

# **REPORT 2012**



INTERNATIONAL UNION OF THEORETICAL AND  
APPLIED MECHANICS

# REPORT 2012



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

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## Contents

<b>Bureau: Officers and Members .....</b>	<b>1</b>
<b>Secretariat.....</b>	<b>1</b>
<b>Past Officers .....</b>	<b>1</b>
<b>Past Congress Presidents.....</b>	<b>2</b>
<b>Adhering Organizations .....</b>	<b>3</b>
<b>Affiliated Organizations .....</b>	<b>13</b>
<b>Members of the General Assembly.....</b>	<b>18</b>
<b>Observers to the General Assembly .....</b>	<b>21</b>
<b>Members of the Congress Committee .....</b>	<b>22</b>
<b>Members of the Symposia Panels .....</b>	<b>23</b>
<b>Members of the Working Parties .....</b>	<b>23</b>
<b>Donations in 2012.....</b>	<b>25</b>
<b>IUTAM Representation in ICSU and its Scientific Committees.....</b>	<b>25</b>
<b>Report of IUTAM Symposia held in 2012.....</b>	<b>26</b>
12-1 IUTAM Symposium on Mobile Particulate Systems – Kinematics, Rheology and Complex Phenomena.....	26
12-2 IUTAM Symposium on Advanced Materials Modelling for Structures.....	31
12-3 IUTAM Symposium "From Mechanical to Biological Systems - an Integrated Approach" .....	37
12-4 IUTAM Symposium on Waves in Fluids: Effects of Nonlinearity, Rotation, Stratification and Dissipation.....	41
12-5 IUTAM Symposium on Multiscale Problems in Stochastic Mechanics.....	48
12-6 IUTAM Symposium on Fracture Phenomena in Nature and Technology.....	53
12-7 IUTAM Symposium on Understanding Common Aspects of Extreme Events in Fluids 59	
12-8 IUTAM Symposium on Topological Fluid Dynamics II.....	64
12-9 IUTAM Symposium on Hysteresis and Pattern Evolution in Non-Equilibrium Solid-Solid Phase Transitions .....	70
12-10 IUTAM Symposium on Particle Methods in Fluid Mechanics .....	73
12-11 IUTAM Symposium on Advances of Optical Methods in Experimental Mechanics .....	76
<b>Report of the IUTAM Summer School held in 2012.....</b>	<b>80</b>
IUTAM Summer School on Biomechanics of Tissue and Tissue-Cell Interaction.....	80
<b>Reports of the IUTAM Working Parties .....</b>	<b>82</b>
WP-2 – Dynamical Systems and Mechatronics .....	82
WP-3 – Mechanics of Materials.....	83
WP-6 – Biomechanics.....	83
<b>ICTAM 2012 Beijing.....</b>	<b>86</b>
<b>Summary Record of the General Assembly Meeting 2012.....</b>	<b>96</b>

<b>2012 Treasurer's Report.....</b>	<b>115</b>
<b>Reports on Affiliated Organizations.....</b>	<b>120</b>
AFMC (Asian Fluid Mechanics Committee).....	120
BICTAM (Beijing International Center for Theoretical and Applied Mechanics) .....	120
CISM (International Centre for Mechanical Sciences).....	121
EUROMECH (European Mechanics Society).....	123
HYDROMAG (International Association for Hydromagnetic Phenomena and Applications) .....	125
IABEM (International Association for Boundary Element Methods) .....	125
IACM (International Association for Computational Mechanics).....	126
IAVSD (International Association for Vehicle Systems Dynamics) .....	128
ICA (International Commission for Acoustics).....	128
ICF (International Congress on Fracture).....	130
ICHMT (International Centre for Heat and Mass Transfer) .....	130
ICM (International Congress on the Mechanical Behaviour of Materials).....	132
ICR (International Committee on Rheology) .....	132
ICTS (International Congresses on Thermal Stresses) .....	133
IHAV (International Institute of Acoustics and Vibration).....	134
ISIMM (International Society for the Interaction of Mechanics and Mathematics) .....	134
ISSMO (International Society for Structural and Multidisciplinary Optimization).....	137
LACCOTAM (Latin American & Caribbean Congress of Theoretical and Applied Mechanics) .....	138
<b>Reports on ICSU and its Scientific Committees .....</b>	<b>139</b>
<b>Statutes.....</b>	<b>140</b>
Statuts de l'Union Internationale de Mécanique Théorique et Appliquée .....	140
Règles de fonctionnement du Comité des Congrès de l'Union .....	145
Règles pour l'élection du Bureau de l'IUTAM *.....	146
Règles pour l'élection de membres cooptés par l'Assemblée Générale*.....	147
Statutes of the International Union of Theoretical and Applied Mechanics .....	148
Rules of procedure for the Congress Committee of IUTAM.....	153
Procedure for election of the Bureau of IUTAM*.....	154
Procedure for electing Members-at-Large of the General Assembly*.....	154
<b>List of Publications.....</b>	<b>156</b>
Proceedings of IUTAM Symposia.....	157
Proceedings of the International Congresses on Theoretical and Applied Mechanics (ICTAM) .....	173
Publications on the history of IUTAM .....	176
<b>List of Addresses .....</b>	<b>177</b>
<b>List by Country .....</b>	<b>177</b>

## Bureau: Officers and Members

The following members of the Bureau of IUTAM have been elected for the period 1 November 2012 to 31 October 2016:

### Officers

Professor V. Tvergaard (Denmark)	President
Professor T.J. Pedley (UK)	Vice-President
Professor P. Eberhard (Germany)	Treasurer
Professor F. Dias (France)	Secretary-General

### Members

Professor N. Aubry (USA)	(elected 2012)
Professor M. Rubin (Israel)	(elected 2012)
Professor B. Schrefler (Italy)	(elected 2012)
Professor W. Yang (China)	(elected 2012)

## Secretariat

IUTAM-Secretariat, Centre de Mathématiques et de Leurs Applications,  
Ecole Normale Supérieure de Cachan, 94235 Cachan, France

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E-mail: [frederic.dias@cmla.ens-cachan.fr](mailto:frederic.dias@cmla.ens-cachan.fr); Internet: <http://www.iutam.net>

## Past Officers

Elected	President	Vice-President	Treasurer	Secretary
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)
2008	T. Pedley (UK)	L.B. Freund (USA)	N. Olhoff (Denmark)	F. Dias (France)

## Past Congress Presidents

Nr.	Year	Place	Congress-President
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
23	2012	Beijing, China	Y. Bai



## **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: Prof. Y. (Yvan) Marusic  
Contact: J. (Jeanette) Mill  
Representatives in IUTAM: Prof. Y. (Yvan) Marusic, Prof. M. (Min) Chong

### **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. F. (Franz) Rammerstorfer  
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  
Representatives in IUTAM: Prof. F. (Franca) Arruda, Prof. A. (Alvaro) Prata

**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. S. (Stefan) Radev

Representatives in IUTAM: Prof. S. (Stefan) Radev

**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 Beisihuanxi Road, Beijing 100190

President/Chair: Prof. H. (Haiyan) Hu

Secretary: Prof. X. (Xiqiao) Feng

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, City University of Hong Kong, 83 Tat Chee av., Kowloon Tong, HK

President/Chair: Dr. J. (Jane) Lu

Secretary: Dr. Jeff Jianfeng Wang

Contact: Prof. A. (Andrew) Leung

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. M.-C. (Ming-Chuen) Yip

Secretary: D.-J. (Da-Jeng) Yao

Contact: Prof. C.-C. (Chien-Cheng) Chang

Representatives in IUTAM: Prof. C.-C. (Chien-Cheng) Chang, Prof. W.-C. (W-Chung) Wang

**Croatia (1994)**

Croatian Society of Mechanics

Ivana Lucica 5, HR-10000 Zagreb .

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

Contact: Prof. G. (Goran) Turkalj

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

**Cyprus (2010) (*Associate Organization*)**

Cyprus Mathematical Society,

36 Stanisou street, Office 102, Strovolos 2003, Nicosia

President/Chair: Prof. G. (Gregory) Makrides

Contact: Prof. Y.-S. (Yorgos-Socrates) Smyrlis

**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: Dr C. (Christian) Niordson, 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. P. (Pierre) Suquet

Secretary: Prof. F. (Frédéric) Dias

Contact: Prof. A. (Ahmed) Benallal, Prof. F. (François) Charru, Prof. A. (Alain) Molinari

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

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)

Clausthal University of Technology, Institute of Applied Mechanics, Adolph-Roemer-Str. 2a, D-38678 Clausthal-Zellerfeld

President/Chair: Prof. P. (Peter) Eberhard

Secretary: Prof. S. (Stefan) Hartmann

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

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

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. K. (Krishan) Lal

Contact: Prof. G. (Gautam) Biswas

Representatives in IUTAM: Prof. G. (Gautam) Biswas, Prof. N. (Narinder) Gupta, Prof.

S. (Sanjay) Mittal, Prof. S. Gopalakrishna, V.D. Sharma

**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. Z. (Zohar) Yosibash  
Representatives in IUTAM: 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. C. (Carlo) Cinquini  
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. T. (Tsutomu) Kambe  
Representatives in IUTAM: Prof. K. (Kikuo) Kishimoto, Prof. T. (Tsutomu) Kambe,  
Prof. N. (Naosi) Nishimura, Prof. Y. (Youichirou) Matsumoto

**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, Prof. R (René) de Borst

Representatives in IUTAM: Prof. R (René) de Borst, Prof. D.H. (Dick) van Campen,  
Prof. G. (GertJan) van Heijst

**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. P. (Paul) Behrens

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. I. (Irina) Goryacheva  
Secretary: Prof. V. (Vladimir) Karev  
Contact: Prof. F.L. (Felix) Chernousko, Prof. N.F. (Nikita) Morozov  
Representatives in IUTAM: Prof. F.L. (Felix) Chernousko, Prof. I. (Irina) Goryacheva, Prof. V. (Vladimir) Karev, 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, Dr. M.I. (Mohammed ibn Ibrahim) Al-Suwaiyel  
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  
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. S. (Shalk) Kok

**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. L. (Laszlo) Fuchs  
Secretary: Prof. M. (Mathias) Wallin  
Contact: Prof. D. (Dan) Henningson, Prof. P. (Per) Stahle  
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. J. (Jürg) Dual, 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  
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. L. (Lance) Collins  
Secretary: Prof. C.T. (Carl) Herakovich  
Contact: Prof. C.T. (Carl) Herakovich  
Representatives in IUTAM: Prof. N. (Nadine) Aubry, Prof. L. P. (Linda) Franzoni, Prof.  
C.T. (Carl) Herakovich, Prof. S. (Stelios) Kyriakides, Prof. Z. (Zhigang) Suo

**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:

### **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:

**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 (1992-2010)**

Caribbean Congress of Fluid Dynamics

*(the acronym CACOFD has been changed into LACCOTAM in 2010 – see LACCOTAM below)*

**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. M. (Martin) Schanz

**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. Hans Boden

Secretary: Prof. Semyung Wang

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

**BICTAM (2010)**

Beijing International Center for Theoretical and Applied Mechanics

Institute of Mechanics, Chinese Academy of Sciences, 15 Beisihuanxi Road, 100190,  
Beijing, China

President/Chair: Prof. J. (Jiachun) Li

President/Chair: Prof. H. (Haiyan) Hu

Representative of BICTAM in IUTAM: Prof. H. (Haiyan) Hu

Representative of IUTAM in BICTAM: Prof. N. (Narinder) Gupta

**LACCOTAM (2010)**

Latin American and Caribbean Conference on Theoretical and Applied Mechanics

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 LACCOTAM in IUTAM: Prof. H. (Harold) Ramkissoon

Representative of IUTAM in LACCOTAM:

## Members of the General Assembly

<i>Member</i>	<i>Representative of</i>	<i>Remarks</i>
Prof. J. (Jan) Achenbach		Member-at-Large
Prof. A. (Andreas) Acrivos		Member-at-Large
Dr. M.I. (Mohammed ibn Ibrahim) Al-Suwaiyel	Saudi Arabia	
Prof. F. (Franca) Arruda	Brazil	
Prof. N. (Nadine) Aubry	USA	Bureau member
Prof. Y. (Yi-long) Bai	China	
Prof. A. (Ahmed) Benallal	France	
Prof. G. (Gautam) Biswas	India	
Prof. B. (Bruno) Boley		Member-at-Large
Prof. R. (René) de Borst	Netherlands	
Prof. P. (Philippe) Boulanger	Belgium	
Prof. T. (Tadeusz) Burczynski	Poland	
Prof. D. (Dinar) Camotim	Portugal	
Prof. D.H. (Dick) van Campen	Netherlands	Member-at-Large
Prof. S. (Sébastien) Candel	France	
Prof. C.-C.(Chien Cheng) Chang	China-Tapei	
Prof. F. (Francois) Charru	France	
Prof. F.L. (Felix) Chernousko	Russia	
Prof. M. (Min) Chong	Australia	
Prof. F. (Frédéric) Dias		Bureau member
Prof. E. (Erik) Dick	Belgium	
Prof. J. (Jürg) Dual	Switzerland	
Prof. P. (Peter) Eberhard	Germany	Bureau member
Prof. H. (Horia) Ene	Romania	
Prof. N.A. (Norman) Fleck	UK	
Prof. M. (Maciej) Floryan	Canada	
Prof. L. P. (Linda) Franzoni	USA	
Prof. B. (Ben) Freund		Member-at-Large
Prof. M. (Michael) Gilchrist	Ireland	
Prof. I.G. (Irina) Goryacheva	Russia	
Prof. J. (John) Grue	Norway	
Prof. N. (Narinder) Gupta	India	
Prof. A.N. (Alexandr) Guz	Ukraine	
Prof. G.J.F.(GertJan) van Heijst	Netherlands	
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. H. (Haiyan) Hu	China	
Prof. J. (Jan) Hult		Member-at-Large
Prof. M.K. (Mohamed) Ismail	Egypt	
Prof. G. (George) Jaiani	Georgia	
Prof. T. (Tutomu) Kambe	Japan	
Prof. V. (Vladimir) Karev	Russia	
Prof. B.L. (Bhushan) Karihaloo	UK	
Prof. R. (Reinhold) Kienzler	Germany	
Prof. K. (Kikuo) Kishimoto	Japan	
Prof. A. (Alfred) Kluwick	Austria	
Prof. S. (Schalk) Kok	South Africa	
Prof. A. (Andrejs) Krasnikovs	Latvia	
Prof. S. (Stelios) Kyriakides	USA	
Prof. A.Y.T. (Andrew) Leung	China-Hong Kong	
Prof. J. (Jiachun) Li	China	Representative of AFMC
Prof. F. (Fernando) Lund	Chile	
Prof. S. (Staffan) Lundstrom	Sweden	
Prof. G. (Giulio) Maier	Italy	Member-at-Large
Prof. S. (Stevan) Maksimovic	Serbia	
Prof. N. (Nicos) Makris	Greece	
Prof. Y. (Yvan) Marusic	Australia	
Prof. Y. (Youichirou) Matsumoto	Japan	
Prof. S. (Sanjay) Mittal	India	
Prof. K. (Keith) Moffatt		Member-at-Large Chair WP-9
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. (Roddam) Narasimha		Member-at-Large
Dr C. (Christian) Niordson	Denmark	
Prof. N. (Naosi) Nishimura	Japan	Representative of IABEM
Prof. M. (Martin ) Oberlack	Germany	
Prof. M. (Miloslav) Okrouhlik	Czech Republic	
Prof. N. (Niels) Olhoff		Member-at-Large
Prof. J. (Juha) Paavola	Finland	
Prof. N. (Nigel) Peake	UK	
Prof. T.J. (Timothy) Pedley	UK	Bureau member
Prof. H. (Henryk) Petryk	Poland	
Prof. P. (Paolo) Podio-Guidugli	Italy	

<b>Member</b>	<b>Representative of</b>	<b>Remarks</b>
Prof. A. (Alvaro) Prata	Brazil	
Prof. S. (Stefan) Radev	Bulgaria	
Prof. E. (Eduardo ) Ramos	Mexico	
Prof. G. (Giuseppe) Rega	Italy	
Prof. M.B. (Miles) Rubin	Israel	Bureau member
Prof. A. (Andrus) Salupere	Estonia	
Prof. S.B. (Stuart) Savage	Canada	
Prof. W. (Werner) Schiehlen		Member-at-Large
Prof. B.A. (Bernhard) Schrefler		Bureau member
Prof. S. (Suresh) Shrivastava	Canada	
Prof. L. (Leopold) Skerget	Slovenia	
Prof. J. (Jan) Sladek	Slovakia	
Prof. Y.S. (Yorgos-Socrates) Smyrlis	Cyprus	
Prof. P. (Per) Stahle	Sweden	
Prof. R. (Rolf) Stenberg	Finland	
Prof. G. (Gabor) Stepan	Hungary	
Prof. E.S. (Erdogan) Suhubi	Turkey	
Prof. H.J. (Hyung Jin) Sung	Republic of Korea	
Prof. Z. (Zhigang) Suo	USA	
Prof. J.N. (Jens Nørkær) Sørensen	Denmark	
Prof. T. (Tomomasa) Tatsumi		Member-at-Large
Prof. A. (André) Thess	Germany	
Prof. G. (Goran) Turkalj	Croatia	
Prof. V. (Viggo) Tvergaard		Bureau member
Prof. D. (Dirk) Vandepitte	Belgium	
Prof. W.C. (Wei Chung) Wang	China-Taipei	
Prof. G. (Graham) Weir	New Zealand	
Prof. L. (Leen) van Wijngaarden		Member-at-Large
Prof. W. (Wei) Yang	China	Bureau member Chair WP-7
Prof. Z. (Zohar) Yosibash	Israel	
Prof. J.W. (Jean) Zu	Canada	

**Observers to the General Assembly**

<i>Name</i>	<i>Country</i>	<i>Representative of</i>
Prof. O. (Olivier) Allix	France	Chair WP-3
Prof. F. (Faruk) Arinc	Turkey	ICHMT
Prof. M. (Mats) Berg	Sweden	IAVSD
Prof. M. (marc) Bonnet	France	IABEM
Prof. M.J. (Malcolm) Crocker	USA	IIAV
Prof. J. (Jacob) Fish	USA	Chair WP-5
Prof. N. (Norman) Fleck	UK	Chair SP Solids
Prof. S.N.Y. (Samir) Gerges	Brazil	ICA
Prof. M. (Michael) Hayes	Ireland	ISIMM
Prof. R.B. (Richard) Hetnarski	USA	ICTS
Prof. G. (Gerhard) Holzapfel	Austria	Chair WP-6
Prof. P. (Patrick) Huerre	France	EUROMECH
Prof. G. (Gary) Leal	USA	ICR Chair WP-1 Chair SP Fluids
Prof. L. (Jiachun) Li	China	AFMC
Prof. P. (Paul) Linden	UK	Chair WP-8
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	LACCOTAM
Prof. G. (George) Rozvany	Hungary	ISSMO
Prof. B.A. (Bernhard) Schrefler	Italy	CISM
Prof. H.Y. (Hiroshi) Yabuno	Japan	Chair WP-2

## Members of the Congress Committee

\*Year indicates end of term

<i>Member</i>	<i>Country</i>	<i>Year*</i>	<i>Remarks</i>
Prof. L. (Leslie) Banks-Sills	Israel	2016	
Prof. D.H. (Dick) van Campen	Netherlands	2016	Member of XCCC
Prof. R. (Renato) Cotta	Brasil	2014	
Prof. F. (Frédéric) Dias	France	2016	
Prof. P. (Peter) Eberhard	Germany	2014	
Prof. B. (Bruno) Eckhart	Germany	2014	Member of XCCC
Prof. H. (Horacio) Espinosa	USA	2016	
Prof. M. (Maciej) Floryan	Canada	2016	Member of XCCC
Prof H. (Huajian) Gao	USA	2016	
Prof. N.K. (Narinder) Gupta	India	2016	
Prof. G. (Gertjan) van Heijst	Netherlands	2014	
Prof. C.T. (Carl) Herakovich	USA	2014	
Prof. P. (Patrick) Huerre	France	2016	
Prof. Y. (Yukio) Kaneda	Japan	2016	
Prof. A. (Ann) Karajozian	USA	2016	
Prof. D. (Djimedo) Kondo	France	2016	
Prof. J.B. (Jean-Baptiste) Leblond	France	2014	
Prof. T. (Tianjian ) Lu	China	2016	
Prof. J. (Jacques) Magnaudet	France	2016	Member of XCCC
Prof. N. (Nicos) Makris	Greece	2016	
Prof. V. (Valery) Matveenko	Russia	2016	
Prof. R.M. (Robert) McMeeking	USA	2016	Secretary of XCCC
Prof. N.F. (Nikita) Morozov	Russia	2014	
Prof. N. (Nigel) Peake	UK	2014	
Prof. R. (Renzo) Piva	Italy	2016	
Prof. K. Ravi-Chandar	USA	2014	
Prof. E. (Eric) Shaqfeh	USA	2016	
Prof. G. (Gabor) Stépan	Hungary	2014	Member of XCCC
Prof. H. (Howard) Stone	USA	2014	
Prof. K. (Kazuo) Tanishita	Japan	2014	
Prof. V. (Viggo) Tvergaard	Denmark	2016	President of XCCC
Prof. J. (Jens) Walther	Denmark	2016	
Prof. G. (Genki) Yagawa	Japan	2014	

## 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. H. (Haecheon) Choi	Korea	2014	
Prof. L.G. (Gary) Leal	USA	2016	Chair
Prof. N. (Nigel) Peake	UK	2016	
Prof. K. R. (Katepalli) Sreenivasan	Italy	2014	
Prof. M.A. (Michael) Stiasnie	Israel	2014	
<b>Symposia Panel for Solid Mechanics</b>			
<i>Member</i>	<i>Country</i>	<i>Year*</i>	<i>Remarks</i>
Prof. A. (Alberto) Corigliano	Italy	2016	
Prof. N.A. (Norman) Fleck	UK	2016	Chair
Prof. H. (Huajian) Gao	USA	2016	
Prof. J.-B. (Jean-Baptiste) Leblond	France	2016	
Prof. G. (Gábor) Stépán	Hungary	2014	

\*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. H.Y. (Hiroshi) Yabuno, Japan (chair); Prof. F.L. (Felix) Chernousko,  
Russia; Prof. R.S. (Robin) Sharp, UK; Prof. M. (Masayoshi) Tomizuka, USA

**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. J. (Jacob) Fish, USA (chair); Prof. E. R. (Eduardo) de Arantes  
e Oliveira, Portugal; 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, UK (chair); Prof. H. (Hervé) Le Treut, France;  
Prof. J.W. (John) Rudnicki, USA; Prof. J. Srinivasan, India

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

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

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## **Donations in 2012**

Donations given to IUTAM Symposia are recorded under the heading “Financial Support” of the Reports of Symposia and Summer Schools held in 2012.

