited by K. Gersten, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996. ISBN 0-7923-4138-4.
- 95-3 *IUTAM Symposium on Advances in Nonlinear Stochastic Mechanics* (Trondheim, Norway, 3 - 7 July 1995).  
The Proceedings of the Symposium, edited by A. Naess and S. Krenk, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996. ISBN 0-7923-4193-7.
- 95-4 *IUTAM Symposium on Nonlinear Instability and Transition in Three-Dimensional Boundary Layers* (Manchester, UK, 17-20 July 1995).  
The Proceedings of the Symposium, edited by P.W. Duck and P. Hall, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996. ISBN 0-7923-4079-5.
- 95-6 *IUTAM Symposium on Micromechanics of Plasticity and Damage of Multiphase Materials* (Paris, France, 29 August-1 September 1995).  
The Proceedings of the Symposium, edited by A.Pineau and A.Zaoui, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1996. ISBN 0-7923-41388-0.

- 95-7 *IUTAM Symposium on Nonlinear Analysis of Fracture*  
(Cambridge, UK, 3-7 September 1995).  
The Proceedings of the Symposium, edited by J. Willis, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4378-6.
- 95-9 *IUTAM Symposium on Combustion in Supersonic Flows*  
(Poitiers, France, 2-6 October 1995).  
The Proceedings of the Symposium, edited by M. Champion and B. Deshaies, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4313-1.
- 1996**
- 96-1 *IUTAM Symposium on Interaction between Dynamics and Control in Advanced Mechanical Systems*  
(Eindhoven, The Netherlands, 21-26 April 1996).  
The Proceedings of the Symposium, edited by D.H. van Campen have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4429-4.
- 96-2 *IUTAM Symposium on Innovative Computational Methods for Fracture and Damage*  
(Dublin, Ireland, 30 June-5 July 1996).  
The Proceedings of the Symposium, edited by P. E. O' Donoghue, M. D. Gilchrist and K. B. Broberg, have been published in the "Computational Mechanics Journal", 19, 447- 552; 20, 3-198, 1997.
- 96-3 *IUTAM Symposium on Variable Density Low Speed Turbulent Flows*  
(Marseille, France, 7-10 July 1996). Co-sponsored by ICSU.  
The Proceedings of the Symposium, edited by Louis Fulachier, John L. Lumley and Fabien Anselmet, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4602-5.
- 96-4 *IUTAM Symposium on Mechanics of Granular and Porous Materials*  
(Cambridge, UK, 15-17 July 1996).  
The Proceedings of the Symposium, edited by N.A. Fleck and A.C.F. Cocks, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4553-3.

**1997**

- 97-1 *IUTAM Symposium on Lubricated Transport of Viscous Materials*  
(Tobago, 7-10 January 1997).  
The Proceedings of the Symposium, edited by Harold Ramkissoon, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1997. ISBN 0-7923-4897-4.
- 97-2 *IUTAM Symposium on Transformation Problems in Composite and Active Materials*  
(Cairo, Egypt, 9-12 March 1997).  
The Proceedings of the Symposium, edited by Y.A. Bahei-El-Din and G.J. Dvorak, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5122-3.
- 97-3 *IUTAM Symposium on Non-Linear Singularities in Deformation and Flow*  
(Haifa, Israel, 17-21 March 1997).  
The Proceedings of the Symposium, edited by D. Durban and J.R.A. Pearson, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5349-8.
- 97-4 *IUTAM Symposium on Variations of Domains and Free-Boundary Problems in Solid Mechanics*  
(Paris, France, 22-25 April 1997).  
The Proceedings of the Symposium, edited by P. Argoul, M. Frémond and Q.S. Nguyen, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5450-8.
- 97-5 *IUTAM Symposium on Simulation and Identification of Organized Structures in Flows*  
(Lyngby, Denmark, 25-29 May 1997).  
The Proceedings of the Symposium, edited by J.N. Sørensen, E.J. Hopfinger, and N. Aubry, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1999. ISBN 0-7923-5603-9.
- 97-6 *IUTAM Symposium on Discretization Methods in Structural Mechanics*  
(Vienna, Austria, 1-6 June 1997).  
The Proceedings of the Symposium, edited by H.A. Mang and F.G. Rammerstorfer, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands 1999. ISBN 0-7923-5591-1.

- 97-7 *IUTAM Symposium on Material Instabilities in Solids*  
(Delft, The Netherlands, 9-13 June 1997)  
The Proceedings of the Symposium, edited by R. de Borst en E. van der Giessen, have been published by John Wiley & Sons, Chichester, UK, 1998 . ISBN 0-471-97460-9.
- 97-8 *IUTAM Symposium on Statistical Energy Analysis*  
(Southampton, UK. 8-11 July 1997).  
The Proceedings of the Symposium, edited by F.J. Fahy and W.G Price, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998, ISBN 0-7923-5457-5.
- 97-9 *IUTAM Symposium on Rheology and Computation*  
(Sydney, Australia, 20-25 July 1997).  
No formal Proceedings of the Symposium have been published. Selected papers have been published in several 1999-volumes of the "Journal of Non-Newtonian Fluid Mechanics", with a footnote attached to each of those papers.
- 97-10 *IUTAM Symposium on New Applications of Nonlinear and Chaotic Dynamics in Mechanics*  
(Ithaca, NY, USA, 27 July-1 August 1997).  
The Proceedings of the Symposium, edited by Francis C. Moon, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5276-9.
- 97-11 *IUTAM Symposium on Computational Methods for Unbounded Domains*  
(Boulder, USA, 3-7 August 1997).  
The Proceedings of the Symposium, edited by Thomas L. Geers, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5266-1.
- 97-12 *IUTAM Symposium on Micro- and Macrostructural Aspects of Thermoplasticity*  
(Bochum, Germany, 25-29 August 1997).  
The Proceedings of the Symposium, edited by O.T. Bruhns and E. Stein, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5265-3.
- 97-13 *IUTAM Symposium on Dynamics of Slender Vortices*  
(Aachen, Germany, 31 August - 3 September 1997).  
The Proceedings of the Symposium, edited by E. Krause and K. Gersten, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5041-3.