## **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	<i>To be nominated</i>
SCOR	Scientific Committee on Oceanic Research	Prof. M. Stiassnie

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## Report of IUTAM Symposia held in 2012

### 12-1 IUTAM Symposium on Mobile Particulate Systems – Kinematics, Rheology and Complex Phenomena

Bangalore, India, January 23 – January 27, 2012

The IUTAM Symposium on Mobile Particulate Systems – Kinematics, Rheology and Complex Phenomena was held at the Indian Institute of Science, Bangalore, India, during the week of 23-27 January 2012.

#### a) Scientific Committee

Prabhu R. Nott (India, Chair), John F. Brady (USA), Joe D. Goddard (USA), Elisabeth Guazzelli (France), Hisao Hayakawa (Japan), Devang Khakhar (India), Sankaran Sundaresan (USA), L. Gary Leal (USA- IUTAM representative)

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

The central theme of the meeting was the mechanics of mobile particulate systems. Examples are flowing granular materials, particle-fluid suspensions, and suspensions of swimming microorganisms.

The area of dry granular flows was discussed over two days of the symposium. Several new ideas emerged from the presentations and the discussions: the influence of anisotropic micro- and mesostructure on the stress, the influence of particle inertia as a departure from quasistatic flows, and the development of continuum models that accommodate these physical features. New experiments pose challenges for constitutive modelling of granular mechanics, although some experimental investigations emphasize more on new and intriguing phenomena rather than address fundamental questions on modelling. Computational simulations such as the discrete element (DEM) continue to play a key role in the development validation of constitutive equations. The so-called “intermediate regime”, lying between the extremes of quasistatic and rapid flows is still largely uncharted. Some phenomenological approaches for this regime were proposed, but a micromechanical understanding is lacking.

The rheology and dynamics of Stokesian suspensions was discussed over a day of the symposium. Though this area has acquired maturity as it has been investigated for the past 4 decades, new results pose interesting challenges to our understanding. Several presentations challenged the conventional notion that the stress in a suspension is largely due to hydrodynamic interactions, and suggested that particle contact may be account for a significant fraction of the net stress. A few novel experiments to study the rheology of very dense suspensions were proposed, and deserve further pursuit. Shear-induced particle migration and segregation continues



to be a phenomenon of interest to many researchers, due to its implication for practical applications.

Two-phase flow modelling of turbulent fluid-particle suspensions remains a challenging problem, and was discussed over half a day. While computational techniques have reached a level of sophistication that realistic flows can be simulated, questions still remain about accounting for some important physical ingredients in the models, such as how particles modulate fluid turbulence, and how inter-particle interactions can be accounted. New experimental tools that provide good temporal and spatial resolution appear to be show promise.

The last day of the symposium was devoted to the somewhat new area of living suspensions. Though the fluid mechanics of self-propelled microorganisms has been investigated for several decades, starting from the pioneering work of G. I. Taylor (PNAS, **209**, 1951), challenges remain in understanding the dynamics of collections of swimmers. Continuum approaches that have built on early work by Pedley and coworkers have shown that the theories predict instabilities that may explain some observed phenomena in experiments, such as spontaneous aggregation and large-scale swirls. Computational methods that track individual swimmers appear to be useful, but have so far been limited to dilute suspensions or systems of small numbers of swimmers; moreover, refinement of the models used for an individual swimmer is necessary. Experimental measurements of the rheology and dynamics of such suspensions provide the impetus for new theoretical and computational approaches.

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

There were 72 registered participants from the following countries: Australia, Canada, France, Germany Hungary, India, Japan, Mexico, Netherlands, Poland, UK, and USA.

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

Though it was planned to have the Proceedings published by Elsevier in the *Procedia IUTAM* series, for which funds were set aside, Elsevier did not provide an invoice before the completion of the meeting, as per the funder's requirement. During the meeting, the editor of *Physics of Fluids*, Prof. L. Gary Leal, offered to publish the papers presented in the symposium in a special section of an issue, which found widespread enthusiasm amongst the participants. Additionally, Prof. Leal has proposed that a summary of the Proceedings of the symposium, coauthored by a small number of the participants, will precede the contributed articles. As of now, roughly 10 papers are under review for the special section.

**e) Financial support**

IUTAM: US\$ 6000

Department of Science & Technology, India: Rs 250,000

National Science Foundation, USA: US\$ 26,000

**Industry co-sponsors:**

M/s. Anton Paar, India: Rs. 50,000

M/s. Tata Consultancy Services, India: Rs. 50,000

M/s. Accurion Scientific Instruments Pvt. Ltd., India: Rs. 25,000

**f) Scientific Program****Day 1: January 23, 2012****Rheology and dynamics of suspensions**

09:15-10:00 E. J. Hinch, Fluctuations in the velocities of sedimenting particles

10:00-10:30 M. L. Ekiel-Jezewska, Clusters of particles settling under gravity in a viscous fluid

11:00-11:30 A. Ramachandran, Demonstration of secondary currents in the pressure driven flow of a concentrated suspension through a square conduit

11:30-12:00 A. Singh, Radial segregation of settling suspension in horizontally rotating cylinder

12:00-12:30 M. S. Tirumkudulu, Ultimate strength of a colloidal packing saturated with a solvent

14:00-14:30 O. Pouliquen, Rheology of very dense suspensions

14:30-15:00 G. Ovarlez, Local behavior of dense suspensions of noncolloidal particles

15:00-15:30 A. Lindner, Flow of dense granular suspensions: an experimental study.

16:00-16:30 J. F. Morris, Inertial effects upon rheology, migration, and segregation in suspensions

16:30-17:00 G. Leal, The role of copolymer surfactants in determining the polydispersity of drop size distribution and copolymer concentration in disperse phase polymer blends

**Day 2: January 24, 2012****Slow Granular Flows**

08:45-09:30 J. D. Goddard, Dissipative potentials in the mechanics of particulate media

09:30-10:00 P. R. Nott, Kinematics and stress in dense granular materials sheared in a cylindrical Couette device

10:00-10:30 F. Radjai, Fabric states and plastic behavior of granular materials

11:00-11:30 K. Kamrin, Local and nonlocal models for dense granular flow

- 11:30-12:00 T. G. Murthy, Experimental studies of particle shape effects on slow flow in a dense granular ensemble
- 14:00-14:30 D. Khakhar, Rheology and segregation of granular mixtures in dense flow
- 14:30-15:00 K. Hill, Segregation of binary mixtures: competing effects of gravity and shear rate gradients
- 15:00-15:30 E. Guazzelli, Dense suspension rheology: normal stresses and migration
- 16:00-16:30 J. A. Dijksman, Particle diffusion in the bulk of slow granular flows
- 16:30-17:00 A. V. Orpe, Interstitial fluid effects on the dynamics of dense granular flows

### **Day 3: January 25, 2012**

#### **Granular flows in the intermediate regime**

- 08:45-09:30 S. Sundaresan, Rheology of dense granular flows: regime bridging and implications for kinetic theory
- 09:30-10:00 J. C. Ruiz-Suarez, Falling inside a superlight granular medium
- 10:00-10:30 N. Gray, Particle size segregation and spontaneous levee formation in geophysical mass flows
- 11:00-11:30 R. H. Davis, Collisions of wet particles
- 11:30-12:00 I. Sharma, Stability of granular asteroids
- 12:00-12:30 T. Poeschel, Packing structure of granular systems

#### **Rapid granular flows**

- 14:00-14:45 V. Kumaran, Transition in a dense granular flow
- 14:45-15:15 T. Borzsonyi, Orientational order and alignment of elongated particles induced by shear
- 15:15-15:45 N. M. Vriend, The second normal-stress difference in avalanching granular flows
- 16:15-16:45 H. Hayakawa, Nonlinear analysis for a sheared granular flow: relaxation to a steady state and response around a steady state
- 16:45-17:15 S. Luding, From particles to continuum theory: shear-bands, jamming and dilatancy

### **Day 4: January 26, 2012**

#### **Turbulent fluid-particle flows**

- 08:45-09:30 M. Reeks, Segregation of particles in incompressible random flows: singularities, intermittency and random uncorrelated motion
- 09:30-10:00 T. Tanaka, Numerical model for the motion of a large object in dense gas-solid flows
- 10:00-10:30 P. S. Goswami, Particle dynamics in a turbulent particle-gas suspension at high Stokes number
- 10:30-11:00 S. Roy, Dynamic flow structure in multiphase systems using single radio-labelled particle tracking

### *11:00-12:30* **Poster presentations**

#### **Day 5: January 27, 2012**

##### **Living suspensions**

08:45-09:30 S. Ramaswamy, Chemotactic catalytic colloids

09:30-10:00 M. D. Graham, Hydrodynamic coordination of bacterial motions: from bundles to biomixing

10:00-10:30 S. Rafai, Active suspensions under flow

11:00-11:30 G. Subramanian, Pair-correlations in a bacterial suspension

11:30-12:00 P. Peyla, Rheology of active suspensions. Active rotors

12:00-12:30 D. Saintillan, The dynamics of active suspensions: effects of confinement and of concentration

14:00-14:30 J. Brady, Reaction-induced motion: chemical swimming, sailing and surfing

14:30-15:00 A. S. Sangani, Evaluation of proposed mechanisms for ciliary beating of eukaryotic cells

15:00-15:30 R. Prabhakar, Measurements of extensional viscosities of suspensions of motile microbes

##### **Acknowledgements**

Funding from all the agencies mentioned in (e) is gratefully acknowledged. We also thank the Indian Institute of Science for providing logistical and other support that was crucial to holding the meeting. Finally, we are grateful to all the student volunteers for their tireless efforts in the smooth running of the meeting.

**Report prepared by P. Nott**

**12-2 IUTAM Symposium on Advanced Materials Modelling for Structures**  
Paris, France, April 23 – April 27 , 2012

The IUTAM Symposium on Advanced Materials Modelling for Structures was held at the Ecole Nationale Supérieure des Mines de Paris, France, during the week of April 23-27, 2012.

**a) Scientific committee**

Holm Altenbach (Germany), Esteban Busso (France), Andre Dragon (France), Fionn Dunne (U.K.), Noel O'Dowd (Ireland), Masamichi Kawai (Japan), Nobutada Ohno (Japan), Jacek Skrzypek (Poland), Serge Kruch (France, Chair)

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

The IUTAM symposium “Advanced Materials Modelling for Structures”, held in Paris in April 23-27, 2012, was co-organised by Onera (The French Aerospace Lab) and the Ecole des Mines de Paris under the auspice of the International Union of Theoretical and Applied Mechanics.

The meeting was a new version of the previous IUTAM symposia “Creep in Structures” proposed every 10 years to discuss recent advances and results in this fundamental field of applied mechanics.

These last years an important progress was observed in testing practice for high temperature behaviour as well as in observation techniques, giving important information on deformation patterns and damage evolutions in interaction with the material microstructure which can be used to propose more physically based constitutive models.

In the same time, the research fields in solid mechanics and particularly the modelling of advanced materials have evolved considerably thanks to the development of multiscale approaches. Although some progress has been made in the theoretical field, the application of multi-scale modelling to compute real components subjected to strong thermo mechanical loads is still at an early stage, with different groups around the world following a wide range of approaches. This is particularly the case for high temperature structures where non linear phenomena, like creep, are predominant and drive lifetime.

Aims of the proposed Symposium were not only to consolidate the advance of high temperature materials research, but also to provide a forum to discuss the new horizon placing a particular emphasis on multiscale approaches at several length-scales applied to non linear and heterogeneous materials.

Discussion of new approaches have been emphasised from various related disciplines, including metal physics, micromechanics, mathematical and computational mechanics.

According to the spirit and following the Rule and Guidelines of IUTAM symposia, this Symposium gathered a group of active scientists and engineers researching within well-defined fields. The single session format conference gave the opportunity for in depth discussions between delegates and for young doctorate students to interact with seniors.

A wide range of topics have been discussed during the meeting. Accordingly, the program was divided in the following main fields:

- Crystal Plasticity (3 sessions)
- Mechanical Modelling (2 sessions)
- Continuum Damage Mechanics (2 sessions)
- Coupled Fields (2 sessions)
- Material Science (2 sessions)
- Cyclic Plasticity (2 sessions)
- Creep Modelling and Interactions (2 sessions)
- Multiscale Modelling (2 sessions)

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

The International Symposium brought together 61 participants from 11 countries: France 15, UK 11, Japan 9, Germany 8, USA 6, Ireland 3, Poland 2, Italy 2, China 2, Switzerland 2, the Netherlands 1. 49 invited oral presentations were divided in relatively long talks (45 minute General lectures and 35 minute ordinary ones) in order to encourage interactions and discussions.

#### **d) Publication of Proceedings**

A contract to publish the Proceedings in a book within the Springer Series "Advanced Structured Materials" has been signed. These Proceedings will be edited by H. Altenbach and S. Kruch and they will appear in 2013.

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

The Symposium was generously supported by Onera and the Ecole Nationale des Mines de Paris which provided facilities and administration.

#### **f) Scientific Program**

##### **April 23 (Monday)**

10:00 – 10:15 Opening Address – **Serge Kruch**

10:15 – 11:00 **General Lecture (Chairperson : Noel O’Dowd)**

Micromechanical studies of deformation, lattice rotation, stress and crack nucleation in single and polycrystal materials: **Fionn Dunne**, Mehmet Kartal and Caoimhe Sweeney

11:00 – 12:10 **Crystal Plasticity (1) (Chairperson: Noel O'Dowd)**

Dwell Fatigue Initiation in Polycrystalline Ti Alloys Using Multi-Time Scaling

Crystal Plasticity FE Models: **Somnath Ghosh**

Length scale effects in generalised continuum crystal plasticity: **Esteban P. Busso**, Nicolas Cordero and Samuel Forest

13:30 – 14:15 **General Lecture (Chairperson: Fionn Dunne)**

Lifetime prediction for low cycle and thermo-mechanical fatigue - cyclic plasticity, microcrack growth and microstructural evolution: **Hermann Riedel**

14:15 – 16:00 **Mechanical Modelling (1) (Chairperson: Fionn Dunne)**

An exploration of the interaction between residual stress and applied loading of high temperature structures: **David Smith**, Chris Truman, Yiqiang Wang and Anil Shirahatti

Modeling of coupled dissipative phenomena in engineering materials: **Halina Egner**, Władysław Egner

Multiscale Optimization of Joints of Dissimilar Materials in Nature and Lessons for Engineering Applications: **Victor Birman**, Yanxin Liu, Stavros Thomopoulos, Guy M. Genin

16:30 – 18:15 **Mechanical Modelling (2) (Chairperson : Victor Birman)**

Mechanics of materials for microelectronic components and packages: **Vadim V. Silberschmidt**

An investigation of the mechanical properties of open cell aluminium foam struts: microtensile testing and modelling: **Charles Betts**, Jianguo Lin, Daniel Balint

Viscoplastic Constitutive Model to Divide Inelastic Strain into Time-Independent and Time-Dependent Strains: **Ken-ichi Ohguchi** and Katsuhiko Sasaki

#### **April 24 (Tuesday)**

9:00 – 9:45 **General Lecture (Chairperson : Amine Benzerga)**

Microstructural modelling and characterisation of deformation in polycrystalline steels: **Noel P. O'Dowd**, Dong-Feng Li, Catrin M. Davies, Shu-Yan Zhang

9:45 – 10:55 **Crystal Plasticity (2) (Chairperson : Amine Benzerga)**

A microstructure sensitive model to account for the non-isothermal creep behavior of Ni-based single crystal superalloys: **Jonathan Cormier**, J. Ghighi, J.-B. Le Graverend, T. Link, L. Dirand, Z. Hervier, E. Ostojka-Kuczynski, S. Kruch, F. Gallerneau, J. Mendez, G. Cailletaud

A cyclic crystal plastic model considering both dislocation slipping and twinning for Ti-6Al-4V alloy: Chao Yu, **Guozheng Kang**

11:25 – 12:35 **Crystal Plasticity (3) (Chairperson : Masamichi Kawai)**

Advances and open issues about the microscopical and the macroscopical modelling of single crystal superalloys: **Bernard Fedelich**

A strain rate sensitive formulation to account for the effect of  $\gamma'$  rafting on the high temperature mechanical properties of Ni-based single crystal superalloys: **Jean-Briac le Graverend**, J. Cormier, S. Kruch, F. Gallerneau, J. Mendez

13:30 – 14:15 **General Lecture (Chairperson : Nobutada Ohno)**

Dwell fatigue initiation in polycrystalline Ti alloys using multi-time scaling crystal plasticity FE models: **Somnath Ghosh**

14:15 – 15:25 **Continuum Damage Mechanics (1) (Chairperson : Nobutada Ohno)**

High-temperature inelastic behavior of the austenitic steel AISI type 316: **Yevgen Gorash** and Holm Altenbach

Damage deactivation of engineering materials and structures: **Artur Ganczarski** and Marcin Cegielski

15:55 – 17:40 **Continuum Damage Mechanics (2) (Chairperson : Somnath Ghosh)**

Kelvin modes based cubic plasticity and induced anisotropic damage. Application to creep of AM1 single crystal: **Roxane Marull**, Rodrigue Desmorat

Modeling of microstructural degradation during long-term high-temperature creep of strength enhanced high Cr ferritic steel: **Kouichi Maruyama**, R. P. Chen, J. Nakamura and M. Igarashi

Nakamura and M. Igarashi

Micro-mechanical numerical studies on the stress state dependence of ductile damage: **Michael Brünig**, Steffen Gerke, Vanessa Hagenbrock

### **April 25 (Wednesday)**

9:00 – 9:45 **General Lecture (Chairperson: Ahmed Benallal)**

Some consequences of stress range dependent constitutive models in creep: **James T. Boyle**

9:45 – 10:55 **Coupled Fields (1) (Chairperson: Ahmed Benallal)**

Power-law creep from discrete dislocation dynamics simulations: **Amine A. Benzerga** and S. M. Keralavarma

Modeling the creep threshold stress due to climb of a dislocation in the stress field of a misfitting precipitate: Matthew E. Krug, **David C. Dunand**

11:25 – 12:35 **Coupled Fields (2) (Chairperson: David Dunand)**

Phase-field simulation of microstructural evolution in nickel-based superalloys during creep and in low carbon steels during martensite transformation: **Yoshinori Murata**, Yuhki Tsukada and Toshiyuki Koyama

Application of the phase field model of dislocations to the study of high-temperature mechanical behaviour of Ni-base superalloys: **Vassili A. Vorontsov**, R.E. Voskoboinikov and C.M.F. Rae

13:30 – 14:15 **General Lecture (Chairperson: David Smith)**

From reheat cracking to improved creep damage models: **Mike W. Spindler**

14:15 – 15:25 **Material Science (1) (Chairperson: David Smith)**



Dislocation-induced internal stresses: **Peter Geantil**, Benoit Devincere, Michael E. Kassner

Recent advances in the processing and properties of ultrafine-grained metals using severe plastic deformation: **Terence G. Langdon**

15:55 – 17:40 **Material Science (2)** (**Chairperson:** Jian Lu)

Microscale Residual Stresses due to Nanoscale Precipitates: **Siegfried Schmauder**  
Enriched digital image correlation for precise characterization of time-dependent metallic microbeam bending: **Lambert I.J.C. Bergers**, J.P.M. Hoefnagels, J. Neggers, M.G.D. Geers

Fatigue and Fracture criterion in nano-components: Takayuki Kitamura, **Takashi Sumigawa** and Takahiro Shimada

### **April 26 (Thursday)**

9:00 – 9:45 **General Lecture** (**Chairperson:** Esteban Busso)

The Effect of Temperature on Interfacial gradient plasticity in Metallic Thin Films: **George Z. Voyiadjis** and Danial Faghihi

9:45 – 10:55 **Cyclic Plasticity (1)** (**Chairperson:** Esteban Busso)

A masing-type modelling concept for cyclic plasticity at elevated temperature:

**Thomas Mayer**, E. Mazza, S. R. Holdsworth

On the non saturation of cyclic plasticity law: a power law for kinematic hardening:

**Rodrigue Desmorat**

11:25 – 12:35 **Cyclic Plasticity (2)** (**Chairperson:** George Voyiadjis)

Multiaxial Low Cycle Fatigue for Ni-base Single Crystal Super Alloy at High Temperature: **Masao Sakane**, Shengde Zhang, Akira Yoshinari, Noriaki Matsuda and Nobuhiro Isobe

Finite element modelling of the thermo-mechanical behaviour of A 9Cr martensitic steel: Sean B. Leen, Peter E. O'Donoghue, **Richard A. Barrett**

13:30 – 14:15 **General Lecture** (**Chairperson:** Sean B. Leen)

Effect of orientation on the creep and creep crack growth properties of 2xxx aluminium alloy forgings: **Elisabetta Gariboldi**, A. Lo Conte

14:15 – 15:25 **Creep Modelling and Interactions (1)** (**Chairperson:** Sean Leen)

Constitutive models for the description of creep and plasticity of cast and wrought Mg-Al and Mg-Zn alloys: **Stefano Spigarelli**, M. El Mehtedi

An overview of small specimen creep testing: **Thomas H. Hyde**, W. Sun and C. J. Hyde

15:55 – 17:40 **Creep Modelling and Interactions (2)** (**Chairperson:** Elisabetta Gariboldi)

A Grand Master Curve Approach for off-axis creep rupture behavior of orthotropic polymer matrix composites at different temperatures: **Masamichi Kawai**

Deformation and failure of various alloys under creep-fatigue loading and their modelling: **Yukio Takahashi**

Creep crack growth modelling in 316H stainless steel: **Catrin M. Davies**, A. Mehmanparast, K. M. Nikbin

### **April 27 (Friday)**

9:00 – 9:45 **General Lecture (Chairperson: Holm Altenbach)**

Homogenized elastic-viscoplastic behavior of anisotropic open-porous bodies with pore pressure: **Nobutada Ohno**, Kazutaka Ikenoya, Dai Okumura, Tetsuya Matsuda

9:45 – 10:55 **Multiscale Modelling (1) (Chairperson: Holm Altenbach)**

Micromechanical modelling of void healing: **Shireen Afshan**, D. Balint, J. Lin and D. Farrugia

Multiscale mechanics for the study of high strength and high ductility nanomaterials: **Jian Lu**, L.L.Zhu, H.L.Chan, A.Y.Chen, H.N.Kou

11:25 – 13:10 **Multiscale Modelling (2) (Chairperson: Jianguo Lin)**

Macro/Micro Elastic-Viscoplastic Analysis of Woven Composite Laminates with Misaligned Woven Fabrics: **Tetsuya Matsuda**, S. Kanamaru, N. Honda, N. Ohno

Surface viscoelasticity and effective properties of materials and structures: **Holm Altenbach** and Victor Eremeyev

A Micromechanical model for the mechanical behaviour of irradiated austenitic stainless steels: **Xu Han**, Jacques Besson, Samuel Forest and Benoit Tanguy

13:10 Closing Address – **Serge Kruch**

### **Acknowledgements**

The success of this event is due to the help of many people. We would like to thank the International Scientific Committee, the Organising Committee and the session chairpersons who were really effective in leading discussions.

**Report prepared by Serge Kruch**

**12-3 IUTAM Symposium "From Mechanical to Biological Systems - an Integrated Approach"**

Izhevsk, Russia, 5 June-10 June, 2012

The IUTAM Symposium "From Mechanical to Biological Systems - an Integrated Approach" was held on June 5-10, 2012 at the Udmurt State University, Izhevsk, Russia.

**a) Scientific Committee**

Valery V. Kozlov, Russia (Chairman), Alexey V. Borisov, Russia (Vice-chairman), Felix L. Chernousko, Russia (IUTAM Representative), Dominique Barthes-Biesel, France, Viktor Berbyuk, Sweden, Gerhard A. Holzapfel, Austria, Oliver M. O'Reilly, USA, Friedrich Pfeiffer, Germany, Kazuo Tanishita, Japan, Masayoshi Tomizuka, USA, Anatoliy P. Markeev, Russia, Alexander P. Ivanov, Russia, Jair Koiller, Brazil

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

The main goal of the Symposium was to promote an integrated approach to the understanding of the dynamical structures of mechanical artefacts, on the one hand, and living bodies, on the other hand. Therefore, the participants from a wide range of disciplines such as theoretical and applied mechanics, stability theory, computer science, biomechanics and biomimetics were invited to participate in the symposium.

Areas of emphasis included:

- Ground-moving self-propelling mechanisms: from mobile, spherical and legged locomotion devices to robot-technical models of snakes and multiped organisms;
- Air and aquatic locomotion: mathematical models, simulations, robotic devices;
- Mechanical paradoxes and artefacts.

The talks were enhanced with visual presentations, video and photo materials, and experimental models of robots. A round table was held where the participants discussed the presented results and the main questions in this area. In particular, a number of experiments on the rolling motion with friction and on nonholonomic rolling were proposed in the course of discussions to verify the existing models exhibiting these processes and - if necessary - to develop new ones. In addition, the causes of the asymptotic stability of motions in systems with nonholonomic constraints were specified. A lot of new international scientific contacts were made and future collaborations were planned to further scientific progress in the areas of applied mechanics and robotics.

### c) Countries represented and number of participants

63 invited participants from 8 countries took part in this Symposium: Russia (48), Brazil (4), USA (3), Germany (2), China (2), Japan (2), Ireland (1), UK (1).

### d) Publication of Proceedings of the Symposium

For the symposium "From Mechanical to Biological Systems: an Integrated Approach", the refereed Proceedings will be published as a special issue of the Springer journal entitled Regular and Chaotic Dynamics (RCD <http://www.springeronline.com/journal/11819/>). Many libraries subscribe to RCD so the Proceedings should see good circulation. The Proceedings volume will be published within a year of the Symposium and will be available free of charge to all presenting authors.

### e) Financial support

The following institutions have provided financial support for the Symposium: Udmurt State University, IUTAM, Russian Foundation for Basic Research, Institute of Computer Science.

### f) Scientific Program

#### June 6 (Wednesday)

10.30-11.05 Felix Chernousko, Nikolay Bolotnik, Tatiana Figurina *Optimal control of vibrationally excited locomotion systems*

11.05-11.40 Jair Koiller, Kurt Ehlers *Is acoustic streaming a locomotion principle in (Nature and) artificial devices?*

11.40-12.15 Scott David Kelly, Kwitae Chong, Jeff Eldredge, Stephen Howard, Stuart Smith *Manipulation of suspended microparticles using vibrating cilia*

14.00-14.35 Anatoly Markeev *On the rotational motion of a heavy rigid body carrying a material point*

14.35-15.10 Tetsuya Tanoue, Yasuhiro Shobayashi, Satoshi Tateshima, Daisuke Wakui, Kazuo Tanishita *Effect of wall shear stress on the arterial wall structure and enzyme expression in the induced cerebral aneurysm with rabbits*

15.10-15.45 Hongbin Fan, Jian Xu *N-module worm-like locomotion system: analysis, optimization and synchronization*

16.15-16.50 Boris Bardin *Transcendental cases of the stability problem in classical and celestial mechanics*

#### June 7 (Thursday)

11.00-11.50 Alexander Ivanov *On a minimal principle in mechanics*

11.50-12.25 Peter Lynch, Miguel Bustamante *Rocking and rolling: box and loop orbits*

12.25-13.00 Andy Ruina *Passive and low-energy-use walking robots at Cornell*

- 14.00-14.35 Andy Ruina *Some comments on the energetics and control of walking*  
14.35-15.10 Hermes Gadelha, Eamonn Gaffney, David Smith, Jackson Kirkman-Brown, Alain Goriely *Mathematical modelling and observation: what we can learn about mammalian sperm motility*  
15.10-15.45 Jorge Zubelli *Calibration of structured population models: from mechanics to biology*  
16.15-16.50 Sergey Ramodanov *Motion of a body with a rigid surface and variable distribution of mass in a liquid*  
16.50-17.25 Felix Becker, Vladimir Minchenya, Klaus Zimmermann *Amphibious vibration-driven micro robots with piezoelectric actuators*  
17.25-18.00 Andrey Tsiganov *Simple non-Hamiltonian systems with an invariant measure*

#### June 8 (Friday)

- 10.00-10.35 Stefan Llewellyn Smith *Generalizing point vortices*  
10.35-11.10 Sergey Gonchenko, Alexander Gonchenko *Towards chaotic dynamics of celtic stone*  
16.00-17.30 Round table (discussion) "From Mechanical to Biological Systems – an Integrated Approach"

#### June 9 (Saturday)

- 10.00-10.35 Alexey Borisov, Ivan Mamaev, Alexander Kilin *What is the way to control the Chaplygin ball using rotors?*  
10.35-11.10 Alexey Borisov, Ivan Mamaev, Ivan Bizyaev *The hierarchy of the dynamics of a body rolling without slipping and spinning on a plane and a sphere*  
11.10-11.45 Sergey Jatsun, K.A. Saponov, Lyudmila Volkova *Modelling of movement of the four-link robot moving with the jump from the rough surface*  
11.45-12.20 Sergey Trefilov, Yury Karavaev *Brushless DC motor control algorithm for inertial sphero robots actuators*  
13.30-14.05 Andy Ruina *Rotation with zero angular momentum: Demonstrations of the falling cat phenomenon go sour*

14.05-15.00 Poster session:

- Boris Bardin, Tatyana Rudenko, Alexander Savin *On orbital stability of planar periodic motions of a rigid body in the Bobylev-Steklov case*  
Alexey Borisov, Alexey Kazakov *Strange attractors in the rock'n'roller in the plane problem*  
Nadezhda Erdakova, Ivan Mamaev *On the dynamics of point vortices in an annular region*  
Tatiana Ivanova, Ivan Mamaev *Numerical and analytical researches of equilibrium of a liquid self-gravitating elliptic cylinder with internal rotation*  
Ivan Ovsyannikov *On the stability of the Chaplygin ball rolling under friction*

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Vladimir Pavlovsky, Alexey Panchenko *HEXMINI Mini Hexapod Robot Dynamics and Control*

Vladimir Pavlovsky, Dmitry Trifonov *Bipedal Balance Control based on Contact Force Optimization*

Sergey Ramodanov, Sergey Sokolov *Motion of a heavy circular cylinder interacting dynamically with a point vortex*

Valentin Tenenev, Evgeny Vetchanin, Alexander Shaura *Motion control of a rigid body in viscous liquid*

Valentin Tenenev, Evgeny Vetchanin *Spatial hydrodynamics of bodies with variable mass center*

**Report composed by Valery Kozlov and Alexey Borisov**

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**12-4 IUTAM Symposium on Waves in Fluids: Effects of Nonlinearity, Rotation, Stratification and Dissipation**  
Moscow, Russia, June 18 – June 22, 2012

The IUTAM Symposium on Waves in Fluids: Effects of Non-Linearity, Rotation, Stratification and Dissipation was held at the A. Ishlinsky Institute for Problems in Mechanics of the RAS, Moscow, Russian Federation, during the week of June 18 – 22, 2012.

**a) Scientific Committee**

Yu.D. Chashechkin (Russia, Chair), Konrad Bajer (Poland), David G. Dritschel (United Kingdom), Joseph H.S. Fernando (USA), John Grue (Norway), Jose-Manuel Redondo (Spain), Lev Shemer (Israel), Chantal Staquet (France), Felix L. Chernousko (Russia - IUTAM representative)

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

Studies of the waves, one of the traditional branches of classical fluid mechanics, remain relevant over the several centuries. Interest in the topic is supported by logic of the scientific research development – the wave theme is one of the stimulus for the development of fundamental and applied mathematics, and is the subject of intense experimental researches. Stimulated factors are practical needs as global disasters and local destructions of a wave nature (tsunami, floods, extreme wave heights, inundation) are applied to the most significant loss of life accompanied by economic damage. The object of intensive research is the development of techniques to estimate the power of wave action on the fixed or floating engineering structures, which is still a number of fundamental difficulties.

In recent years, there has been significant progress in this subject due to several factors. The development of information technology has allowed to implement a more advanced methods of constructing solutions that require a large amount of computations resources and intellectual efforts. New computer resources help to realize before developed algorithms which were known, but not implemented due to technical difficulties. They stimulated the development of analytical methods, which has been increasing attention paid to the study of the effects of nonlinearity, stratification, rotation and dissipation, both individually and in the most general formulation of the complex problems. The new generation of fluid flows models which are closed, self-consistent and can be directly compared with precise wave measurements was presented.

At the same time technique of laboratory studies of waves has been greatly improved. A number of new tanks with advanced engineering equipment have been built in different countries. Expanding observation fields and the development of

remote sensing methods, allows to record fine details of the variability of natural systems that are the atmosphere and the hydrosphere. Large amounts of information are made available to distant users with the development of systems of international data exchange.

New approaches show good agreement between independently performed calculations based on the theory that does not contain empirical constants or additional hypotheses, and data of precision experiments performed with modern scientific instruments. As an example, calculations of propagating internal waves (report by Yu.D. Chashechkin, Russia) and PIV-measurement of internal wave beams in a fluid with an arbitrary stratification with the critical level (report by M.S. Paoletti, H.L. Swinney, USA) are fitted up to a few percents.

A large number of talks were devoted to the discussion of the influence of the global effects of rotation, which are associated with gyroscopic wave splitting, geostrophic balance and the formation of spatial structures. Effects associated with the formation of secondary waves and small spray droplets from drops falling onto the surface of the liquid and from destructing waves crests were discussed. Great interest was aroused by the experimental studies of the dynamics of decay to drop of large bodies of water (water shells).

Great scientific and technological interest is the study of the connection between the regular wave field and the structure of a complex random hydrodynamic fields that are traditionally associated with the phenomenon of turbulence. The delicate questions of mathematical modeling of structure formation in the bulk fluid and the collapse of the interface in the waves were discussed. Paradoxical experimental results of the substance transport in the eddies and currents with global rotation were presented.

In general, it should be noted that the authors were ready for constructive discussions. The high level of interest in the reports determined the audience conservation, which was maintained until the last meeting. An indicator of the high interest of the scientific community to the subject of the event is the presentation of a video interview with key participants in the symposium "Waves in Fluids" ("Волны в жидкостях") on the website of the Russian Academy of Sciences: <http://www.ras.ru/#>

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

There were 171 registered participants form the following countries: Czech Republic, France, Estonia, Germany, Israel, Mexico, Norway, Russian Federation, Thailand, UK, Ukraine and USA.



Geographic representation of Russian scientists was quite wide: from Vladivostok to St. Petersburg, including the main research centers: Novosibirsk, Nizhniy Novgorod, Perm, Chernogolovka and others. The activity of young scientists – post graduate students and young PhD students from Moscow, Ufa, Nizhniy Novgorod, Perm, Kiev – should be highlighted.

#### **d) Publication of Proceedings**

The participants were given the book of abstracts “Wave in Fluids: Effects of non-linearity, rotation, stratification and dissipation,” ISBN 978-5-317-04107-6. Selected papers will appear in Procedia IUTAM under “IUTAM Symposium on Wave in Fluids: Effects of Non-Linearity, Rotation, Stratification and Dissipation”, edited by Yuli D. Chahshechkin and David G. Dritschel, Elsevier. V. 8. 2013. ISSN 2210-9838 (5 copies hard cover and 45 soft cover, 31 papers).