- 97-14 *IUTAM Symposium on Rheology of Bodies with Defects*  
(Beijing, China, 2-6 September 1997).  
The Proceedings of the Symposium, edited by Ren Wang, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1998. ISBN 0-7923-5297-1.
- 1998**
- 98-1 *IUTAM Symposium on Three-Dimensional Aspects of Air-Sea Interaction*  
(Nice, France, 17-21 May 1998)  
The Proceedings of the Symposium, edited by F. Dias and C. Kharif, have been published as a special issue of the "European Journal of Mechanics B / Fluids", Vol. 18, No. 3 (1999)
- 98-2 *IUTAM Symposium on Synthesis in Bio Solid Mechanics*  
(Lyngby, Denmark, 24-27 May 1998).  
The Proceedings of the Symposium, edited by Pauli Pedersen and Martin P. Bendsøe, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1999. ISBN 0-7923-5615-2.
- 98-3 *IUTAM/IUGG Symposium on Developments in Geophysical Turbulence*  
(Boulder, USA, 16-19 June 1998).  
The Proceedings of the Symposium, edited by R.M. Kerr and Y. Kimura, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000 ISBN 0-7923-6673-5.
- 98-4 *IUTAM Symposium on Viscoelastic Fluid Mechanics*  
(Stanford, USA, 21-25 June 1998).  
A Report on this Symposium by E.S.G. Shaqfeh and a collection of selected papers have been published in the "Journal of Non-Newtonian Fluid Mechanics", Vol. 82 (1999), pp. 127-457.
- 98-5 *IUTAM Symposium on Unilateral Multibody Contacts*  
(Munich, Germany, 3-7 August 1998).  
The Proceedings of the Symposium, edited by F. Pfeiffer and Ch. Glocker, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1999. ISBN 0-7923-6030-3.
- 98-6 *IUTAM/IFTtoMM Symposium on Synthesis of Nonlinear Dynamical Systems*  
(Riga, Latvia, 24-28 August 1998).  
The Proceedings of the Symposium, edited by E. Lavendelis and M. Zakrzhevsky, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1999. ISBN 0-7923-6106-7.

- 98-7 *IUTAM Symposium on Advanced Optical Methods and Applications in Solid Mechanics*  
(Poitiers, France, 31 August-4 September 1998).  
The Proceedings of the Symposium, edited by A. Lagarde, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6604-2.
- 98-8 *IUTAM/IASS Symposium on Deployable Structures: Theory and Applications*  
(Cambridge, UK, 6-9 September 1998).  
The Proceedings of the Symposium, edited by S. Pellegrino and S.D. Guest, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6516-X.
- 98-9 *IUTAM Symposium on Mechanics of Passive and Active Flow Control*  
(Göttingen, Germany, 7-11 September 1998).  
The Proceedings of the Symposium, edited by G.E.A. Meier and P.R. Viswanath, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 1999. ISBN 0-7923-5928-3.
- 1999**
- 99-1 *IUTAM Symposium on Nonlinearity and Stochastic Structural Dynamics*  
(Madras, India, 4-8 January 1999).  
The Proceedings of the Symposium, edited by S. Narayanan and R.N. Iyengar, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6733-2.
- 99-2 *IUTAM Symposium on Mechanical and Electromagnetic Waves in Structured Media*  
(Sydney, NSW, Australia, 18-22 January 1999).  
The Proceedings of the Symposium, edited by R.C. McPhedran, L.C. Botten and N.A. Nicorovici, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7038-4.
- 99-3 *IUTAM Symposium on Recent Developments in Nonlinear Oscillations of Mechanical Systems*  
(Hanoi, Vietnam, 2-5 March 1999).  
The Proceedings of the Symposium, edited by N. Van Dao and E.J. Kreuzer, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6470-8.