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

Russian Foundation for Basic Research – 300 000 rubles (or roughly 10 000 US\$)

Presidium of the Russian Academy of Sciences – 120 000 rubles (approximately 4000 US\$ to support participation of young scientists),

A. Ishlinsky Institute for Problems in Mechanics of the RAS 90 000 rubles (approx. 4 000 US\$).

#### **f) Scientific Program**

##### **Monday, June 18, 2012**

10:30 – 10:50 *Zagumennyi I.A.* Diffusion-Induced Flows on a Strip: Theoretical, Numerical and Laboratory Modeling

10:50 – 11:10 *Aktershev S.P., Alekseenko S.V.* New Model for Waves in a Falling Film

11:10 – 11:30 *Sazhin S.S., Boronin S.A., Begg S., Crua C., Heikal M.R., Healey J. Lebedeva N.A., Osipov A.N., Kaplanski F.* Jets and Vortex Ring-Like Structures in Internal Combustion Engines: Stability Analysis and Analytical Solutions

11:30 – 11:50 *Kozlov V.G., Polezhaev D.A.* Inertial Waves and Acoustic Streaming in Rimming Flows

11:50 – 12:10 *Kuibin P.A., Sharypov O.V.* Effects of Inertia and Thermocapillarity in Non-Isothermal Film Flow

12:30 – 12:50 *Sokolovskiy M.A., Filyushkin B.N., Carton X.* Modelling of Interaction of Intrathemocline Vortex with the Ridge Seamounts in Vicinity of Critical Points of Currents

12:50 – 13:10 *Reznik G.M.* Geostrophic Splitting and Gyroscopic Waves

13:10 – 13:30 *Kistovich A.V.* The Exact Complex-Valued Solution for Steady Surface Waves

13:10 – 13:30 *Chaplina T.O.* Transport of Oil in a Compound Vortex

- 15:00 – 15:20 *Ermakov M.K.* Stability of Thermocapillary Convection in a Liquid Bridge at High-Prandtl Number
- 15:20 – 15:40 *Lukin S.V., Urmancheev S.F.* Capillary Effects at Wave Propagation in Porous Media
- 15:40 – 16:00 *Baydulov V.G.* On the Acoustic Precursors of Convective Structures in a Stratified Fluid
- 16:30 – 16:50 *Khizbullina S.F., Urmancheev S.F.* Oscillation Regimes of Dynamic Parameters Changing in Couette Flow of Anomalous Thermoviscous Liquids
- 16:50 – 17:10 *Arkipov D.G., Khabakhpashev G.A.* New Model Equations for the Nonlinear Waves Interaction in Shallow Water
- 17:10 – 17:30 *Kurakin L.G.* Stability, Resonances and Instability of the Steady Rotation of a System of Three Equidistant Vortices Outside a Circle

### **Tuesday, June 19, 2012**

- 10:00 – 10:20 *Ilyinykh A.Yu.* Waves of drop impact
- 10:20 – 10:40 *Golitsyn G.S.* The Role of Viscosity in the Contaminant Diffusion in the Field of Wind Surface Waves
- 10:40 – 11:00 *Druzhinin O.A., Troitskaya Yu.I.* The radiation of internal waves by a turbulent fountain in a stratified fluid
- 11:00 – 11:20 *Byalko A.V.* Underwater Gas Tornado: First Experiments and Initial Theoretical Analysis
- 11:20 – 11:40 *Stepanova E.V.* Dye Transport Pattern in Compound Vortex Flow
- 12:00 – 12:30 *Paoletti M.S., Swinney H.L.* Propagating and Evanescent Internal Waves in a Model of the Deep Ocean (*invited*)
- 12:30 – 13:00 *Chashechkin Yu.D.* The Complex Structure of Wave Fields in Fluids (*invited*)
- 15:00 – 15:20 *Meshkov E.E., Oreshkov V.O., Fedorenko Ya.V., Yanbaev G.M.* Transformation of Flying Cylindrical Water Shell
- 15:20 – 15:40 *Prokhorov V.E.* Internal Waves and Microstructure Detected in a Field of Ultrasonic Backscattering of the Stratified Flow
- 15:40 – 16:00 *Blekhman I.I., Blekhman L.I., Vaisberg L.A., Sorokin V.S., Vasilkov V.B., Yakimova K.S.* Motion of Gas Bubbles and Rigid Particles in Vibrating Fluid Filled Volumes
- 16:20 – 16:40 *Serebryany A.N.* Observations of Nonlinear Internal Waves and Connected Processes in the Sea Using ADCP
- 16:40 – 17:00 *Fuka V., Brechler J.* Large Eddy Simulation of the Stratified Flow Over Terrain Obstacles: First Results
- 17:00 – 17:20 *Gadzhimagomedov G.G., Vlasov V.A., Lutovinov V.M., Sboev D.S.* PIV Based Measurements of Aerodynamic Loads

### **Wednesday, June 20, 2012**

- 10:00 – 10:20 *Stepanova E.V.* Dye Transport Pattern in Compound Vortex Flow

- 10:20 – 10:40 *Denisova M.O., Kostarev K.G.* Occurrence of the Motion of a Fluid with a Free Surface of Small Area
- 10:40 – 11:00 *Moiseev K.V., Volkova E.V., Urmanceev S.F.* Effect of Convection on Polymerase Chain Reaction in a Closed Cell
- 11:00 – 11:20 *Bakunin O.G.* Stochastic Instability Increment in Two Dimensional Turbulent Flows in the Presence of Inverse Cascade
- 11:50 – 12:20 *Shemer L., Noskowicz S.H.* On Kinematics and Dynamics of Breaking Water Waves (*invited*).
- 12:20 – 12:40 *Cherevko A.A., Chupakhin A.P., Ivanova A.V., Ostapenko V.V.* Numerical Simulation Problem of Discontinuity Disintegration on Rotating Attractive Sphere
- 12:40 – 13:00 *Sergeev D.A., Troitskaya Yu.I., Kandaurov A.A.* Experimental Modeling of Air-Sea Interaction Under Hurricane Wind Conditions
- 13:00 – 13:20 *Gavrilov N.V., Liapidevskii V.Yu., Khrapchenkov F.F.* Solitary Internal Waves in a Shelf Zone
- 13:20 – 13:40 *Slunyaev A.V., Shrira V.I.* The Problem of the Highest Wave in a Group: Fully Nonlinear Simulations of Water Wave Breathers Vs Weakly Nonlinear Theory
- 15:00 – 15:20 *Gorodtsov V.A.* Wave-Vortex Disturbances in Stratified Viscous Fluids.
- 15:20 – 15:40 *Erofeev V.I., Tkach M.E., Soldatov I.N.* Gyroscopic Waves in a Rotating Layer of Conducting Viscous Fluid in a Constant Magnetic Field
- 15:40 – 16:00 *Mokhov I.I., Chefranov S.G., Chefranov A.G.* Interaction of Global Scale Atmospheric Vortices: Modelling Based on Hamiltonian Dynamic System of Antipodal Point Vortices on Rotating Sphere
- 16:20 – 16:40 *Harlander U., Koch S., Borcia I., Seelig T., Herzog N., Egbers C., Kurgansky M.V., Will A., Hollerbach R.* Inertial Waves Driven by Modulated Rotation: Spherical Shell and Annulus Geometry
- 16:40 – 17:00 *Budnikov A.A.* The Floating Markers Shifting on the Compound Vortex Surface
- 17:00 – 17:20 *Kuznetsova D.V., Sibgatullin I.N.* Specifics of Convective Regimes in the Presence of Density Maximum
- 17:20 – 17:40 *Fedyushkin A.I., Rozhkov A.N.* Investigation of the Impact and Spreading of Liquid Drops on Solid Surfaces
- 17:40 – 18:00 *Bulatov V.V., Vladimirov Yu.V.* Wave Dynamics of Stratified Mediums with Variable Depth: Exact Solutions and Asymptotic Representations

**Thursday, June 21, 2012**

- 10:00 – 10:20 *Georgievskaya A.B., Krasovsky G.B., Meshkov E.E., Ogorodnikov L.L., Tochilina A.A.* Hydrodynamic Models of Plane and Converging Cylindrical Shock Waves
- 10:20 – 10:40 *Chupakhin A.P., Cherevko A.A., Khe A.K., Telegina N.Yu.,*

- Krivoshapkin A.L., Orlov K.Yu., Panarin V.A., Baranov V.I.* Hemodynamics of Cerebrovascular Anomalies  
10:40 – 11:00 *Kistovich A.V.* The Integration of Multiscale Functions  
11:00 – 11:20 *Zagumennyi Ia.V., Bardakov R.N.* Ground Effect in Hydrodynamics of a Strip in a Stratified Fluid  
11:20 – 11:40 *Prokhorov V.E.* Surface Waves Excited by Ultrasound  
12:00 – 12:30 *Grue J.* Method for Interfacial Motion of Very Large Amplitude. Documentation of Mathematical Formulation and Numerical Experiments (*invited*)  
12:30 – 12:50 *Novotryasov V.V., Stepanov D.V.* On the tracer advection by nonlinear coastal Kelvin wave  
12:50 – 13:10 *Kalinichenko V.A., Wongwises S.* The Effect of Viscoelasticity on Breaking Standing Waves  
13:10 – 13:30 *Troitskaya Yu.I., Sergeev D.A., Kandaurov A.A.* Laboratory Investigation of the Wind Wave Surface Spectra for Smooth and Steep Waves  
15:00 – 15:20 *Collado H.* Control of Parametrically Excited Crane  
15:20 – 15:40 *Reutov V.P., Rybushkina G.V.* Numerical Simulation of Different Scale Convective Structures in Evaporating Liquid Layer with Shear Current  
15:40 – 16:00 *Kozlov N.* Inertial Oscillations and Average Dynamics of a Light Cylinder in Rotating Cavity with Liquid  
16:30 – 16:50 *Aktershev S.P., Kuibin P.A.* Stability of Swirl Axisymmetric Incompressible Flow  
17:00 – 17:20 *Baydulov V.G., Trofimov A.A.* The Flow Caused by Rotation of a Horizontal Cylinder in a Stratified Fluid  
17:20 – 17:40 *Fedyushkin A.I.* Heat Transfer of Water in Channel Flow with and without the Vibrations and Boiling  
17:40 – 18:00 *Bazarov M.Yu., Bazarov Yu.B., Golubev M.B., Meshkov E.E.* About possibility of decrease whirlpool negative effect

### **Friday, June 22, 2012**

- 10:00 – 10:20 *Elkin D.N., Kremenetskiy V.V., Zatsepin A.G.* Laboratory Study of Horizontal Mixing Process Between Two River Plumes at the Sea Shelf (with an Application to the Kara Sea)  
10:20 – 10:40 *Nesterov S.V.* Influence of a Vertical Electric Field on the Boundary Between Two Liquids (Theory and Experiment)  
10:40 – 11:00 *Meshkov E.E., Sirotkin A.A., Zamyslov D.N.* Bath-Tube Vortex Attenuates with the Increase of In-Vessel Water Level  
11:20 – 11:40 *Vulfson A.N., Borodin O.O.* Kinetic Theory and Distribution of Thermals over Velocities in a Turbulent Convective Mixed Layer  
12:00 – 12:30 *Dritschel D.G.* Waves and Turbulence: Their Cooperative Role in Structure Formation (*invited*)  
12:30 – 12:50 *Koshel K.V., Aleksandrova O.V., Kosolapkin G.U.* Numerical Modeling of the Diffusion of Passive Tracers in a Random Velocity Field

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12:50 – 13:10 *Shagalov S.V., Rybushkina G.V.* Nonlinear Interaction of the Unstable Normal Modes of a Parallel Shear Flow in Rotating Stratified Fluid Near the Onset of the Instability

13:10 – 13:30 *Kopiev V.F., Belyaev I.V., Faranosov G.A., Kopiev V.A., Zaytsev M.Yu.* Acoustic Forcing for Instability Wave Control in Turbulent Jets

13:30 – 13:50 *Vladimirov V. A.* Theory of Strongly Oscillating Flows

### **Acknowledgements**

Funding from all the agencies mentioned in (e) is gratefully acknowledged.

We also thank the Ministry of Education and Science of the Russian Federation for informative and visa request support.

Finally, we are grateful to all members of the Laboratory of Fluid Mechanics IPMech RAS for their tireless efforts in the smooth running of the meeting.

**Report composed by Y. Chashechkin**

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**12-5 IUTAM Symposium on Multiscale Problems in Stochastic Mechanics**  
Karlsruhe, Germany, June 25 – June 28, 2012**a) Scientific Committee**

*J.-M. Bourinet*, IFMA Clermont-Ferrand, France

*L. Graham-Brady*, John Hopkins University, USA

*M. A. Gutiérrez*, TU Delft, The Netherlands

*E. Kreuzer*, TU Hamburg, Germany (Representative of IUTAM)

*A. Naess*, NTNU Trondheim, Norway

*C. Proppe*, KIT Karlsruhe, Germany (Chairman)

*P. D. Spanos*, Rice University, Texas, USA

*W. Q. Zhu*, Zhejiang University, Hangzhou, China

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

The scientific committee selected presentations from 27 participants. They represented mathematicians, material scientists and engineers. The presentations addressed stochastic multiscale problems in continuum mechanics and multiscale problems in stochastic dynamics and stability. They covered the following scientific fields:

**Identification:**

H. G. Matthies reported on Bayesian parameter identification for nonlinear models. He presented a deterministic approach to a probabilistic interpretation of inverse problems. K. Sepahvand determined uncertain material parameters by generalized polynomial chaos expansion based on the general Pearson model. N. Sri Namachchivaya investigated real time filtering for complex multiscale systems. He combined stochastic dimensional reduction and nonlinear filtering for computing lower dimensional particle filters which are specifically adapted to the complexities of the underlying multiscale signal.

**Stochastic Multiscale Methods in Continuum Mechanics:**

M. Ostoja-Starzewski critically discussed stochastic multiscale mechanics from the standpoint of random fields of material properties and the choice of classical versus non-classical continua. He examined whether non-local continuum formulations can be generalized to stochastic settings consistent with the principles of mechanics. R. Cottreau extended the Arlequin method to a stochastic deterministic coupling method for multiscale problems and applied this approach to numerical homogenization of random materials. P. B. Nair presented projection schemes for the solution of stochastic partial differential equations with a large number of random variables. J. Guilleminot proposed prior representations for apparent material properties based on random fields. M. Di Paola discussed fractional hereditary materials and provided a description by a multiscale stochastic model. I.

E. Poloskov studied stochastic hereditary systems by obtaining chains of Fokker-Planck-like equations that were solved subsequently.

#### Stochastic Multiscale Modelling of Heterogeneous Materials:

G. Muscolino considered non-local interactions in unidimensional heterogeneous solids and adopted an interval model to represent the fluctuating mass density of the material. He was then able to obtain bounds of the axial displacements in closed form. M. Vasta investigated fiber distributions for biological tissues and developed improved hyperelastic material models for soft tissues. C. Proppe reported on stochastic multiscale modelling for metal foams. He presented a general approach for the prediction of macroscopic properties from stochastic geometry models. E. Savin developed probing techniques for anisotropic random media based on transport of elastic waves. S. Adhikari presented a stochastic multiscale approach for mid-frequency vibration problems based on a random matrix model.

#### Stochastic Multiscale Modelling for Damage and Fracture:

L. Graham-Brady presented an upscaling method for crack propagation and for random interactions in brittle materials under dynamic loading. Z. Yang investigated fracture models for asphalt mixtures with randomly distributed aggregates and embedded cohesive cracks. J.-M. Bourinet reported on the concept of damage tolerance and reliability assessment for aeronautical applications under random Markovian loads.

#### Multiscale Modelling in Stochastic Dynamics and Control:

L. Dostal reported on stochastic averaging of coupled roll-pitch and roll-heave motion in random seas. G. K. Er computed approximations for the probability density function of nonlinearly stretched beams excited by filtered white noise by means of a novel exponential expansion technique. J. Li presented the probability density evolution method and applied it to the evaluation of stochastic damage. F. Colonius computed supports of conditionally stationary measures for random diffeomorphisms. D. A. Yurchenko investigated the stochastic dynamics of a parametrically excited rotating pendulum.

#### Stability Problems in Multiscale Stochastic Dynamics:

W. V. Wedig presented in a survey his results on bifurcation and stability analysis in multi-scaled stochastic mechanics. V. Wihstutz compared noise induced resonance and rotation and mixing of modes. W. Kliemann computed stability radii of large stochastic systems from Lyapunov Exponents. L. Socha investigated the mean-square stability of linear stochastic hybrid systems possessing two different time-scales. I. Pavlyukevich reported on planar dynamical systems perturbed by heavy-tailed Lévy noise.

In summary, a multidisciplinary approach to the modelling and understanding of multiscale stochastic phenomena in continuum mechanics and in dynamics has been achieved and the importance of model order reduction has been highlighted.

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

There were 35 participants representing nine countries: Canada (1), China (4), Germany (13), France (4), Italy (3), Poland (1), Russia (1), UK (3), USA (5).

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

A contract has been signed for publication of the Proceedings in Elsevier's *Procedia IUTAM* series. Moreover, a limited number of extended and revised manuscripts will be published in a special issue of "Probabilistic Engineering Mechanics".

### **e) Financial Support**

The following support has been received:

- German Research Association (DFG): 3889,52 € for conference room rental, material and personnel
- German-French University (DFH): 2841,00 € for publication fees
- Karlsruhe Institute of Technology: personnel for conference organization and realization

Due to this generous support, the fee for the participants could be held low: a contribution of 350 € covered all expenses including conference room rental and material, publication fees, coffee breaks, four lunches, an excursion to Heidelberg with a guided tour and a visit to the castle and the university prison, the conference dinner and a guided bus tour to KIT labs.

### **f) Scientific Program**

#### **Monday, 25.06.12**

##### **1. Identification (Chair: P. B. Nair)**

10:00-10:30 H. G. Matthies, B. Rosić, O. Pajonk, A. Kučerová, J. Sýkora: Bayesian Identification of Parameters Describing Nonlinear Models of Heterogeneous Media

11:00-11:30 K. Sepahvand, S. Marburg: On Construction of Uncertain Material Parameters Using Generalized Polynomial Chaos Expansion from Experimental Data

11:30-12:00 N. Lingala, N. Sri Namachchivaya, N. Perkowski, H. C. Yeong: Multiscale Dynamics and Information in Data Collection and Assimilation for Complex Systems

##### **2. Stochastic Multiscale Methods in Continuum Mechanics (Chair: J.-M. Bourinet)**

14:00-14:30 M. Ostoja-Starzewski: From Random Fields to Classical or Generalized Continuum Models



14:30-15:00 R. Cottreau, D. Clouteau, H. Ben Dhia, C. Zaccardi: A Stochastic Deterministic Coupling Method for Multiscale Problems. Application to Numerical Homogenization of Random Materials

15:00-15:30 P. B. Nair, C. Audouze: Projection Schemes for High-Dimensional Stochastic Problems

16:00-16:30 J. Guillemot, C. Soize: Prior Representations of Random Fields for Stochastic Multiscale Modeling

16:30-17:00 M. Di Paola, M. Zingales: The Multiscale Stochastic Model of Fractional Hereditary Materials

17:00-17:30 V. V. Malanin, I. E. Poloskov: On some Methods for Study of Stochastic Hereditary Systems

### **Tuesday, 26.06.12**

#### **3. Stochastic Multiscale Modelling for Heterogeneous Materials (Chair: L. Graham-Brady),**

9:00-9:30 G. Muscolino, A. Sofi, M. Zingales: Long-Range Interactions of 1D Heterogeneous Solids with Uncertainty: Interval Versus Stochastic Analysis

9:30-10:00 M. Vasta, A. Pandolfi, A. Gizzi: A Fiber Distributed Model of Biological Tissues

10:00-10:30 C. Proppe: Stochastic Multiscale Modelling of Metal Foams

11:00-11:30 E. Savin: Kinetic Modeling for Anisotropic Transport of Elastic Waves in Random Media

11:30-12:00 S. Adhikari: A stochastic multiscale approach for mid-frequency vibration problem

#### **4. Stochastic Multiscale Modelling for Damage and Fracture (Chair: M. Ostoja-Starzewski),**

14:00-14:30 L. Graham-Brady: Upscaling Crack Propagation and Random Interactions in Brittle Materials under Dynamic Loading

14:30-15:00 A. Yin, X. Yang, Z. Yang: 2D and 3D Fracture Modelling of Asphalt Mixture with Randomly Distributed Aggregates and Embedded Cohesive Cracks

15:00-15:30 J.-M. Bourinet, C. Mattrand: Damage Tolerance and Reliability Assessment under Random Markovian Loads

### **Wednesday, 27.06.12**

#### **5. Multiscale Modelling in Stochastic Dynamics and Control (Chair: W. V. Wedig)**

9:00-9:30 L. Dostal, E. Kreuzer, N. Sri Namachchivaya: Stochastic Averaging of Coupled Roll-Pitch and Roll-Heave Motion in Random Seas

9:30-10:00 G. K. Er: The Probabilistic Solutions of Some Nonlinear Stretched Beams Excited by Filtered White Noise

10:00-10:30 J. Li, X. Ren: Density Based Modeling of Stochastic Damage Evolution

11:00-11:30 F. Colonius: Supports of Conditionally Stationary Measures for Random Diffeomorphisms

11:30-12:00 D. A. Yurchenko, P. Alevras: Stochastic Dynamics of a Parametrically Excited Rotating Pendulum

**Thursday, 28.06.12**

**6. Stability Problems in Multiscale Stochastic Dynamics (Chair: N. Sri Namachchivaya)**

9:00-9:30 W. V. Wedig: Bifurcation and Stability in Multi-Scaled Stochastic Mechanics

9:30-10:00 V. Wihstutz: Noise Induced Resonance versus Rotation and Mixing of Modes. A Survey.