- 99-4 *IUTAM/IACM/IABEM Symposium on Advanced Mathematical and Computational Mechanics Aspects of the Boundary Element Method* (Cracow, Poland, 31 May-3 June 1999).  
The Proceedings of the Symposium, edited by T. Burczynski, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7081-3.
- 99-5 *IUTAM Symposium on Segregation in Granular Flows* (Cape May, New Jersey, USA, 5-10 June 1999).  
The Proceedings of the Symposium, edited by A.D. Rosato and D.L. Blackmore, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6547-X.
- 99-6 *IUTAM Symposium on Nonlinear Wave Behaviour in Multi Phase Flow* (Notre Dame, Indiana, USA, 7-9 July 1999)  
The Proceedings of the Symposium edited by H.C. Chang, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6454-6.
- 99-7 *IUTAM Symposium on Theoretical and Numerical Methods in Continuum Mechanics of Porous Materials* (Stuttgart, Germany, 5-10 September 1999).  
The Proceedings of the Symposium, edited by W. Ehlers, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-6766-9.
- 99-8 *IUTAM Symposium on Laminar-Turbulent Transition* (Sedona, Arizona, USA, 12-18 September 1999).  
The Proceedings of the Symposium, edited by H. Fasel and W.S. Saric, have been published by Springer-Verlag, Berlin/Heideberg/New York, 2000. ISBN 3-540-67947-2.
- 99-9 *IUTAM Symposium on Geometry and Statistics of Turbulence* (Hayama, Japan, 1-5 November 1999).  
The Proceedings of the Symposium edited by T. Kambe, T. Nakano and T. Miyauchi, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-6711-1.
- 2000**
- 00-1 *IUTAM Symposium on Creep in Structures* (Nagoa, Japan, 3-7 April 2000).  
The Proceedings of the Symposium, edited by S. Murakami and N. Ohno, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2000. ISBN 0-7923-6737-5.

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- 00-2 *IUTAM Symposium on Bluff Body Wakes and Vortex-induced Vibration*  
(Marseille, France, 13-16 June 2000).  
The Proceedings of the Symposium edited by T. Leweke, P.W. Bearman and C.H.K. Williamson, have been published by Academic Press in the Journal of Fluids and Structures, Special Issue on Bluff Body Wakes and Vortex-Induced Vibrations, London, 2001. ISSN 0889-9746, Vol. 15, nos. 3/4.
- 00-2a *IUTAM Symposium on Scaling Laws in Ice Mechanics and Ice Dynamics*  
(Fairbanks, Alaska, USA, 13-16 June 2000).  
The Proceedings of the Symposium, edited by J.P. Dempsey and H.H. Shen, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 1-4020-0171-1.
- 00-3 *IUTAM Symposium on Mechanical Waves for Composite Structures Characterization*  
(Chania, Crete, Greece, 14-17 June 2000).  
The Proceedings of the Symposium, edited by D.A. Sotiropoulos, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7164-X.
- 00-4 *IUTAM Symposium on Advances in Mathematical Modelling of Atmosphere and Ocean Dynamics*  
(Limerick, Ireland, 2-7 July 2000).  
The Proceedings of the Symposium, edited by P.F. Hodnett, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7075-9.
- 00-5 *IUTAM Symposium on Free Surface Flows*  
(Birmingham, United Kingdom, 10-14 July 2000).  
The Proceedings of the Symposium, edited by A.C. King and Y.D. Shikhmurzaev, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7085-6.
- 00-6 *IUTAM Symposium on Diffraction and Scattering in Fluid Mechanics and Elasticity*  
(Manchester, England, 17-20 July 2000).  
The Proceedings of the Symposium, edited by I.D. Abrahams, P.A. Martin and M.J. Simon, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002. ISBN 1-4020-0590-3.

- 00-7 *IUTAM Symposium on Field Analyses for Determination of Material Parameters-Experimental and Numerical Aspects* (Kiruna, Sweden, 31 July-4 August 2000).  
The Proceedings of the Symposium, edited by P. Stahle and K.G. Sundin, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1283-7.
- 00-8 *IUTAM Symposium on Smart Structures and Structronic Systems* (Magdeburg, Germany, 26-29 September 2000).  
The Proceedings of the Symposium, edited by U. Gabbert and H.S. Tzou, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-6968-8.
- 00-9 *IUTAM Symposium on Designing for Quietness* (Bangalore, India, 12-14 December 2000).  
The Proceedings of the Symposium, edited by M.L. Munjal, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002. ISBN 1-4020-0765-5.
- 2001**
- 01-1 *IUTAM Symposium on Flow in Collapsible Tubes and Past Other Highly Compliant Boundaries* (Warwick, Coventry, March 26-30, 2001).  
The Proceedings of the Symposium, edited by P.W. Carpenter and T.J. Pedley, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1161-X.
- 01-2 *IUTAM Symposium on Material Instabilities and the Effect of Microstructure* (Austin, Texas, USA, 7-11 May 2001).  
The Proceedings of the Symposium, edited by S. Kyriakides and N. Triantafyllidis, have been published by Elsevier Science Ltd. as a special issue of the International Journal of Solids and Structures, number 39, 2002.
- 01-3 *IUTAM Symposium on Turbulent Mixing and Combustion* (Kingston, Ontario, Canada, 3-6 June 2001).  
The Proceedings of the Symposium, edited by A. Pollard and S. Candel, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002. ISBN 1-4020-0747-7.

- 01-4 *IUTAM Symposium on Micromechanics of Martensitic Phase Transformation in Solids*  
(Hong Kong, 11-15 June 2001).  
The Proceedings of the Symposium, edited by Q.P. Sun, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002.  
ISBN 1-4020-0741-8
- 01-5 *IUTAM Symposium on Analytical and Computational Fracture Mechanics of Non-Homogeneous Materials*  
(Cardiff, England, 18-22 June 2001).  
The Proceedings of the Symposium, edited by B.L. Karahaloo, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002.  
ISBN 1-4020-0510-5
- 01-6 *IUTAM Symposium on Computational Mechanics of Solid Materials at Large Strains*  
(Stuttgart, Germany, 20-24 August 2001).  
The Proceedings of the Symposium, edited by C. Miehe, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003.  
ISBN 1-4020-1170-9
- 01-7 *IUTAM Symposium on Tubes, Sheets and Singularities In Fluid Dynamics*  
(Zakopane, Poland, 2-7 September 2001).  
The Proceedings of the Symposium, edited by K. Bajaj and H.K. Moffatt, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2002. ISBN 1-4020-0980-1

**2002**

- 02-1 *IUTAM Symposium on Micromechanics of Fluid Suspensions and Solid Composites*  
(Austin, Texas, USA, 3-5 April 2002).  
The Proceedings of the Symposium have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, in a special issue of the Philosophical Transactions: Mathematical, Physical & Engineering Sciences in May 2003
- 02-2 *IUTAM Symposium on Unsteady Separated Flows*  
(Toulouse, France, 8-12 April 2002).  
The Proceedings of the Symposium edited by M. Braza, Ch. Hirsch and F. Hussain, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, in a special issue of Flow, Turbulence and Combustion, Volume 71, Nos 1-4, 2003. ISSN 1386-6184.

- 02-3 *IUTAM Symposium on Dynamics of Advanced Materials and Smart Structures* (Yamagata, Japan, 20-24 May 2002).  
The Proceedings of the Symposium edited by K. Watanabe and F. Ziegler, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1061-3.
- 02-4 *IUTAM Symposium on Asymptotics, Singularities and Homogenisation in Problems of Mechanics* (Liverpool, UK, 8-11 July 2002).  
The Proceedings of the Symposium edited by A.B. Movchan, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1780-4.
- 02-5 *IUTAM Symposium on Complementary, \_Dual Variational Principles in Nonlinear Mechanics* (Shanghai, China, 13-16 August 2002).  
The Proceedings of the Symposium edited by David Y. Gao have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, in 2004. ISBN 1-4020-7887-0 (HB) and ISBN 1-4020-7888-9 (E-book)
- 02-6 *IUTAM Symposium on Nonlinear Stochastic Systems* (Urbana-Champaign, Illinois, USA, 25-31 August 2002).  
The Proceedings of the Symposium edited by N. Sri Namachchivaya and Y.K. Lin, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1471-6.
- 02-7 *IUTAM Symposium Transsonicum IV* (Göttingen, Germany, 02-06 September 2002).  
The Proceedings of the Symposium edited by H. Sobieczky, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1608-5.
- 02-8 *IUTAM Symposium on Reynolds Number Scaling in Turbulent Flow* (Princeton, N.J. USA, 11-13 September 2002).  
The Proceedings of the Symposium edited by A.J. Smits, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1775-8.
- 02-9 *IUTAM Symposium on Evolutionary Methods in Mechanics* (Cracow, Poland, 24-27 September 2002).  
The Proceedings of the Symposium edited by Tadeusz Burczynski and Andrzej Osyczka have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, in 2004. ISBN 1-4020-2266-2 (HB) and ISBN 1-4020-2267-0 (E-book)

- 02-10 *IUTAM Symposium on Multiscale Modeling and Characterization of Elastic-Inelastic Behavior of Engineering Materials*  
(Marrakech, Morocco, 20-25 October 2002).  
The Proceedings of the Symposium edited by S. Ahzi, M. Charkaoui, M.A. Khaleel, H.M. Zbib, M.A. Zikry, and B. LaMatina, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003.  
ISBN 1-4020-1861-4.
- 2003**
- 03-1 *IUTAM Symposium on Mechanics of Physicochemical and Electromechanical Interactions in Porous Media*  
(Kerkrade, The Netherlands 18-23 May 2003).  
The Proceedings of the Symposium edited by J.M. Huyghe, P.A.C. Raats and S.C. Cowin, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN: 978-1-4020-3864-8
- 03-2 *IUTAM Symposium on Integrated Modeling of Fully Coupled Fluid-Structure Interactions*  
(Rutgers, N.J. USA 02-06 June 2003).  
The Proceedings of the Symposium edited by Haym Benaroya and Thomothy Wei, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2003. ISBN 1-4020-1806-1.
- 03-3 *IUTAM Symposium on Chaotic Dynamics and Control of Systems and Processes in Mechanics*  
(Rome, Italy, 08-13 June 2003).  
The Proceedings of the Symposium edited by G. Rega and F. Vestroni have been published by Springer, Dordrecht, The Netherlands in 2005.  
ISBN 1-4020-3267-6 (HB) and ISBN 1-4020-3268-4 (E-book)
- 03-4 *IUTAM Symposium on Mesoscopic Dynamics of Fracture Process and Materials Strength*  
(Osaka, Japan, 06-11 July 2003).  
The Proceedings of the Symposium edited by H. Kitagawa and Y. Shibutani, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2004. ISBN 1-4020-2037-6 (HB) and ISBN 1-4020-2111-9 (e-book).