10:00-10:30 W. Kliemann: Stability Radii via Lyapunov Exponents for Large Stochastic Systems

11:00-11:30 E. Seroka, L. Socha: Mean-Square Stability of Two -Time Scale Linear Stochastic Hybrid Systems

11:30-12:00 M. Högele, I. Pavlyukevich: Planar Dynamical Systems Perturbed by Heavy-Tailed Lévy Noise

12:00-12:30 Closing Session

14:00-17:00 Technical Tour to KIT Labs and Facilities

**Report prepared by C. Proppe**

**12-6 IUTAM Symposium on Fracture Phenomena in Nature and Technology**

Brescia, Italy, July 01 – July 05, 2012

The IUTAM Symposium on Fracture Phenomena in Nature and Technology was held at the School of Engineering, University of Brescia, Italy, during the week of July 1-5, 2012.

**a) Scientific Committee**

Bigoni Davide (*Italy, Chair*), Antony R. Ingraffea (*USA*), Jean Baptiste Leblond (*France*), James R. Rice (*USA*), Ares J. Rosakis (*USA*), Alberto Salvadori (*Italy*), John Willis (*UK*), Ben Freund (*USA, IUTAM Bureau Representative*).

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

This Symposium covered the following topics:

- Configurational forces
- Brittle fracture
- Dynamic fracture
- Ductile fracture
- Fatigue
- Interface fracture
- Multiscale mechanisms of fracture
- Fracture in Biomechanics
- Hydraulic fracture, Shale gas, geomaterials
- Identification

In their keynote lectures, J. Willis revisited the crack perturbation method that he contributed to found and J.Rice discussed the material physics of faults in rapid shear and consequences for earthquake dynamics. Recent developments in ductile fracture were analyzed in two invited lectures [K. Ravi-Chandar, D. Mohr], on the experimental and on the modeling sides.

The crack initiation and brittle fracture propagation continues to exert a profound challenge for mathematically inclined fracture mechanicians and for numerical simulators. A review of the current status of this problem and further advances were given mostly by scientists from the Italian and French schools, who investigated and presented general methods for brittle fracture and crack propagation. Two sessions focused dynamic fracture and microstructural changes – both in terms of reconstruction of microcrack post-mortem patterns and microstructural evolution – as well as interfaces – either features of structured ones along a crack with a harmonic feeding or constitutive modeling of nonlinear phenomena and laws, friction, dilatancy. Size /scale effects in the fracture of concrete, center point of

debate at many conferences for many years, have been revisited in a new perspective lecture.

Remarkable results concerning fracture and adhesion of materials at the nano-scale were presented in four devoted lectures. Quantum mechanics effects in the interstitial diffusion of species in lattice materials and new mechanism wherein hydrogen accumulation at nanometer scales takes place finally leading to macroscopic embrittlement have been discussed.

Other topics covered by notable lectures included biomechanics, hydraulic fracture towards modeling of shale gas extraction and CO<sub>2</sub> sequestration, identification using inverse analysis methods, simulations of fracture over multiple scales. The latter mainly aimed at bridging microscopic damage and macroscopic fracture, taking into account major computational issues as lack of scale separation.

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

There were 65 registered participants from 13 countries: Italy 17, USA 10, France 9, UK 8, Germany 4, Spain 4, Ukraine 4, Austria 3, Netherlands 3, Switzerland 3, Israel 2, Russia 1, Japan 1.

#### **d) Publication of Proceedings**

A contract to publish Proceedings in the online IUTAM Procedia series has been signed with Elsevier. These Proceedings will be edited by D. Bigoni, A.Salvadori, & K.Ravi-Chandar and it is hoped that they will appear in 2013.

#### **e) Financial Support**

In addition to the \$6000 support from IUTAM, the Symposium was generously supported by the University of Brescia, which also provided all support services, facilities and administration. In the week leading up to the international conference, thanks to a call of the University of Brescia, it was also organized a summer school on "Computational Multiscale Fracture Mechanics." The Summer School was attended by 25 students and 2 teachers (D. Warner, Cornell University, USA and S. Bordas, Cardiff University, Wales). We recall the support of the Episcopal boarding school St. George and the collaboration of the Faculty of Sciences of the Catholic University of Brescia. The attention from the Brescia area has allowed us to cover part of the cost to researchers from Eastern Europe, North Africa and who, because of the economic crisis, has requested assistance in order to participate in the event.

#### **f) Scientific Program**

**Monday July 2, 2012**

*General Lecture*

- 10.30 – 11.00 *J. Willis* Crack front perturbations reconsidered
- 11.00 – 11.20 *L.B. Freund* Interactions between molecular bonding, binder mobility and thermal fluctuations in cell membrane adhesion
- 11.20 – 11.40 *L. Lunghi and L. Deseri* Strain gradient membrane effects during cyclic adenosine monophosphate pathway in human trophoblast cells
- 11.40 – 12.00 *A.A. Abdel-Wahab, S. Li, E. Demirci, and V.V. Silberschmidt* Fracture processes in cortical bone
- 12.00 – 12.20 *O. Kolednik, J. Predan, J. Zechner, R. Schöngrundner, P. Fratzl, and F.D. Fischer* Assessment of cracks in inhomogeneous technical and biological materials
- 12.20 – 12.40 *J. Llorca, L.P. Canal, C. González, J. Segurado, J.M. Molina-Aldareguía, and F. Sket* Fracture of heterogeneous materials: a microstructural perspective
- 14.10 – 14.30 *J.B. Leblond, A. Karma, and V. Lazarus* Geometrical instability of coplanar crack propagation in mixed-mode I+III
- 14.30 – 14.50 *M. Negri* Analysis of finite and linear elasticity in quasi-static brittle fracture
- 14.50 – 15.10 *A. Pandolfi* A numerical study of heat driven fracture instabilities in brittle plates
- 15.10 – 15.30 *F. Fantoni, A. Salvadori, J.B. Leblond, and A. Carini* Minimum theorems in 3d incremental linear elastic fracture mechanics
- 16.00 – 16.20 *A. Needleman, V. Tvergaard, E. Bouchaud, Y. Cao, and L. Ponson* Variation of ductile fracture roughness with material properties
- 16.20 – 16.40 *T. Wierzbicki, K. Wang, and M. Luo* Periodic slant fracture in hole-expansion problems
- 16.40 – 17.00 *G. Del Piero* A diffuse cohesive energy model for fracture and plasticity
- 17.00 – 17.20 *D. Bigoni, L. Argani, and G. Mishuris* Dislocations in prestressed metals

## **Tuesday July 3, 2012**

### *General Lecture*

- 09.00 – 09.30 *J.R. Rice* Materials physics of faults in rapid shear and consequences for earthquake dynamics
- 09.30 – 09.50 *A. Carpinteri and M. Paggi* Crack size dependencies of paris' law parameters, fatigue threshold and fatigue limit: an interpretation based on fractality of crack surfaces
- 09.50 – 10.10 *R. Pippan, S. Wurster, W. Grosinger, G. Rathmayr, T. Klünsner, and C. Motz* Fatigue and fracture in micro dimensions
- 10.40 – 11.00 *V. Mantič and E. Graciani* Evaluation of the energy release rate in interface cracks with friction: application to a single fibre test in composites

- 11.00 – 11.20 *D.S. Kammer, V.A. Yastrebov, A.M. Aragon, and J.F. Molinari* Numerical modeling of slip dynamics at frictional interfaces
- 11.20 – 11.40 *M. Perelmuter* Multi-scale crack bridging model of composites fracture toughness
- 11.40 – 12.00 *G. Wimmer and H.E. Pettermann* Computational methods for the prediction of emergence and growth of delaminations in laminated composite components
- 12.00 – 12.20 *L. Ponson, S. Xia, G. Ravichandran, and K. Bhattacharya* Designed pinning of peeling fronts in thin film adhesives
- 12.20 – 12.40 *J.G.M. van Mier* Size/scale effects in the fracture of concrete: a new perspective
- 14.10 – 14.30 *M.J. Nieves, D.J. Colquitt, N.V. Movchan, I.S. Jones, and A.B. Movchan* Crack propagation within an inhomogeneous structured solid
- 14.30 – 14.50 *D. Dalmas, C. Guerra, J. Scheibert, and D. Bonamy* Understanding dynamic fracture in brittle materials from reconstruction of microcrack post-mortem patterns
- 14.50 – 15.10 *M. Brun and L.I. Slepyan* D'Alembert's paradox: from fluid to elasticity
- 15.10 – 15.30 *D. Rittel, S. Osovski, P. Landau, and A. Venkert* The causes for adiabatic shear failure: microstructural, thermal or both?

*POSTER SESSION: 16.00 – 17.30*

- F. Atrash and D. Sherman* Dynamic fracture instabilities in brittle crystals generated by thermal phonon emission: experiments and atomistic calculations
- P.N. Baranova* Fatigue crack growth in thin finite plates under completely reversed uniaxial loading
- J. Barés, D. Bonamy, D. Dalmas, and L. Hattali* Intermittency in brittle cracks: model experiment in artificial rocks
- E. Bosco, E. Coenen, V. Kouznetsova, M. Geers, and A. Salvadori* Multiscale computational homogenization modelling of microscale damage towards macroscopic failure
- A. Can Altunlu, P. van der Hoogt, and A. de Boer* Implementation of xfem-based crack for assessment for gas turbine combustor
- A.R. Cerrone, A. Nonn, A.R. Ingrassia, and C. Kalwa* Microstructure based modelling of high-strength pipeline steels
- D.J. Colquitt, M.J. Nieves, N.V. Movchan, I.S. Jones, and A.B. Movchan* Effect of a micro-structure on the thermal striping damage of an edge-cracked slab
- J. Kermode* Multiscale simulation of brittle fracture in oxide materials
- M. Lopez Pedrosa, M. Zanganeh, Y.H. Tai, and C. Pinna* Analysis of damage development in aa2050 in relation to 3d digital image correlation measurements
- E. Martínez-Pañeda and R. Gallego* Finite element evaluation of fracture mechanics in functionally graded materials

*M. Paggi and P. Wriggers* Bounds to the effective elastic properties, anisotropy and strength of hierarchical materials with imperfect interfaces

*T. Putelat and J.H.P. Dawes* Slope sliding transient dynamics

### **Wednesday July 4, 2012**

#### *General Lecture*

09.00 – 09.30 *K. Ravi-Chandar* Stress-based and strain-based modeling of ductile fracture at low stress triaxialities

09.30 – 09.50 *S. Kubo, T. Sakagami, and S. Ioka* Crack identification from electric potential response using inverse analysis methods

09.50 – 10.10 *V. Buljak, G. Cocchetti, and G. Maier* Calibration of fracture models by sharp indenters and inverse analysis

10.40 – 11.00 *A. Piccolroaz, G. Mishuris, and E. Radi* Mode III crack propagation in couple stress elastic materials

11.00 – 11.20 *M. Sauzay and K. Vor* Influence of plastic strain localization on grain boundary stress fields and microcrack nucleation

11.20 – 11.40 *P. Shanthraj and M.A. Zikry* Microstructural modeling of intergranular and transgranular failure modes in crystalline solids

11.40 – 12.00 *P.H. Geubelle and A. Aragón* Effect of in-plane deformations on the failure of heterogeneous adhesives: a 3D multiscale cohesive analysis based on an interface-enriched GFEM

12.00 – 12.20 *V.G. Kouznetsova, E.W.C. Coenen, E. Bosco, and M.G.D. Geers* A multi-scale approach for bridging microscale damage and macroscale fracture

12.20 – 12.40 *P. Kerfriden, A. Akbari, O. Goury, S.P.A. Bordas, and L. Margetsis* Addressing lack of scale separation in fracture simulations

14.10 – 14.30 *W.A. Curtin and J. Song* Crack size dependencies of Paris' law parameters, fatigue threshold and fatigue limit: an interpretation based on fractality of crack surfaces

14.30 – 14.50 *S.R. Na, K.M. Liechti, Y.J. Chabal, O. Seitz, and T. Peixoto* Molecularly informed traction-separation relations

14.50 – 15.10 *N.M. Pugno* Fracture and adhesion of super-nanomaterials: graphene (the strongest), spider-silk (the toughest), gecko foot (the most adhesive) and lotus leaf (the most anti-adhesive)

15.10 – 15.30 *D.H. Warner, R.J. Zamora, and A.K. Nair* Illuminating the chemo-mechanics of crack tip processes via quantum mechanics based concurrent multiscale modeling

16.00 – 16.20 *A.R. Ingraffea* Unconventional development of natural gas from shale: natural and unnatural hydraulic fracturing

16.20 – 16.40 *R. Conti, C. Tamagnini, and A. DeSimone* Subcritical softening and viscous regularization in Cam-Clay plasticity

16.40 – 17.00 *P. Ponte Castañeda* The effect of porosity and its anisotropic evolution on the viscoplastic behaviour of metals

17.00 – 17.20 *D. Leguillon, E. Karnaeva, A. Baroni, and C. Putot* Tight sedimentary covers for CO<sub>2</sub> storage

17.20 – 17.40 *G. Mishuris, M. Wrobel, and A. Linkov* Remarks on numerical simulation of the PKN model of hydrofracturing

### **Thursday July 5, 2012**

#### *General Lecture*

09.00 – 09.30 *D. Mohr, F. Ebnoether, and M. Dunand* Stress-based and strain-based modeling of ductile fracture at low stress triaxialities

09.30 – 09.50 *R. Denzer and A. Menzel* Configurational forces in nonlinear fracture mechanics of electro-active polymers

09.50 – 10.10 *M. Kuna* Generalized J-integrals and configurational forces for cracks in piezo- and ferroelectric materials

10.40 – 11.00 *R. Kienzler* Material conservation laws and reciprocity

11.00 – 11.20 *F. Fraternali* Some recent results in computational variational fracture

11.20 – 11.40 *F. Freddi and G. Royer-Carfagni* Fracture, plastic slip and damage: a common variational approach

11.40 – 12.00 *A. Piccolroaz and G. Mishuris* Integral identities for a semi-infinite interfacial crack in 2D and 3D elasticity

12.00 – 12.20 *V. Lazarus, G. Gauthier, B. Bourdin, and C. Maurini* Brittle fracture energy minimisation principles applied to the ex nihilo prediction of shrinkage cracks patterns

**Report prepared by D. Bigoni**



**12-7 IUTAM Symposium on Understanding Common Aspects of Extreme Events in Fluids**

Dublin, Ireland, July 02 – July 06, 2012

The IUTAM Symposium on Understanding Common Aspects of Extreme Events in Fluids was held at the Clinton Auditorium, University College Dublin, Ireland, during the week of July 2-6, 2012.

**a) Scientific Committee**

Miguel D. Bustamante (Ireland – Chairman), Amitava Bhattacharjee (USA), Marc Brachet (France), Robert Kerr (UK), Alan Newell (USA), Brian Sawford (Australia), Makoto Tsubota (Japan), Frédéric Dias (Ireland and France, IUTAM Bureau representative).

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

The Symposium has succeeded in putting together different disciplines that are faced with extreme events in disparate areas of research, such as magnetic fluids, quantum fluids, classical fluids, nonlinear optics, atmosphere, oceans, and solar physics. In several instances, researchers working on different areas found that they have been asking similar questions and using similar techniques. In other instances, techniques and ideas were transferred from one research area to another. All participants agreed that it was very useful to have confronted observations, experiments, numerical experiments and modelling, theory and analytical approaches in a multi-disciplinary environment.

The symposium covered many of the modern issues in fluid turbulence and the type of extreme events that occur therein:

- i. The possible occurrence of finite time singularities in the 3D incompressible Euler equations & reduced Euler models;
- ii. The 3D Navier-Stokes equations;
- iii. The primitive equations of the oceans & atmospheres;
- iv. Wave turbulence;
- v. Quantum turbulence;
- vi. Boundary layer turbulence;
- vii. Some aspects of nonlinear optics & other topics.

Several participants were interested in continuing multi-disciplinary collaborations, and have agreed to take part in a COST Action application led by Dr. Bustamante (chairman of the Symposium) at UCD. Some of the questions to be answered in future meetings and summer schools are the following:

- How to detect and classify observationally the signature of extreme events?
- How to resolve and validate numerical simulations of extreme events?

- How to approximate or model extreme events using mathematical and geometrical methods, and how to justify these models rigorously?

Some of the topics where methods are likely to be transferrable amongst disciplines are the following:

- The study of the behavior of vorticity field lines in classical fluids and superfluids, and magnetic field lines in MHD flows. For example, the local topology of the vorticity filaments in inviscid classical fluids apparently plays a central role in whether the solution to the Euler equation will generate singularities in finite time. Similarly, it is well established that magnetic field line reconnection is often accompanied by a strong release of energy.
- Pre-singularity and post-singularity scenario. Many physical systems behave in similar ways on certain length scales. For example, at length scales significantly larger than the dissipative length scales in classical systems or the healing length scales in quantum systems, the dynamics are essentially governed by the Euler equations. Therefore, when using a truncated model such as the Euler equation to simulate physics on such length scales, we can expect many similarities between a classical and a quantum system.
- Rogue waves. The rogue-wave solutions derived for the NLS equation were originally motivated in the context of water waves. However, we now understand that this equation is quite universal appearing in a broad range of problems including optics and more recently in Bose-Einstein condensates (BECs). Recent advances in the study of nonlinear optics has meant that these structures could be probed in these systems where the key assumptions used to arrive at the soliton solutions are more valid than in the water wave context. This is supported by the first experimental realization of the Peregrine soliton which was achieved with nonlinear optics. However, in more recent years a new system in the form of BECs has been created which allows an unprecedented level of control of system parameters.

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

The meeting attracted 57 participants, who came from institutions located in 12 different countries: Australia, Brazil, Chile, Czech Republic, France, Germany, India, Ireland, Japan, Russian Federation, UK and USA. More than 78% of the delegates were from overseas, and 21% of the delegates were postgraduate students or postdoctoral researchers.

### **d) Publication of Proceedings**

A contract to publish Proceedings in the online Procedia IUTAM series has been signed with Elsevier. The expected date of publication is September 2013.

**e) Financial support**

The following institutions have provided financial support for the Symposium: IUTAM (€4676), SIG (€4000), French Embassy in Dublin (€2500), SFI (€14400), UCD (€12500), Failte Ireland (€500).

**f) Scientific program****Monday 2 July 2012      Main Topic: Magnetic Fluids**

09h00 Foreword by Prof. Frédéric Dias, Secretary General IUTAM

09h10 Opening by Dr. Miguel D. Bustamante, Chairman IUTAM Symposium

09h15 Daniel Lathrop (Maryland, USA) – *Self-focusing in fluid dynamics*

10h15 David Pontin (Dundee, UK) – *On the relaxation of braided magnetic fields*

11h05 Gunnar Hornig (Dundee, UK) – *Relaxation of braided vorticity fields*

11h25 Sébastien Galtier (U. Paris-Sud, France) – *Solar magnetohydrodynamic turbulence*

11h45 Colm Connaughton (Warwick, UK) – *Rare events in stochastic aggregation*

14h30 Rainer Grauer (Bochum, Germany) – *Singularities and turbulence*

15h30 Anthony Yeates (Durham, UK) – *New topological constraints on magnetic relaxation*

16h20 Annick Pouquet (NCAR, USA) – *Ideal evolution of MHD turbulence when imposing Taylor-Green symmetries*

16h40 Yi-Min Huang (New Hampshire, USA) – *Magnetohydrodynamic instabilities and current sheet formation in line-tied systems*

17h00 Amitava Bhattacharjee (New Hampshire, USA) – *Fast reconnection due to the plasmoid instability in high-Lundquist-number plasmas: dynamics and statistics*

17h20 Quaker Meeting (40 min.)

18h00 Poster Inauguration

**Tuesday 3 July 2012      Main Topic: Classical Hydrodynamics**

09h00 Charles Meneveau (Johns Hopkins, USA) – *Lagrangian evolution and modeling of velocity gradient tensor in hydrodynamic turbulence*

10h00 Laurent Chevillard (ENS Lyon, France) – *A random vectorial field representing the local nature of turbulence*

10h50 Diego Donzis (Texas A&M, USA) – *Extreme events in turbulence: scaling and forecast through high-resolution direct numerical simulations*

11h10 Gregory Bewley (Max-Planck-Institute DS, Göttingen, Germany) – *Observation of the sling effect*

11h30 Jérémie Bec (Obs. Côte d'Azur, Nice, France) – *Timescales of turbulent relative dispersion*

13h50 John D. Gibbon (Imperial College, UK) – *On the gradient of potential vorticity*

14h50 Robert Kerr (Warwick, UK) – *Fully developed hydrodynamic turbulence from a chain reaction of reconnection events*

15h40 Joseph Klewicki (New Hampshire, USA, & Melbourne, Australia) – *On the singular nature of turbulent boundary layers*

16h00 Jason Laurie (ENS Lyon, France) – *A large deviation approach to computing rare transitions in multi-stable stochastic turbulent flows*

16h20 Brian Sawford (Monash, Australia) – *Turbulent Lagrangian velocity statistics conditioned on extreme values of dissipation*

16h40 Quaker Meeting (1 hr. 20 min.) – On the singularity problem

**Wednesday 4 July 2012** *Main Topic: Fundamental Systems: Pure Mathematics' Viewpoint*

09h00 Cédric Villani (Lyon, France)

10h00 Chuong van Tran (St. Andrews, UK) – *Regularity of magnetohydrodynamic turbulence in the absence of magnetic diffusion*

10h50 Evgenii Kuznetsov (RAS Moscow, & Novosibirsk, Russia) – *Collapse and the Kolmogorov spectrum*

11h10 Marc Brachet (ENS Paris, France) – *Interplay between the BKM theorem and the analyticity-strip method to investigate numerically the incompressible Euler singularity problem*

11h30 Gregory Eyink (Johns Hopkins, USA) – *Large Deviations in Wave Kinetics*

11h50 Miguel D. Bustamante (University College Dublin, Ireland) – *3D Euler equations and ideal MHD mapped to regular systems: probing the finite-time blowup hypothesis*

**Thursday 5 July 2012** *Main Topic: Quantum Hydrodynamics*

09h00 Vanderlei Bagnato (São Paulo, Brazil) – *Many aspects of Quantum Turbulence in Trapped atomic superfluid*

10h00 Rahul Pandit (Indian Institute of Science, Bangalore, India) – *Dissipationless Gross-Pitaevskii turbulence in two dimensions*

10h50 Hiroki Saito (Univ. Electro-Communications, Tokyo, Japan) – *Hydrodynamic instabilities and vortex streets in superfluids*

11h10 Francesco Fedele (Georgia Institute of Technology, USA) – *Wave breaking and vortex breakdown in axisymmetric Poiseuille pipe flows*

11h30 Marco La Mantia (Charles Univ., Prague, Czech Republic) – *Motion of solid hydrogen and deuterium particles in He II thermal counterflow*

13h50 Carlo Barenghi (Newcastle, UK) – *Quantum vortex reconnections*

14h50 Victor Tsepelin (Lancaster, UK) – *Pure quantum turbulence in superfluid  $^3\text{He-B}$  at low temperatures*

15h40 Makoto Tsubota (Osaka City Univ., Japan) – *Quantum turbulence: the interests and the brief research history*

16h00 Giorgio Krstulovic (Obs. Côte d'Azur, Nice, France) – *Kelvin-waves in Gross-Pitaevskii vortices*

16h20 Hayder Salman (East Anglia, UK) – *Self-reconnecting quantized vortices in superfluid turbulence*

16h40 Quaker Meeting (40 min.)

**Friday 6 July 2012**      **Main Topic: Atmosphere, Waves and Optics**

09h00 Vladimir Zakharov (Arizona, USA)

10h00 Frédéric Dias (University College Dublin, Ireland) – *Extreme wave events in Ireland : 14680 BP – 2012*

10h50 John Dudley (Franche-Comté, France) – *Kuznetsov-Ma soliton dynamics in optical fibre*

11h10 Pavel Lushnikov (New Mexico, USA) – *Beyond log-log scaling of critical collapse of nonlinear Schrödinger equation*

11h30 Patrick Shipman (Colorado, USA) – *Patterns and oscillations in topochemical microtornados, microhurricanes, and microstalactites*

11h50 Alan Newell (Arizona, USA, also Warwick, UK) – *Pattern quarks and leptons*

14h30 John Methven (Reading, UK) – *Extreme cyclones: recent observations, high-resolution simulation and opportunities for theoretical advance*

15h30 Phillipe Caillol (Concepción, Chile) – *A nonlinear and singular vortex Rossby wave within a rapidly rotating vortex*

16h20 Emiliano Renzi (University College Dublin, Ireland) – *Analytical and numerical investigation on landslide tsunamis propagating along a plane beach*

16h40 Quaker Meeting (40 min.) – Final discussion and closing comments

**Report composed by M. Bustamante**

## 12-8 IUTAM Symposium on Topological Fluid Dynamics II

Cambridge, UK, 23 July – 27 July, 2012

The IUTAM Symposium on Topological Fluid Dynamics was held at the Isaac Newton Institute for Mathematical Sciences, University of Cambridge, UK, during the week of July 23-27, 2012.

### a) Scientific committee

Yoshifumi Kimura (*Japan, Chair*), Konrad Bajer (*Poland, Co-Chair*), Jean-Marc Chomaz\* (*France*), Mark Stremler\*\* (*USA*), Peter Constantin (*USA*), David Dritschel (*UK*), Keith Moffatt (*UK, Co-Chair*), Timothy Pedley (*UK, IUTAM Bureau Representative*).

\*Jean-Marc Chomaz resigned from the Committee in February 2012 on account of illness.

\*\*Mark Stremler was co-opted to the Committee in succession to Hassan Aref (*USA*) who had served on the Committee until his untimely death in September 2011.

### b) Short summary of scientific progress achieved

This Symposium was a sequel to the the IUTAM Symposium *Topological Fluid Mechanics* held in Cambridge UK in August 1989, and was planned to cover the following topics:

- Steady vortical solutions of the Euler equations and their stability;
- Interaction of vortex pairs, vortex rings, etc;
- Vortex reconnection by viscosity;
- The finite-time singularity problem for Euler and Navier-Stokes equations;
- Application to the structure of turbulence and the process of turbulent dissipation.

Fluid dynamics and topology are natural companions, both being concerned to some extent with continuous deformation ('flow' or 'isotopy' depending on one's point of view). This is vividly illustrated by the applicability of the Thurston-Nielsen theory of diffeomorphisms of surfaces to the problem of stirring in two-dimensions by a number of rods undergoing a prescribed time-periodic movement in the plane (Boyland, Aref & Stremler 2000, *JFM* **403**, 277-304). Three keynote lecturers [P. Boyland, J.-L. Thiffeault, M. Stremler] treated the underlying theory and applications. Exponential growth of material line elements occurs under a suitable succession of 'interchange' displacements of the stirring rods, behaviour that is probably generic. Many fascinating questions are raised by this approach to problems of stirring and mixing; in particular, can the results be extended in any meaningful way to 3D flow? The spirit of Hassan Aref was very evident in these lectures, as also in the 'Aref Memorial Lecture' given by M. Brøns on *Equilibria of*

*point vortices*, a classical subject dear to Hassan's heart, on which new discoveries are still being made.

Topological ideas in fluid mechanics go back to Kelvin, who recognised that vortex knots and links would persist indefinitely in an ideal fluid (at least for so long as singularities of vorticity do not occur). The simplest measure of the net linkage of a field of vorticity is the total helicity of the flow, and a number of papers in the Symposium were concerned with flows with non-zero helicity. Typhoons, tornadoes and dust-devils are well-known examples in geophysics. In this context, Peralta-Salas and Enciso presented their remarkable results concerning the existence of Beltrami flows containing vortex lines of any knot- or link type [Ann. Math. 2012, **175**, 345-367]. Again, many fascinating questions are raised by this result: What is the global structure of the Beltrami flow associated with a given knot? Are such Beltrami flows dynamically stable under isovortical perturbation? Do such flows necessarily have regions of chaos (exponential divergence of streamlines)?

The proviso concerning possible singularities of vorticity under Euler evolution continues to exert a profound challenge for mathematically inclined fluid dynamicists, and for direct numerical simulators. A review of the current status of this problem was given by E.Titi, and lectures bearing upon it were given by J.Gibbon, R.M.Kerr, S.Childress, B.Protas, and others.

Other topics covered by notable lectures having a topological flavour included reconnection of quantised vortices [T. Lipniacki], the structure and stability of flow in a precessing sphere [S. Kida], and topological transitions of a soap-film under slow deformation of the boundary wire [R.E. Goldstein]. The opening lecture [C.R. Doering] concerned rigorous upper bounds for vertical heat transport in Rayleigh-Bénard convection.

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

There were 79 registered participants from 14 countries: UK 19, USA 15, Japan 10, Poland 6, France 5, Spain 5, Russia 5, Germany 3, Italy 3, Israel 3, Canada 2, Australia 1, Brazil 1, Denmark 1.

### **d) Publication of Proceedings**

A contract to publish Proceedings in the online IUTAM *Procedia* series has been signed with Elsevier. These Proceedings will be edited by K.Bajer, Y Kimura & H.K.Moffatt, and it is hoped that they will appear early in 2013.

**e) Financial Support**

In addition to the \$6000 support from IUTAM, the Symposium was generously supported by the Newton Institute, which also provided all support services, facilities and administration.

**f) Scientific Program**

(K): keynote lecture; \* presenting author

**Monday 23 July**

10.40-11.00 H.K.Moffatt. Opening Remarks

**Session 1 Chair: Y.Kimura**

11.00-11.40 (K) Doering CR

Ultimate state of two-dimensional Rayleigh-Bénard convection.

11.45-12.05 \*Schneider K, Jacobitz F, Bos W & Farge M

On helical multi-scale characterisation of homogeneous turbulence.

12.10-12.30 \*Chkhetiani O, Koprov V & Koprov B

Turbulent vorticity and helicity in stratified atmospheric boundary layer.

**Session 2 Chair: M.Berger**

14.00-14.40 (K) Oberlack M

New conservation laws of helical flows.

14.45-15.05 Kurganski MV

Simple models of helical baroclinic vortices.

15.10-15.30 Yahalom A

Using fluid variational variables to obtain new analytic solutions with nonzero helicity.

**Session 3 Chair: J.-L.Thiffeault**

16.00-16.40 (K) Boyland P

Exponential growth in two-dimensional topological fluid dynamics.

16.45-17.05 Tanda S

Topological crystals as a new paradigm.

17.10-17.30 \*Ohkitani K & Al Sulti F

Numerical and analytical study of an asymptotic equation for deformation of vortex lattices.

**Tuesday 24 July****Session 4 Chair: R.Ricca**

09.00-09.40 (K) Peralta-Salas D

Knotted vortex tubes in the Euler equations.

09.45-10.05 Enciso A

Knots and links in fluid mechanics.

10.10-10.30 \*Maggioni F, Alamri SZ, Barenghi CF & Ricca RL

Velocity, energy and helicity of vortex knots and unknots.

**Session 5 Chair: E.Titi**



11.00-11.40 (K) Gibbon JD

Intermittency and conditional regularity of solutions of the 3D Navier-Stokes equations.

11.45-12.05 Barenghi CF

Vortices and knots in quantum fluids.

12.10-12.30 \*Luzzatto-Fegiz P & Williamson CHK

An accurate and efficient method to compute steady vortices without symmetry.

**Session 6 Chair: E.Meiberg**

14.00-14.40 (K) Friedlander S

Instabilities and ill-posedness for the magnetogeostrophic equation.

14.45-15.05 Kerr RM

Dissipation and enstrophy statistics in turbulence: are the simulations and mathematics converging?

15.10-15.30 \*Kolomenskiy D, Moffatt HK, Farge M & Schneider K

Fluid dynamics of flapping wings associated with change in domain topology.

15.35-15.55 Petrosian A

Vortical dynamo in turbulent multiphase flows.

15.55-16.05 Libin A

Coherent Beltrami structures.

**16.00-16.40 Afternoon tea and poster session**

**Posters:**

Allshouse M. Dynamically distinct decomposition via braid theory.

Córdoba D & Gómez-Serrano J. Splash singularity for water waves.

Gilbert AD. Complex singularities for two-dimensional fluid flows.

Libin A. Coherent Beltrami structures.

Matsuura T. Creation of topological crystals and topology-change surgery.

**Session 7 Chair: H.K.Moffatt**

16.45-17.30 **Aref Memorial Lecture:** Brøns M

Relative equilibria of point vortices.

**Wednesday 25 July**

**Session 8 Chair: Y.Fukumoto**

09.00-09.40 (K) Khesin B

Variational principles for steady flows.

09.45-10.05 Liu X & Ricca RL

Tackling structural complexity by Jones' polynomials.

10.10-10.30 Mitsumatsu Y

Helicity in differential topology.

**Session 9 Chair: J.Gibbon**

11.00-11.40 (K) Titi E

How much do we know about the problem of global regularity for the three-dimensional Navier-Stokes and Euler equations?

11.45-12.05 Ricca RL

Impulse of vortex knots from diagram projections.

12.10-12.30 Goldstein RE, Moffatt HK, Pesci AI

A soap-film Möbius strip changes topology with a twist singularity.

### Thursday 26 July

#### Session 10 Chair: M.Stremler

09.00-09.40 (K) Thiffeault J-L

Topological approaches to problems of stirring and mixing.

09.45-10.05 \*Hornig G, Wilmot-Smith A & Pontin D

Relaxation of braided magnetic and vorticity fields.

10.10-10.30 Velasco-Fuentes O

Stirring vortices with vorticity holes.

#### Session 11 Chair: A.Gilbert

11.00-11.40 (K) Stremler MA

Identifying topological chaos using set-oriented methods.

11.45-12.05 Kimura Y

Mass transport by vortex motions.

12.10-12.30 Sadowski W

Lagrangian trajectories for the 3D Navier-Stokes equations.

#### Session 12 Chair: M.Farge

14.00-14.40 (K) Kida S

Instability by weak precession of the flow in a rotating sphere.

14.45-15.05 \*Elimelech Y, Kolomenskiy D, Moffatt HK & Dalziel SB

Evolution of the leading edge vortex over an accelerating rotating wing.

15.10-15.30 Kudela H & Kosior A

Parallel computation of vortex tube reconnection using graphics card and vortex particle methods.

15.35-15.55 Kurska M, Bajer K & \*Lipniacki T

Cascade of vortex loops initiated by a single reconnection of quantum vortices.

15.55-16.05 Boatto S

Motion of point vortices on a curved surface.

#### Session 13 Chair: T.J.Pedley

16.45-17.30 (K) Cordoba D

Finite time singularities for the free boundary incompressible Euler equations.

### Friday 27 July

#### Session 14 Chair: K.Bajer

09.00-09.40 (K) Meiberg E

Three-dimensional vorticity dynamics in miscible Hele-Shaw displacements.

09.45-10.05 Hattori Y & Llewellyn-Smith SG

Motion of axisymmetric magnetic eddies with swirl.

10.10-10.30 Hirota M, Morrison PJ, Ishii Y, Yagi & Aiba N

Variational method for estimating nonlinear acceleration of collisionless magnetic reconnection.

**Session 15 Chair: C. Williamson**

11.00-11.40 (K) Yoshida Z

Singular Casimir elements: their mathematical justification and physical implications.

11.45-12.05 \*Fukumoto Y & Sakuma H

A unified view of topological invariants of barotropic and baroclinic fluids and their application to

formal stability analysis of three-dimensional ideal gas flows.

12.10-12.30 Klein R, \*Nguyen-van-yen R & Waidman M

Non-stationary boundary layers and energy dissipation in incompressible flows.

**Session 16 Chair: C.R. Doering**

14.00-14.40 (K) Childress S

How fast can vorticity stretch itself?

14.45-15.05 \*Hormoz S & Brenner MP

Absence of singular stretching of interacting vortex filaments.

15.10-15.30 Protas B

Probing fundamental bounds in hydrodynamics using variational optimisation methods.

**Acknowledgements**

The Isaac Newton Institute provided an ideal environment for informal interactions throughout the week of the Symposium, and we are grateful to the Director and Staff of the Institute for their tireless efforts to ensure the success of the meeting.

**Report composed by Y. Kimura, K. Bajer and H.K. Moffatt**

**12-9 IUTAM Symposium on Hysteresis and Pattern Evolution in Non-Equilibrium Solid-Solid Phase Transitions**

Hong Kong, August 15 – August 18, 2012

**a) Scientific Committee**

Qingping Sun (Hong Kong, Chairman), Richard D. James (USA), Lev Truskinovsky (France), Henryk Petryk (Poland), Yilong Bai (China), John Ball (UK), Jordi Ortin (Spain), Stelios Kyriakides (USA, IUTAM Representative).

**b) Short summary of the scientific activity of the symposium**

Phase transition phenomena in solids are of vital interest to physicists, materials scientists and engineers who need to understand, model and control the mechanical behaviors and properties of solids during phase transitions. Materials with solid-solid phase transitions have important applications in many technical fields, especially with the fast development of nano-materials and nano-technology. Nonlinearity, non-equilibrium and multi-scale coupling are inherent in the phase transition process and play central roles in the hysteretic behaviors and deformation patterns observed in different kinds of materials. The aim of this symposium is to bring scientists from material science, biology, physics and mechanics together to discuss different aspects and the latest advances of this active multi-discipline field. Sponsored by the IUTAM, this 4-day symposium followed the tradition of IUTAM and was held in the single session format of IUTAM symposia. The scientific presentation and discussions focused on the following topics:

- coupling of physical processes at different time and length scales;
- mechanical behavior and kinetics of solid-solid phase transitions;
- hysteresis and pattern evolution in nonequilibrium phase transitions;
- instability, bifurcation, formation and evolution of spatial-temporal structures;
- trans-scale modelling in the mechanics of solid-solid phase transition;
- scaling laws of material's response in solid-solid phase transitions;
- experimental technique for multiscale and multi-field coupling;
- solid-solid phase transition phenomena in biological systems.

**c) Countries and number of participants**

50 registered participants (some of them PhD students and Postdocs) attended the technical session of the symposium. 26 oral presentations were made by distinguished scholars. Theoretical, experimental and computational aspects of the subject were discussed and addressed in the symposium. These invited speakers came from 8 countries: Australia (2), Hong Kong and mainland China (8), France (4), USA (7), Germany (1), Poland (1), Romania (1), Japan (1).

**d) Proceedings of the symposium**

A special issue of the International Journal of Solids and Structures to publish the selected papers from the symposium has been discussed and arranged. Hopefully it will be published in 2014.