**2004**

- 04-1 *IUTAM Symposium on Size Effects on Material and Structural Behavior at Micron- and Nano-Scales*  
(Hong Kong, China, 30 May-4 June, 2004)  
The Proceedings of the Symposium edited by Q.P. Sun and P. Tong, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-4945-5
- 04-3 *IUTAM Symposium on Non-Uniqueness of Solutions to the Navier-Stokes equations and their Connection with Laminar-Turbulent Transition*  
(Manchester, UK, 9-11 August, 2004)  
The Proceedings of the Symposium edited by T. Mullin and R.R. Kerswell, have been published by Springer, Dordrecht, The Netherlands in 2005.  
ISBN 1-4020-4048-2
- 04-4 *IUTAM Symposium on One Hundred Years of Boundary Layer Research*  
(Göttingen, Germany, 12-14 August, 2004)  
The Proceedings of the Symposium edited by G.E.A. Meier, K.R. Sreenivasan et.al, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-4149-7
- 04-5 *IUTAM Symposium on Elastohydrodynamics and Microelastohydrodynamics*  
(Cardiff, UK, 1-3 September, 2004)  
The Proceedings of the Symposium edited by R.W. Snidle and H.P. Evans, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-4532-8
- 04-6 *IUTAM Symposium on Mechanics and Reliability of Actuating Materials*  
(Beijing, China, 1-3 September, 2004)  
The Proceedings of the Symposium edited by W. Yang, have been published by Springer, Dordrecht, The Netherlands in 2005. ISBN 1-4020-4130-6
- 04-7 *IUTAM Symposium on Computational Approaches to Multiphase Flow*  
(Argonne, Illinois, USA, 4-7 October, 2004)  
The Proceedings of the Symposium edited by S. Balachandar and A. Prosperetti, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-4976-5
- 04-8 *IUTAM Symposium on Elementary Vortices and Coherent Structures: Significance in Turbulence Dynamics*  
(Kyoto, Japan, 26-28 October, 2004)  
The Proceedings of the Symposium edited by Kida, Shigea, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-4180-2

- 04-9 *IUTAM Symposium on Laminar-Turbulent Transition*  
(Bangalore, India, 13-17 December, 2004)  
The Proceedings of the Symposium edited by Govindarajan, Rama, have been published by Springer, Dordrecht, The Netherlands in 2006.  
ISBN 1-4020-3459-8
- 2005**
- 05-1 *IUTAM Symposium on Multiscale Modelling of Damage and Fracture Processes in Composite Materials*  
(Kazimierz Dolny, Poland 23-27 May, 2005).  
The Proceedings of the Symposium edited by T. Sadowski, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2006.  
ISBN 978-1-4020-4565-3.
- 05-2 *IUTAM Symposium on IUTAM Symposium on Mechanical Behavior and Micro-mechanics of Nanostructured Materials*  
(Beijing, China 27-30 June 2005).  
The Proceedings of the Symposium edited by Y.L. Bai, Q.S. Zheng and Y.G. Wei have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007. ISBN 978-1-4020-5623-9.
- 05-3 *IUTAM Symposium on Impact Biomechanics: From Fundamental Insights to Applications*  
(Dublin, Ireland 11-15 July, 2005).  
The Proceedings of the Symposium edited by M.D. Gilchrist, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2005.  
ISBN 978-1-4020-3795-5.
- 05-4 *IUTAM Symposium on Vibration Control of Nonlinear Mechanisms and Structures*  
(Munich, Germany 18-22 July, 2005).  
The Proceedings of the Symposium edited by H. Ulbrich and W. Günthner, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2005. ISBN 978-1-4020-4160-0.
- 05-5 *IUTAM Symposium on Topological Design Optimization of Structures, Machines and Materials - Status and Perspectives*  
(Aalborg and Lyngby, Denmark, 26-29 October, 2005).  
The Proceedings of the Symposium edited by M.P. Bendsøe, N. Olhoff and O. Sigmund, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2006. ISBN 978-1-4020-4729-9.



**2006**

- 06-1 *IUTAM Symposium on Multiscale Problems in Multibody System Contacts* (Stuttgart, Germany, February 20-23, 2006).  
The Proceedings of the Symposium edited by Peter Eberhard, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2006. ISBN 978-1-4020-5980-3
- 06-2 *IUTAM Symposium on Interactions for Dispersed Systems in Newtonian and Viscoelastic Fluids* (Guanajuato, Mexico, March 26-31, 2006).  
A report on the Symposium was published and appeared in *Physics of Fluids*, Vol 18, 121501-1, 2006.
- 06-3 *IUTAM Symposium on Plasticity at the Micron Scale* (Lyngby, Denmark, May 21 - May 25, 2006).  
The Proceedings of the Symposium edited by V. Tvergaard, have been published by IOP Publishing, in a special issue of *Modelling and Simulation in Materials Science and Engineering*, Volume 15, number 1, 2007, ISSN 0965-0393.
- 06-4 *IUTAM Symposium on Hamiltonian Dynamics, Vortex Structures, Turbulence* (Moscow, Russia, August 25-30, 2006).  
The Proceedings of the Symposium edited by Borisov, A.V., Kozlov, V.V. et.al., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007.  
ISBN 978-1-4020-6743-3
- 06-5 *IUTAM Symposium on Discretization Methods for Evolving Discontinuities* (Lyon, France, September 04-07, 2006).  
The Proceedings of the Symposium edited by Combescure, Alain, Borst, René de, Belytschko, Ted, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007.  
ISBN 978-1-4020-6529-3
- 06-6 *IUTAM Symposium on Computational Physics and new Perspectives in Turbulence* (Nagoya, Japan, September 11-14, 2006).  
The Proceedings of the Symposium edited by Kaneda, Yukio, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007. ISBN 978-1-4020-6471-5