**e) Financial support**

The symposium was sponsored by

- IUTAM (The International Union of Theoretical and Applied Mechanics)
- Croucher Foundation
- Bose Corporation, UAS
- Pymble technology Inc., Taiwan
- Hysitron Inc. USA
- Tegent Scientific Ltd., Hong Kong
- Flir System, Inc. USA
- Hong Kong University of Science and Technology
- HKSTAM (The Hong Kong Society of Theoretical and Applied Mechanics)

**f) Scientific program of the symposium****Wednesday August 15, 2012**

09:40-10:20 Cyclical Phase Transformations in Driven Alloy Systems *Jong K. Lee*

10:50-11:30 Martensite Reorientation in Magnetic Shape Memory Alloys under Multiaxial Magneto-mechanical Loadings *Yongjun He*

11:30-12:10 Deformation patterns in solid solutions due to PLC: the example of AA5083-H116 aluminum alloy *Ahmed Benallal*

13:40-14:20 Functionally Graded NiTi Shape Memory Alloy *Yinong Liu*

14:20-15:00 Effect of Nonlinearity on the Steady Motion of a Twinning Dislocation *Anna Vainchtein*

15:30-16:10 Modeling Post-buckling Pattern Formation in a Compressed Layer on Compliant Substrates *Yong Ni*

16:10-16:50 Hyperstabilization of Thermoelastic Martensite *Jan van Humbeeck*

16:50-17:30 Energy Dissipations and Latent Heat in Stress-induced Martensitic Transformations under Non-static Loadings *Yongzhong Huo*

**Thursday August 16, 2012**

09:00-09:40 Effect of Lüders like Material Instabilities on the Response and Stability of Some Structures *Stelios Kyriakides*

09:40-10:20 Superelasticity with Nearly Vanishing Hysteresis in a Wide Temperature Range *Yunzhi Wang*

10:50-11:30 Micromechanics of Multiferroic Materials: Phase Field Simulations and Scanning Probe Microscopy Characterizations *Jiangyu Li*

11:30-12:10 Simulation of Bacterial Flagellar Phase Transition by Non-convex and Non-local Continuum Modeling *Xiaoling Wang*

13:40-14:20 On Wave Propagation in Phase-transforming Strings - Thermal Effects and Damping Properties *Cristian Făciu*

14:20-15:00 Modeling of Stress-induced Microstructure Evolution and Size-dependent Hysteresis in Shape Memory Alloys *Henryk Petryk*

15:30-16:10 Depth Dependencies of Shape Memory Alloy's Hardness under a Sharp Indenter and a Spherical Indenter *Wenyi Yan*

16:10-16:50 Analytical Solutions for the Hysteresis Loop and Inner Loop in Thin SMA Layer *Hui-Hui Dai*

16:50-17:30 Micromechanical modeling of shape memory alloys – energies and evolution *Philipp Junker*

### **Friday August 17, 2012**

09:00-09:40 Reversible Stress-Induced Martensitic Phase Transformations in Perfect Bi-Atomic Crystals *Nicolas Triantafyllidis*

09:40-10:20 Low-hysteresis Smart Materials by “critical-point-engineering” *Xiaobing Ren*

10:50-11:30 Effect of Stretching Rate on Domain Spacing in a NiTi Shape Memory Alloy Strip *Runhua Zhou*

11:30-12:10 Domain Evolution in Ferromagnetic Materials: A Real Space Phase Field Model and Finite Element Implementation *Jie Wang*

13:40-14:20 Dynamic Sorting of Lipids and Proteins in Multi-component Membranes *Hongyuan Jiang*

14:20-15:00 Thermomechanical Coupling in the Cyclic Behavior of Shape Memory Alloys *Ziad Moumni*

15:30-16:10 Interplay between Martensitic Phase Transformation and Plastic Slip in Polycrystalline Materials *Kaushik Bhattacharya*

16:10-16:50 Temperature and Stress Oscillations under Cyclic Phase Transition of Superelastic NiTi Shape Memory Alloy *Hao Yin*

16:50-17:30 Role of Grain Size in Stress-strain and Cyclic Loading Behavior of Superelastic NiTi *Aslan Ahadi*

**Report prepared by Q. Sun**

**12-10 IUTAM Symposium on Particle Methods in Fluid Mechanics**

Lyngby, October 15 – October 17, 2012

The IUTAM Symposium on Particle Methods in Fluid Mechanics was held at the Department of Mechanical Engineering at the Technical University of Denmark, DK during the week of October 15–17, 2012.

**a) Scientific Committee**

Nikokauss A. Adams (DE), Hassan Aref\* (DK/USA IUTAM Bureau Representative), Frederic Dias\*\* (IE, IUTAM Bureau Representative), Philippe Chatelain (BE), Anthony Leonard (USA), Win Kam Liu (USA), Peter K. Stansby (UK), Danien Violeau (FR), Jens Honore Walther (DK, Chair).

\*\*Frederic Dias was co-opted to the Committee in succession to Hassan Aref\* (DK/USA) who had served on the Committee until his untimely death in September 2011.

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

This Symposium is the first IUTAM Symposium on Particle Methods in Fluid Mechanics, and was planned to cover the following topics:

- Fluctuating dynamics including molecular and dissipative particle dynamics.
- Smoothed particle hydrodynamics.
- Vortex methods.
- Reproducing kernel and moving least squares methods.
- Fast algorithms, including GPU, fast multipole and hybrid particle-mesh algorithms.
- Multiresolution and multiscale coupling.

The Symposium spurred intense discussions on the necessity to add “remeshing” as a key algorithmic component to ensure convergence of particle methods. In addition, boundary conditions were discussed with focus on efficient methods for simulating open systems.

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

There were 26 registered participants from 14 countries: Belgium 3, Germany 4, Brazil 1, India 1, Ireland 1, Italy 1, Denmark 4, USA 2, Switzerland 1, Norway 1, France 3, Slovenia 1, Poland 1, Japan 1.

**d) Publication of Proceedings**

A contract to publish Proceedings in the online IUTAM Procedia series has been signed with Elsevier. These Proceedings will be edited by J. H. Walther and it is hoped that they will appear in 2013.

### e) Financial support

In addition to the \$6000 support from IUTAM, the Symposium was generously supported by the COWI foundation<sup>1</sup> and the Department of Mechanical Engineering, which also provided all support services, facilities and administration.

<sup>1</sup>www.cowifoundation.com

### f) Scientific program

#### Monday, October 15, 2012

09:30 – 10:20 Keynote lecture *Microrheology simulations using particle methods*

Vazques Quesada, A; Ellero, M.; Espanol, P.

10:20 – 11:10 Lecture session 1: SPH

10:20 – 10:45 *Numerical simulation of wave impact on a rigid wall using a coupled two-phase compressible SPH and an incompressible potential flow solver* Rafiee, A.; Dias, F.

10:45 – 11:10 *Coupled SPH-FVM simulation within the OpenFOAM framework*

Kumar, P. K.; Yang, Q.; Jones, V., McCue, L.

11:30 – 12:30 Poster session

*On vortex shedding from smooth and rough bluff bodies in turbulent flows* Bimbato, A. M.; Alcantara Pereira, L. A.; Hirata, M. H.

*Turbulence modelling in the two-dimensional vortex-in-cell method* Hejlesen, M. M.; Rasmussen, J. T.; Larsen, A.; Walther, J. H.

*Three dimensional remeshed smoothed particle hydrodynamics for the simulation of turbulent flow in complex geometries* Obeidat, A.; Walther, J. H.

*A numerical study of the aerodynamic admittance of bridge deck sections by a two-dimensional mesh-free vortex method* Hejlesen, M. M.; Rasmussen, J. T.; Larsen, A.; Walther, J. H.

13:30 – 14:45 Lecture session 2: SPH

13:30 – 13:55 *A SPH model for incompressible turbulence* Hu, X. Y.; Adams, N. A.

13:55 – 14:20 *Density-consistent initialization of SPH on a Cartesian grid:*

*Comparative numerical study of 10 smoothing kernels in 1, 2 and 3 dimensions*

Bjønnes, E.; Bjørnson, F. O.; Busklein, J. O.; Coudert, T.; Klebert, P.; Lavrov, A; Lund, B.; Lye, K. O.; Olsen, J. E.; Pakozdi, C.; Seland, J.; Skjetne, P.; Yang, W.

#### Tuesday, October 16, 2012

09:30 – 10:20 Keynote lecture

*Adaptive resolution simulations coupled to continuum* Praprotnik, M.

10:20 – 11:10 Lecture session 3: SPH

10:20 – 10:45 *Buoyancy driven, multi-phase flow simulations using smoothed particle hydrodynamics: towards the model for boiling phenomena* Szwec, K.; Pozorski, J.; Minier, J.-P.



10:45 – 11:10 *SPH based approach toward the simulation of non-cohesive sediment removal by an innovative technique using a controlled sequence of underwater micro-explosions* Guandalini, R.; Agate, G.; Manenti, S.; Sibilla, S.; Gallati, M.

11:30 – 12:30 Lecture session 4: SPH

11:30 – 11:55 *Bubble formation from submerged orifice under microgravity: a smoothed particle hydrodynamics approach* Das, A. K.; Das, P. K.

11:55 – 12:20 *Simulation of an elastic pendulum with hydrodynamic damping and experimental validation* Beck, F., Fleissner, F. Eberhard, P.

13:30 – 14:45 Lecture session 5: Hybrid Methods

13:30 – 13:55 *Mucus and ciliated cells of human lung: splitting strategies for particle methods and 3D Stokes flows* Chatelin, R.; Poncet, P.; Didier, A.; Murriss-Espin, M.; Anne-Archard, D.; Thiriet, M.

13:55 – 14:20 *Lagrange-remap schemes and low-diffusive interface capturing method for air-water flows* Champmartin, A; De Vuyst, F.

14:20 – 14:45 *Vortex particle-mesh methods with immersed lifting lines for aerospace and wind engineering applications* Backaert, S.; Chatelain, P.; Winckelmans, G.

15:05 – 16:00 Lecture session 6: Hybrid Methods

15:05 – 15:30 *TVD particle methods for conservation laws: design, analysis and applications* Cottet, G.-H.; Magni, A.; Weynans, L.

15:30 – 16:00 *Numerical simulation of transport and diffusion in porous media using a particle set of contours method* Beaugendre, H.; Huberson, S.; Mortazavi, I.

### **Wednesday, October 17, 2012**

09:30 – 10:20 Keynote lecture

*Multi-scale simulations using particles* Koumoutsakos, P.

10:20 – 11:10 Lecture session 7: Vortex Methods

10:20 – 10:45 *Numerical simulation of bubbly flow by vortex in cell method* Uchiyama, T.; Yoshii, Y.

10:45 – 11:10 *Vortex sheet model for the oblique collision of vortex rings* Kaganovskiy, L.; Krasny, R.

11:30 – 12:30 Lecture session 8: Vortex Methods

11:30 – 11:55 *Engineering application of the discrete vortex method in bridge aerodynamics* Larsen, A.; Poulin, S.

11:55 – 12:20 *High order Poisson solver for unbounded flows* Walther, J. H.; Hejlesen, M. M.; Rasmussen, J. T.; Chatelain, P.

13:30 – 14:20 Lecture session 9: Vortex Methods

13:30 – 13:55 *Anisotropic kernels for self-organizing Lagrangian particles* Sbalzarini, I. F.; Häcki, C.; Reboux, S.

13:55 – 14:20 *Unbounded immersed interface solver for vortex particle-mesh methods* Marichal, Y.; Chatelain, P.; Winckelmans, G.

**Report composed by J. H. Walther**

## **12-11 IUTAM Symposium on Advances of Optical Methods in Experimental Mechanics**

Taipei, November 03 – November 06, 2012

The IUTAM Symposium on Advances of Optical Methods in Experimental Mechanics was held at the Grand Hotel, Taipei, Taiwan during the week of November 3-6, 2012.

### **a) Scientific Committee**

Wei-Chung Wang (Taiwan, Chair), Fu-Pen Chiang (USA), Emmanuel Gdoutos (Greece), Jonathan Huntley (UK), Jean-José Orteu (France), Wolfgang Osten (Germany), Giovanni Petrucci (Italy), Ben Freund (USA, IUTAM Representative).

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

This Symposium was a sequel to the IUTAM Symposium on Advanced Optical Methods and Applications in Solid Mechanics held in Poitiers, France, August 31-September 4, 1998. Since the last symposium, much progress on various aspects of optical methods in experimental mechanics has been made. For example, with the implementation of phase-shifting, RGB birefringence detection, spectral contents analysis, and advancements in gray level photoelasticity, traditional photoelasticity can still be applied in the plastics and glass components industry. However, for resolving the Mura phenomenon commonly exists in the TFT-LCD industry, fast and full-field ultra low birefringence measurement in very thin glass plate has still been a challenging task. The unprecedented development rate of MEMS and nanotechnology has constantly brought up the needs for improving the optical methods on respects of design, analysis, testing, fabrication, etc. Biomechanics is certainly a worldwide growing area. However, in many respects, the behavior of a biological tissue is fundamentally different from traditional engineering materials. Traditional optical methods may no longer are appropriate for measuring the mechanical properties of a biological tissue due to its sophisticated hierarchical microstructure, anisotropy, heterogeneity, etc. The recent development of digital image correlation method has provided a new approach for investigating mechanical properties of bio-materials. With mature imaging capabilities, micro and macro computer aided tomography (CT), magnetic resonance imaging (MRI), confocal imaging microscopy (CIM) are few examples of currently available technologies for full-volume imaging of bio-material systems.

The following topics were covered in this Symposium:

1. High-Resolution Inspection Methods
2. Inspection of Components in Micro- and Nano-technology
3. Integration of Intelligent Sensors
4. Methods with Increased Robustness

5. Model-Based Identification Methods/Combination of Simulation and Experiment
6. Multi-Modal Metrology
7. Nondestructive Testing and Evaluation
8. Virtual/Remote Laboratories
9. Wide-Scale 4D-Optical Metrology (3D-Space & Time)

Warm discussion during the Symposium was impressive and therefore the Symposium achieved its aim on evaluating the advances of optical methods in experimental mechanics and stimulating new ideas on further applications and development.

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

There were 53 registered participants from 7 countries: UK 3, USA 6, Japan 6, France 4, China 5, Germany 1, and Taiwan 28.

#### **d) Publication of Proceedings**

Twenty of the authors have submitted their manuscripts. A pen drive containing the scientific program and all the abstracts and full papers was prepared and distributed to all participants.

#### **e) Financial Support**

The following institutions generously provided financial support for the Symposium: IUTAM, National Science Council of Taiwan and National Tsing Hua University.

#### **f) Scientific Program**

##### **November 4 (Sunday)**

9:10-10:00 Plenary Speech (1) Yoshiharu Morimoto

Development of 4D Cameras for Measuring Time-variation of Shape

10:00-10:50 Plenary Speech (2) Yuh-Jin Chao

Dynamic Failure of Resistance Spot Welds as Applied to Auto Industry:

Experimental Design, Test Data and Predictive Model

11:10-12:00 Plenary Speech (3) Phillip Reu

Visualizing Displacement - A Revolution in Experimental Mechanics

Session A: High-Resolution Inspection Methods

13:20-13:40 Ryszard J. (Rich) Pryputniewicz

High-resolution Optical Nondestructive Testing and Evaluation of MEMS

13:40-14:00 Ming-Hsing Shen, Chi-Hung Hwang, Wei-Chung Wang, and Yung-Hsiang Chen

A New Optical System for Measuring Shape, In-Plane and Out-of-Plane Deformations and Deformation Gradient of Microstructures

Session B: Inspection of Components in Micro- and Nano-technology

14:00-14:20 Jianguo Zhu, Zhenxing Hu, Yanjie Li, Huimin Xie  
Microscale Residual Stress Determination by Ring-core Cutting and Digital Image Correlation Methods

14:20-14:40 Dongsheng Zhang, Chenglin Lu  
Applications of Digital Image Correlation to Dental Ceramics

Session C: Integration of Intelligent Sensors

15:00-15:20 Satoru YONEYAMA, Shuichi ARIKAWA  
Instantaneous Phase-stepping Interferometry Based on a Micro-polarizer Array

Session D: Methods with Increased Robustness

15:20-15:40 F. Hild, H. Leclerc, S. Roux, N. Swiergiel, Z. Tomičević  
Circumventing the Curse of Resolution versus Spatial Resolution in Digital Image Correlation: From Local to Global and Regularized Approaches

15:40-16:00 S. Roux, T. Taillandier-Thomas, A. Bouterf, H. Leclerc, T.F. Morgeneyer and F. Hild

Digital Volume Correlation From Tomographic Images: Results and Challenges

16:00-16:20 Shyh-Tsong Lin and Minh-Han Hsieh

Innovative Shearing Interferometer for Slope Contour Measurements

### **November 5 (Monday)**

9:10-10:00 Plenary Speech (4) Eann Alexander Patterson

Validating Computational Models Using Experimental Mechanics: What's Good

10:00-10:50 Plenary Speech (5) Michael A. Sutton

Recent Studies in Biomechanics and Blast Loading: Artery Measurements Under Combined Loading and Scaling Laws of Stuttgart

11:10-12:00 Plenary Speech (6) Yu-Lung Lo

Advances of Optical Methods in Measurements of Anisotropic and Turbid Media

Session E: Model-Based Identification Methods/Combination of Simulation and Experiment

13:20-13:40 L.A. Gomes Perini, J.C. Passieux and J.N. Périé

On the Use of PGD to Deal with Large Scale FE-based DIC Problems

Session F: Multi-Modal Metrology

13:40-14:00 Wei Qiu, Qu Li and Yilan Kang

Multi-scale Experimental Analysis for Strength and Toughness Properties of Carbon Nanotube Fibers

Session H: Virtual/Remote Laboratories

14:00-14:20 Wolfgang Osten, Marc Wilke, Giancarlo Pedrini

A Remote Laboratory for Optical Metrology: The Embedding of Experimental Facilities in a Cloud Computing Environ

Session I: Wide-Scale 4D-Optical Metrology (3D-Space & Time)

14:40-15:00 Helena Jin, Wei-Yang Lu, Alejandro Mota, Jay Foulk, George Johnson

Investigation of Microscale Damage Evolution in High-Strength Al Alloy

15:00-15:20 Motoharu Fujigaki, Takuya Hara, Takahiro Tajiri, Akifumi

Takagi, Noboru Ikoma And Yorinobu Murata

Time-series Displacement Measurement of Large Structures Using Sampling Moire Method

Session J: Others

15:20-15:40 Yasuyuki Morita

Applications of Digital Image Correlation Technique to Dental Biomechanics

15:40-16:00 Jing-Fung Lin

Magnetically Induced Linear Birefringence and Dichroism in Magnetic Fluids

### **November 6 (Tuesday)**

Session G: Nondestructive Testing and Evaluation

9:00-9:20 C. Devivier, F. Pierron, M. R. Wisnom

Full-field Curvature Measurements to Assess Impact Damage in Composite Panels Using a Mechanical Equilibrium Indicator

9:20-9:40 Po-Chi Sung, Wei-Chung Wang, Chi-Hung Hwang, and Guan-Ting Lai

A Novel Stress Measurement Method by Integrating White Light Photoelasticity and Spectrometry

9:40-10:00 Ilisio Viana, Rémi Parlouar, Jean-José Orteu, Ludovic Brèthes

Fast Automated Inspection of Mechanical Assemblies Using a Combined 2D/3D Vision Approach

10:00-10:20 Eddie. O'Brien

Polarized Light leads to Civil Aircraft Structural Health Monitoring

10:40-11:00 Xiaoyuan He, Pengxiang Bai

Out-of-plane Displacement Field Measurement by Biaxial Shearography and Two-step Integration

11:00-11:20 Kazuhiko Oka

Channeled Polarimetry for Snapshot Measurement of Polarization

11:20-11:40 Yukitoshi Otani, Takashi Onuma

Dynamic Birefringence Mapping by High-Speed Polarization Image Sensor

**Report composed by Wei-Chung Wang**

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## Report of the IUTAM Summer School held in 2012

### IUTAM Summer School on Biomechanics of Tissue and Tissue-Cell Interaction

The Summer School took place at Purdue University, West Lafayette, Indiana, USA, from 5 June to 8 June 2012. The chair was Thomas Siegmund.

#### Summary

The IUTAM Summer School was held successfully from June 5 to 8, 2012 at Purdue University. The goal of the summer school was to introduce participants to the state-of-the-art research in the biomechanics of bone, ligament, tendon and soft tissue, to interactions between mechanical loading and cellular response, to the mechanics of interaction between extra-cellular matrices and cells, and to the micro- and nano-scale deformation and failure processes of skeletal tissues, as well as to relevant biomedical image modalities. Participants were introduced to emerging pathways to translation of the rich results emerging from fundamental biomechanical studies into the developments of biomedical treatment approaches.