- 06-7 *IUTAM Symposium on Dynamics and Control of Nonlinear Systems with Uncertainty* (Nanjing, China, September 18-22, 2006).  
The Proceedings of the Symposium edited by Hu, H. Y., Kreuzer E.J., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007. ISBN 978-1-4020-6331-2
- 06-8 *IUTAM Symposium on Flow Control and MEMS* (London, UK, September 19-22, 2006).  
The Proceedings of the Symposium edited by Morrison, J.F., Birch, D.M., Lavoie, P., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007.  
ISBN 978-1-4020-6857-7
- 06-9 *IUTAM Symposium on Computational Contact Mechanics* (Hannover, Germany, November 05-09, 2006).  
The Proceedings of the Symposium edited by Wriggers, Peter, Neckenhorst, Udo have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2007.  
ISBN 978-1-4020-6404-3

**2007**

- 07-1 *IUTAM Symposium on Shell, Plate, Beam and 3D Models* (Tbilisi, Georgia, April 23-28, 2007).  
The Proceedings of the Symposium edited by Jaiani, George; Podio-Guidugli, Paolo, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2008.  
ISBN 978-1-4020-8773-8.
- 07-2 *IUTAM Symposium on Recent Advances in Multiphase Flows: Numerical and Experimental* (Istanbul, Turkey, June 11-14, 2007).  
The Proceedings of the Symposium have been published as a regular issue of the journal *Physics of Fluids*, Vol. 20, Issue 4, April 2008, together with selected papers from the meeting, all of which will have gone through the standard reviewing process of that journal.
- 07-3 *IUTAM Symposium on Unsteady Separated Flows and their Control* (Corfu, Greece, June 18-22, 2007).  
The Proceedings of the Symposium edited by Braza, Marianna; Hourigan, K. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009, and as a special issue of the *Journal of Fluids and Structures*, Vol. 24, Issue 8, November 2008.  
ISBN: 978-1-4020-9897-0.

- 07-4 *IUTAM Symposium on Scaling in Solid Mechanics* (Cardiff, UK, June 25-29, 2007).  
The Proceedings of the Symposium edited by Borodich, F., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009.  
ISBN 978-1-4020-9032-5.
- 07-5 *IUTAM Symposium on Fluid- Structure Interaction in Ocean Engineering* (Hamburg, Germany, July 23-26, 2007).  
The Proceedings of the Symposium edited by Edwin Kreuzer, have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2008.  
ISBN 978-1-4020-8629-8
- 07-6 *IUTAM Symposium on Swelling and Shrinking of Porous Materials: From Colloid Science to Poromechanics* (Petrópolis, Brazil, August 6-10, 2007).  
The Proceedings of the Symposium have been published as a special issue of the *Anais da Academia Brasileira de Ciencias*, Vol. 82(1), Mar. 2010.
- 07-7 *IUTAM Symposium on Advances in Micro- and Nanofluidics* (Dresden, Germany, September 6-8, 2007).  
The Proceedings of the Symposium edited by Ellero, M.; Hu, X.; Fröhlich, J.; Adams, N., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009  
ISBN 978-90-481-2625-5.
- 07-8 *IUTAM Symposium on Mechanical Properties of Cellular Materials* (Cachan, France, September 17-20, 2007).  
The Proceedings of the Symposium edited by Zhao, Han; Fleck, N.A., have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009  
ISBN 978-1-4020-9403-3.
- 07-9 *IUTAM Symposium on Multi- Scale Plasticity of Crystalline Materials* (Eindhoven, The Netherlands, November 05-09, 2007).  
The Proceedings of the Symposium have been published as a special issue of the *Philosophical Magazine* (Publisher: Taylor & Francis), Vol. 88, Issue 30 – 32, October 2008.

**2008**

- 08-1 *IUTAM Symposium on Theoretical, Computational and Modelling Aspects of Inelastic Media* (Cape Town, South Africa, January 14-18, 2008).  
The Proceedings of the Symposium edited by Daya Reddy have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2008.

ISBN: 978-1-4020-9089-9

08-2 *IUTAM Symposium on Modelling Nanomaterials and Nanosystems* (Aalborg, Denmark, 19-22 May, 2008).

The Proceedings of the Symposium edited by Pyrz, R. and Rauhe, Jens C. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009.

ISBN: 978-1-4020-9556-6

08-3 *IUTAM Symposium on Cellular, Molecular and Tissue Mechanics* (Woods Hole, Mass., USA, June 18-21, 2008).

The Proceedings of the Symposium edited by Garikipati, Krishna and Arruda, Ellen M. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010

ISBN: 978-90-481-3347-5

08-4 *IUTAM Symposium on Variational Concepts with Applications to the Mechanics of Materials* (Bochum, Germany, September 22-26, 2008).

The Proceedings of the Symposium edited by Hackl, Klaus have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010

ISBN: 978-90-481-9194-9

08-5 *IUTAM Symposium on 150 Years of Vortex Dynamics* (Technical University of Denmark, October 12-16, 2008).

The Proceedings of the Symposium edited by Aref, Hassan have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010

ISBN: 978-90-481-8583-2

08-6 *IUTAM Symposium on Progress in the Theory and Numerics of Configurational Mechanics* (Erlangen, Germany, October 20-24, 2008).

The Proceedings of the Symposium edited by Steinmann, Paul have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2009

ISBN: 978-90-481-3446-5

08-8 *IUTAM Symposium on Multi-Functional Material Structures and Systems* (Bangalore, India, December 10-12, 2008).

The Proceedings of the Symposium edited by Dattaguru, B., Gopalakrishnan, Srinivasan and Aatre, V. K. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010

ISBN: 978-90-481-3770-1

## 2009

09-1 *IUTAM Symposium on Dynamic Fracture and Fragmentation* (Austin, USA, March 8-12, 2009).

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The Proceedings of the Symposium have been published as a special issue of the International Journal of Fracture (Publisher: Springer), 2010

09-4 *IUTAM Symposium on Laminar-Turbulent Transition* (Stockholm, Sweden, 2009).

The Proceedings of the Symposium edited by Schlatter, Philipp and Henningson, Dan S. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010  
ISBN: 978-90-481-3722-0

09-6 *IUTAM Symposium on The Physics of Wall-Bounded Turbulent Flows on Rough Walls* (Cambridge, UK, July 7-9, 2009).

The Proceedings of the Symposium edited by Nickels, T. B. have been published by Springer Academic Publishers, Dordrecht, The Netherlands, 2010  
ISBN: 978-90-481-9630-2

09-8 *IUTAM Symposium on MATHEMATICAL MODELING AND PHYSICAL INSTANCES OF GRANULAR FLOWS* (Cambridge, UK, July 7-9, 2009).

The Proceedings of the Symposium edited by Joe Goddard, J.T. Jenkins and P. Giovine have been published as AIP Conference Proceedings 1227, April 2010  
ISBN 978-0-7354-0772-5

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## Proceedings of the International Congresses on Theoretical and Applied Mechanics (ICTAM)

Until September 4, 1964 the organization of the International Congresses for Applied Mechanics was supervised by the "International Committee for the Congresses of Applied Mechanics" and for each Congress the organization was separately entrusted to a local Organizing Committee who also undertook the publication of the Proceedings. Consequently, there is no central point from which Proceedings may be ordered, and for each volume, application must be made to the publishers who took care of that particular volume.

Since September 4, 1964 the same task will be fulfilled by the Standing Congress Committee of IUTAM, and local Organizing Committees to be established. The titles of the volumes and the names of the publishing firms are given below.

*1st Congress*, Delft (Netherlands), 22-26 April 1924.

Proceedings of the First International Congress for Applied Mechanics, Delft 1924, edited by C.B. Biezeno and J.M. Burgers (one vol.). Technische Boekhandel en Drukkerij J.Waltman Jr.  
Delft, 1925. No more copies are available for sale at Delft.

*2nd Congress*, Zürich (Switzerland), 12-17 September 1926.

Verhandlungen - Comptes rendus - Proceedings of the 2nd International Congress for Applied Mechanics, Zürich, 12-17 September 1926, herausgegeben von E. Meissner (one vol.). Orell Füssli Verlag, Zürich und Leipzig, 1927.

*3rd Congress*, Stockholm (Sweden), 24-29 August 1930.

Verhandlungen - Comptes rendus - Proceedings of the 3rd International Congress for Applied Mechanics, herausgegeben von A.C.W. Oseen und W. Weibull (3 vol.). AB. Sveriges Litografiska Tryckerier, Stockholm, 1931.

*4th Congress*, Cambridge (UK), 3-9 July 1934.

Proceedings of the Fourth International Congress for Applied Mechanics, Cambridge, UK, 3-9 July, 1934 (one vol.). University Press, Cambridge (UK), 1935.

*5th Congress*, Cambridge (Massachusetts, USA), 12-16 September 1938.

Proceedings of the Fifth International Congress for Applied Mechanics, held at Harvard University and the Massachusetts Institute of Technology, Cambridge, Massachusetts, September 12-16, 1938, edited by J.P. den Hartog and H. Peters (one vol.), John Wiley and Sons, Inc.  
New York (USA), and Chapman and Hall Ltd.  
London (UK), 1939.

*6th Congress*, Paris (France), 22-29 September 1946.

Proceedings not published (was given in the hands of Gauthier-Villars, Paris).

*7th Congress*, London (UK), 5-11 September 1948.

Proceedings of the Seventh International Congress for Applied Mechanics, 1948, published by the Organizing Committee (Introduction, Vol. I, Vol. II - Parts 1 and 2, Vol. III, Vol. IV).

*8th Congress*, Istanbul (Turkey), 20-28 August 1952.

Proceedings published by the Organizing Committee (Vol. I, Vol. II). Faculty of Sciences, University of Istanbul, P.O. Box 245, Istanbul (Turkey), 1953.

*9th Congress*, Brussels (Belgium), 5-13 September 1956.

Proceedings published by the Organizing Committee (Vol. I to Vol. VIII). Free University of Brussels, 50, avenue Franklin-Roosevelt, Brussels (Belgium), 1957.

*10th Congress*, Stresa (Italy), 31 August-7 September 1960.

Proceedings published by the Consiglio Nazionale delle Ricerche, Piazzelle delle Scienze 7, Roma (Italia), printed by Elsevier Publishing Company, Amsterdam-New York, 1962.

*11th International Congress on Theoretical and Applied Mechanics (ICTAM)*, Munich (Germany), 30 August-5 September 1964.

The Proceedings, edited by H. Görtler, have been published by Springer-Verlag, Heidelberger Platz 3, Berlin (Germany), 1966.

*12th International Congress on Theoretical and Applied Mechanics (ICTAM)*, Stanford, Cal. (USA), 26-31 August 1968.

The Proceedings, edited by M. Hetényi and W.G. Vincenti, have been published by Springer-Verlag, Berlin (Germany), 1969.

*13th International Congress on Theoretical and Applied Mechanics (ICTAM)*, Moscow (USSR), 21-26 August 1972.

The Proceedings, edited by E. Becker and G.K. Mikhailov, have been published by Springer-Verlag, Berlin (Germany), 1973.

*14th International Congress on Theoretical and Applied Mechanics (ICTAM)*, Delft (Netherlands), 30 August-4 September 1976.

The Proceedings, edited by W.T. Koiter, have been published by North-Holland Publishing Company, Amsterdam-New York-Oxford, 1976, 1977.

*15th International Congress on Theoretical and Applied Mechanics (ICTAM)*, Toronto (Canada), 17-23 August 1980

The Proceedings, edited by F.P.J. Rimrott and B. Tabarrok, have been published by North-Holland Publishing Company, Amsterdam-New York-Oxford 1980.

*16th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Lyngby (Denmark), 19-25 August 1984.

The Proceedings, edited by F.I. Niordson and N. Olhoff, have been published by Elsevier Science Publishers (North-Holland), Amsterdam, 1985.

*17th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Grenoble (France), 21-27 August 1988.

The Proceedings, edited by P. Germain, M. Piau and D. Caillerie, have been published by North-Holland, Elsevier Science Publishers, Amsterdam, 1989. ISBN 0-444-87302-3.

*18th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Haifa (Israel), 22-28 August 1992.

The Proceedings, edited by S.R. Bodner, J. Singer, A. Solan and Z. Hashin, have been published by Elsevier Science Publishers, Amsterdam, 1993.  
ISBN 0-444-88889-6.

*19th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Kyoto (Japan), 25-31 August 1996.

The Proceedings, edited by T. Tatsumi, E. Watanabe, T. Kambe, have been published by Elsevier Science Publishers, Amsterdam, 1997.  
ISBN 0-444-82446-4.

*20th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Chicago (USA), 27 August-2 September 2000.

The Proceedings, entitled "Mechanics for a new Millenium and edited by H.Aref and J.W.Phillips, have been published by Kluwer Academic Publishers, Dordrecht, The Netherlands, 2001. ISBN 0-7923-7156-9.

*21th International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Warsaw (Poland), 15-21 August 2004.

The Proceedings, entitled "Mechanics of the 21st Century" and edited by W. Gutkowski and T.A. Kowaleski, have been published by Springer, Dordrecht, The Netherlands, 2005. ISBN 1-4020-3456-3.



**Publications on the history of IUTAM***IUTAM - A Short History,*

edited by S. Juhasz, has been published by Springer-Verlag, Berlin, Germany, 1988. ISBN 3-540-50043-X.

The short history is dedicated to the memory of Professor Theodore von Karman who had an essential role in the formation of IUTAM. Contributions by S. Juhasz, Sir James Lighthill, G. Battimelli, J. Hult, N.J. Hoff, D.C. Drucker and F.I. Niordson are included in the book.

*Mechanics at the Turn of the Century,*

edited by W. Schiehlen and L. van Wijngaarden, has been published by Shaker Verlag, Aachen, Germany, 2000. ISBN 3-8265-7714-0.

This Report is the result of an initiative of the Bureau of IUTAM to provide some landmarks on the developments in Mechanics during the 20th Century, to report on the 50 years of impulse to Mechanics by the International Union of Theoretical and Applied Mechanics (IUTAM), to visualize by a poster Meters of Motion on the occasion of the 20th International Congress of Theoretical and Applied Mechanics (ICTAM), to look ahead on a very personal basis and to show the broad international involvement of scientists in IUTAM in recent years.

The booklet “Mechanics at the Turn of the Century” is accessible free of charge on the website of Shaker Verlag. The internet address is [www.shaker.de](http://www.shaker.de) and search for Schiehlen as the author. Moreover, this booklet is available upon request at the IUTAM Secretariat

**Please note again:**

The publications listed above, with the exception of the Annual Reports over the last five years and the booklet “Mechanics at the Turn of the Century”, are not available at the IUTAM Secretariat. Please order directly from the publisher.

Details of all IUTAM publications may be found at

<http://www.iutam.net>

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