#### Lectures

The following lectures were presented:

- *Ozan Akkus (Case Western Reserve University)* Protein structures and mechanics (three lectures)
- *David Burr (Indiana University School of Medicine)* Bone as a multiscale material, Multiscale bone biomechanics, How to read and evaluate (and write) a scientific paper
- *Roger Chan (University of Texas Southwestern Medical Center)* Linear and nonlinear viscoelastic properties of vocal fold tissues, Extracellular matrix scaffolds for tissue engineering: Biomechanical and biological considerations
- *Wayne Chen (Purdue University)* Dynamic mechanical response of soft tissues: muscle, tendon, skin, liver, kidney, Dynamic behavior of extra soft tissues: brain and lung
- *Patrick Onck (University of Groningen)* Cellular materials, Mechanics of the cytoskeleton, MD analysis of the nuclear pore complex
- *Peter McHugh (National University of Ireland)* Introduction and background on constitutive law implementation in FE(Abaqus), Artery constitutive modeling, Arterial Mechanics, Single cell mechanics modelling
- *Eric Nauman (Purdue University)* Mixture theory – fundamentals, Modeling high strain rate behavior of tissue, Applications of mixture theory
- *Thomas Siegmund (Purdue University)* Finite Element modeling in biomechanics, Microstructure informed constitutive models for soft tissue and multiscale modeling of organ function, Tissue toughness

- *Steven Frankel (Guest Lecture) (Purdue University)* A novel cavopulmonary assist device for univentricular Fontan circulation: modelling and measurement
- *Luc Mongeau (Guest Lecture) (McGill University)* Nonlinear laser scanning microscopy of soft tissue

From the lectures and the respective discussion a set of unifying topics emerged: Constitutive models to function, Continuum Modeling, Non-continuum models, Tissue biology, Experiments, Tutorials.

### **Attendance and Registration**

Due to the financial support by IUTAM and by the School of Mechanical Engineering nine participants were awarded a fellowship to attend the Summer School without cost. Regular registration was \$350 for the full program, and \$150 for attendance for 2 days.

23 participants were registered and attended.

### **Poster Presentations**

*Farhad Javid (McGill University)* Design of new knotless fasteners for a percutaneous mitral valve repair

*Siavash Kazemirad (McGill University)* Characterization of viscoelastic properties of biomaterials using wave propagation methods

*Jie Wei (University of Illinois)* Mechanical testing of mice fetal membrane using image correlation strain measurement technique

*Ali Vahdati (Notre Dame University)* Investigation of required mechanical properties of adhesive bond between native and tissue-engineered cartilage

*Michael Poelmann (University of Illinois)* Tensile properties and mechanical modeling of the pregnant rat cervix

*Luc Mongeau (McGill University)* Biomechanics of phonation

*Amir Kamal (McGill University)* Mechanical characterization of vocal fold tissue by a multiscale study

*Abhishek Kumar (University of Michigan)* Atoms to airplanes: integrated computational materials engineering for epoxy matrix materials

*Hossein Hervis (McGill University)* Investigation of vocal fold tissue using atomic force microscopy

**Report composed by Thomas Siegmund**

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

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

The Working Party WP-2 covers a variety of fields related to dynamics and control together with their application methods. Recently, as in ultrasensitive mass sensing, positive utilizations of resonance and mode-localization became very attractive to increase the accuracy. Also, the resonances including nonlinear resonance and parametric resonance, and so on, are focused to design the energy harvester and resonator in nano/micro scales and their efficiency is discussed based on mechatronics which is combined with the resonance in the mechanical parts. Individual members have taken various initiatives as committees of conferences related to the fields of dynamics, controls and mechatronics as follows:

MATHMOD. 7th Vienna Conference on Mathematical Modeling, Vienna, Austria (Felix L. Chernousko); IUTAM Symposium "From mechanical to biological systems - an integrated approach", Izhevsk, Russia (Felix L. Chernousko); International Conference "Constructive Nonsmooth Analysis and Related Topics", St. Petersburg, Russia (Felix L. Chernousko); BMD2013 "Bicycle and Motorcycle Dynamics 2013", Chiba Japan : scheduled (Robin Sharp); 2013 IFAC Symposium on Mechatronics Systems, April, Hangzhou, China (Masayoshi Tomizuka).

Also, the members belong to committees of societies and/or are editors of journals as follows:

the Editor-in-Chief of the Journal of Applied Mathematics and Mechanics (Felix L. Chernousko); Chairman of the Commission of the Russian Academy of Sciences on the development of the scientific heritage of Academician V. G. Shukhov, a great Russian engineer and scientist (Felix L. Chernousko); Advisory Board of Multibody System Dynamics (Robin Sharp); Editorial Board of Vehicle System Dynamics (Robin Sharp); Associate Editor of Trans. of ASME, Journal of Computational and Nonlinear Mechanics (Hiroshi Yabuno); Editorial Board of Journal of Vibration and Control (Hiroshi Yabuno); Associate Editor of International Journal of Dynamics and Control (Hiroshi Yabuno).

WP-2 connects the multidisciplinary fields in order to enhance the performance of mechatronics systems as some examples mentioned above. The working party will provide and promote the interactions with other societies and become a co-sponsor of selected established meetings in the field.

**Report composed by Hiroshi Yabuno, Chairman of WP-2**



**WP-3 – Mechanics of Materials*****Connecting Multiscale Mechanics to Material Complexes Design***

Materials are modular. That is, heterogeneous materials are aggregates of individual components, which we collectively refer to hereafter as multi-component materials. These components act as material building blocks, which by different synthesis and processing techniques self-assemble to form a complex mesostructure or conformation which determines macroscale performance. Design and analysis of such material complexes to resist extreme operating conditions requires modular descriptor-based methodologies that enable modelers to trace and designers to control multiscale “structure-property” metrics. While continuum mechanics concerns the material behavior at macroscopic scales, and quantum mechanics concerns the behavior of electrons and atoms at the Angstrom scale; however, the material behavior at nanoscale or mesoscale often crucially depends on the bridging of these scales through the integration of multiscale components and multiphysical science. Key physical/chemical/biological phenomena take place in the multiresolution scale, and they cannot be properly described by a single scale theory alone. Due to the multitude of physics, complex multiresolution-structures, and difficulty in matching experiments and simulations, multiresolution scale mechanics of complex materials exhibits a great deal of complexity and stochasticity whose understanding and prediction are still beyond the capacity of current state-of-the-art knowledge base.

Theoretical and computational developments in multiresolution scale mechanics can yield great benefits to develop novel complex materials including metals and alloys, micro- and nano-composites and metamaterials, soft materials like shape memory and electroactive polymers, piezo- and thermo-electrics, biological tissue, and beyond. Through an understanding of these complex materials, significant societal impact can be realized in applications to Energy, Biology, and Materials.

**Report composed by Olivier Allix, Chairman of WP-3**

**WP-6 – Biomechanics**

2012 was another exciting year in the field of biomechanics, expressed by numerous conferences, workshops and summer schools. Several scientific meetings in the field of mechanics embraced biomechanical research because there are many examples where mechanics is interrelated with biophysics, chemistry, biology and medicine, to name just a few areas. For example, during the 8th European Solid Mechanics Conference, which took place in Graz, Austria, under the auspices of EUROMECH, there were more than 150 presentations in biomechanics and 12 Mini-Symposia

were devoted to solid mechanics in the life sciences, ranging from the mechanics of cells to biological membranes and aneurysms.

There is still a significant push towards multi-scale modeling. Although multi-scale and multi-physics approaches have existed for many years in basic engineering science, in biomechanics such approaches are not so straightforward because we have to deal with the large variability in anatomical and functional properties, and almost all problems with which we deal with are highly nonlinear; many challenges remain for the future.

In the following, selected events on Biomechanics and biomechanically-related topics in 2012 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 (selected)***

- Summer School on Modeling and Simulation in Soft Tissue Biomechanics: from Structure to Macroscopic Response, Graz, Austria, September 3-7, 2012
- 18th Congress of the European Society of Biomechanics (ESB2012), Lisbon, Portugal, July 1-4, 2012
- 2012 ASME Summer Bioengineering Conference, Farjardo, Puerto Rico, June 20-23, 2012
- IUTAM Symposium "From Mechanical to Biological Systems – an Integrated Approach", June 5-9, 2012, Izhevsk, Russia
- Euromech Colloquium 534 "Advanced Experimental Approaches and Inverse Problems in Tissue Biomechanics", Saint-Étienne, France, May 29-31, 2012
- 3rd Meeting of the EPSRC Patient-Specific Modelling Network. Biomedical Modeling & Translational Research, London, UK, April 16-17, 2012
- 10th Symposium on "Endocardiovascular Biomechanics Research" (EBR 2012), Marseille, France, May 3-4, 2012
- Computational Fluid Dynamics (CFD) in Medicine and Biology and 7th International Biofluid Mechanics Symposium, Ein Bokek, Dead Sea, Israel, March 25-30, 2012
- Glasgow Workshop on Soft Tissue Modelling, Glasgow, UK, March 14-16, 2012

***Conferences and meetings which were not specifically devoted to biomechanics, but which included plenary or keynote lectures and MiniSymposia and sessions on Biomechanics (selected)***

- XXVI Annual Meeting of the European Society for Vascular Surgery, Bologna, Italy, September 19-21, 2012
- 6th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2012), Vienna, Austria, September 10-14, 2012 (several Mini-Symposia)
- 23rd International Congress of Theoretical and Applied Mechanics (ICTAM2012) of IUTAM, Beijing, China, August 19-24, 2012  
*Sectional Lecturers*  
M. Gharib (USA), Lessons for Bio-Inspired Engineering: Fluid Mechanics of Embryonic Heart  
R. Goldstein (UK), Synchronization of Eukaryotic Flagella  
Y. Matsumoto (Japan), Toward the Multi-Scale Simulation for a Human Body Using the Next-Generation Supercomputer  
*One Mini-Symposium*  
Fluid-structure interactions in biological systems  
Chairs: G.A. Holzapfel (Austria), E. Lauga (USA)  
*Several pre-nominated sessions*
- 8th European Solid Mechanics Conference (ESMC2012), Graz, Austria, July 9-13, 2012  
*Plenary Speaker:*  
P.J. Hunter (New Zealand), Biomechanics and the VPH/Physiome Project

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

## ICTAM 2012 Beijing

### **Local Organizing Committee:**

President and Chairman: Yilong Bai

Treasurer: Haiyan Hu

Secretary General: Jianxiang Wang

The 23rd International Congress of Theoretical and Applied Mechanics (ICTAM2012) was held in Beijing, China, over the week of the 19th to the 24th of August 2012. The Congress was hosted by the Chinese Society of Theoretical and Applied Mechanics (CSTAM). The Congress venue was the China National Convention Center (CNCC), which is located in the heart of the Olympic Green of Beijing, adjacent to the National Stadium (Bird's Nest) and the National Aquatics Center (Water Cube). The meeting's scientific program consisted of plenary opening and closing lectures, sectional lectures, mini-symposia, and contributed papers presented in lecture and seminar presentation sessions. These covered all aspects of mechanics. There were also two additional lectures, the Rodney Hill Prize Lecture and G.K. Batchelor Prize Lecture.

### **Special Lectures, Mini-Symposia and Pre-nominated Sessions**

#### ***Opening Lecture:***

Shiyi Chen (China): Multiscale fluid mechanics and modeling

#### ***Closing Lecture:***

Lambert Ben Freund (USA): Entropic forces in the mechanics of solids

#### ***G. K. Batchelor Prize Lecture***

Detlef Lohse (Netherlands): Fully developed Rayleigh-Bénard and Taylor-Couette turbulence

#### ***Rodney Hill Prize Lecture***

Huajian Gao (USA): Probing mechanical principles of cell-nanomaterial interactions

#### ***Sectional Lecturers***

Kaushik Bhattacharya (USA) - *Defects in crystalline solids: Manifestation of quantum mechanics at continuum scales*

René de Borst (Netherlands) - *Multi-scale mechanics and evolving discontinuities: computational issues*

Michael Brenner (USA) - *Droplet splashing*

Alberto Corigliano (Italy) - *Microsystems and mechanics*

- Peter Eberhard (Germany) - *Particles – bridging the gap between solids and fluids*  
Morteza Gharib (USA) - *Lessons for bio-inspired engineering: fluid mechanics of embryonic heart*  
Robert Goldstein (Russia) - *Scale interaction and ordering effects at fracture*  
Yoichiro Matsumoto (Japan) - *Toward the multi-scale simulation for a human body using the next-generation supercomputer*  
Parviz Moin (USA) - *The mechanics and prediction of wall-turbulence*  
Alain Molinari (France) - *Dynamic damage, strain localization and failure of ductile materials*  
Alan Needleman (USA) - *Cohesive surface modeling*  
Katepalli Sreenivasan (USA) - *Cool Stuff at Cold Temperatures*  
Pierre Suquet (France) - *Mechanics of polycrystalline and heterogeneous materials at different scales*  
Grae Worster (UK) - *Dynamics of marine ice sheets*  
Wei Yang (China) - *Nanomechanics of graphenes and nano-crystals*  
Stéphane Zaleski (France) - *Direct numerical simulation of multiphase flows with volume of fluid methods*

### ***Mini-Symposia and Chairs***

#### ***MS01 Mechanical challenges in energy***

Chairs: Kenneth Reifsnider (USA), Jens Nørkær Sørensen (Denmark), Dongxiao Zhang (China)

#### *Introductory lecturers:*

- Robert McMeeking: *The role of solid mechanics in electrochemical energy systems such as lithium-ion batteries and fuel cells*  
Fernando Porte-Agel: *Interaction between large wind farms and the atmospheric boundary layer*  
Kenneth Reifsnider: *Nano-mechanics foundations and experimental methodologies for multiphysics prognosis of functional behavior in heterogeneous functional materials (HeteroFoams)*  
Anil Virkar: *Mechanical behavior of fuel cells*  
Dongxiao Zhang: *Mechanical challenges in geological sequestration of carbon dioxide*

#### ***MS02 Mechanics of natural disasters***

Chairs: Bernhard Schrefler (Italy), Pavel Tkalich (Singapore)

#### *Introductory lecturers:*

R.P. Denlinger: *Land and mudslides*

Frédéric Dias: *On the modelling of tsunami generation and tsunami inundation*

Yasuo Onishi: *Fukush and Chernobyl nuclear accidents' environmental assessments and U.S. Hanford nuclear site's waste management*

Hans von Storch: *Storm surges*

Mark Zheleznyak: *Fluid mechanics approaches to modeling the environmental consequences of nuclear accidents and mud volcano eruption*

**MS03** *Fluid-structure interactions in biological systems*

Chairs: Gerhard Holzapfel (Austria), Eric Lauga (USA)

*Introductory lecturers:*

C. Alberto Figueroa: *Pressure wave propagation in full-body arterial models: a gateway to exploring aging and hypertension*

Emmanuel de Langre: *Flow-plants interactions, ecology and biomimetics*

Michael Shelley: *Active fluids*

Paul Watton: *Modelling the evolution of aneurysms: biomechanics, mechanobiology and multiscale modelling*

**MS04** *Mechanics of transport in microfluidic devices*

Chairs: Matthew Begley (USA), Henrik Bruus (Denmark)

*Introductory lecturers:*

Henrik Bruus: *Theoretical aspects of microchannel acoustophoresis*

Dino Di Carlo: *Inertial microfluidics: high-throughput cell and particle manipulation*

James Landers: *The pinwheel effect for DNA detection: mechanics, mechanism and application*

Thomas Laurell: *Acoustophoresis in life science applications*

Minoru Seki: *Rapid and precise particle manipulation in microfluidic devices*

**MS05** *Dynamics and control of morphing structures*

Chairs: Ephraim Garcia (USA), Haiyan Hu (China)

*Introductory lecturers:*

Jonathan E. Cooper: *Morphing structures for improved aircraft performance*

Jinhao Qiu: *Smart skins and actuators for morphing structures*

Michael Sinapius: *DLR's research in morphing within the European network*

**MS06** *Effects of small size scales in materials modeling*

Chairs: Huajian Gao (USA), Marc Geers (Netherlands)

*Introductory lecturers:*William Curtin: *A mechanistic and predictive model for plasticity size-effects: stress gradient plasticity*Horacio Espinosa: *Atomistic mechanical testing of nanostructures – seeing the invisible and bridging theory and experiments*Erik van der Giessen: *Multiscale plasticity: How far does reductionism go?*Quanshui Zheng: *Size effects of material surface roughness for wetting and transportation: experiments and models***Pre-Nominated Sessions and Chairs****Fluid Mechanics****FM01. Biological fluid dynamics**

Silas Alben (USA)

Tomas Bohr (Denmark)

**FM02. Boundary layers**

Alfred Kluwick (Austria)

Xiyun Lu (China)

**FM03. Combustion and flames**

Sebastien Candel (France)

Lixing Zhou (China)

**FM04. Compressible flow**

Rainer Friedrich (Germany)

Song Fu (China)

**FM05. Convection**

John Patterson (Australia)

Keqing Xia (China)

**FM06. Drops, bubbles and multiphase flows**

Jacques Magnaudet (France)

Roberto Zenit (Mexico)

**FM07. Flow instability and transition**

Nadine Aubry (USA)

Bruno Eckhardt (Germany)

**FM08. Flow in thin films**

Serafim Kalliadasis (UK)

Gherhardt Ribatski (Brazil)

**FM09. Geophysical and environmental fluid dynamics**

Henk Dijkstra (Netherlands)

Grae Worster (UK)

**FM10. Low Reynolds number flow**

Osamu Sano (Japan)

Howard Stone (USA)

**FM11. Magnetohydrodynamics**

Jean-Francois Pinton (France)

Andre Thess (Germany)

**FM12. Non-Newtonian and complex fluids**

Michael Graham (USA)

Keqin Zhu (China)

**FM13. Stirring and mixing**

Jianzhong Lin (China)

Joerg Schumacher (Germany)

**FM14. Turbulence**

Fazle Hussain (USA)

Zhensu She (China)

**FM15. Vortex dynamics (In memory of Hassan Aref and Slava Meleshko)**  
 Yasuhide Fukumoto (Japan)  
 Mikhail Sokolovskiy (Russia)

**FM16. Waves in fluids**  
 Kendall Melville (USA)  
 Nobumasa Sugimoto (Japan)

**FM17. General fluid mechanics**  
 Jacques Magnaudet (France)  
 Timothy Pedley (UK)  
 Jinjun Wang (China)  
 Tsutomu Kambe (Japan)  
 Viktor Kozlov (Russia)  
 Owen Tutty (UK)

### Solid Mechanics

**SM01. Biomechanics and biomaterials**  
 Gang Bao (USA)  
 James Goh (Singapore)

**SM02. Contact and friction mechanics**  
 Irina Goryacheva (Russia)  
 Hongwu Zhang (China)

**SM03. Damage mechanics**  
 Romesh Batra (USA)  
 Carl Herakovich (USA)

**SM04. Elasticity**  
 Davide Bigoni (Italy)  
 Reinhold Kienzler (Germany)

**SM05. Fracture mechanics**  
 Francois Hild (France)  
 Nikita Morozov (Russia)

**SM06. Geophysics and geomechanics**  
 Félix Darve (France)  
 Hans Muhlhaus (Australia)

**SM07. Impact mechanics and wave propagation**  
 K. Ravi-Chandar (USA)  
 Yulong Li (China)

**SM10. Mechatronics**  
 David Limebeer (UK)  
 Heinz Ulbrich (Germany)

**SM11. Multibody and vehicle dynamics**  
 Dieter Bestle (Germany)  
 D. V. Singh (India)

**SM12. Nanostructures and MEMS**  
 Ioannis Chasiotis (USA)  
 Ole Sigmund (Denmark)

**SM13. Plasticity, viscoplasticity and creep**  
 Christian Niordson (Denmark)  
 George Voyiadjis (USA)

**SM14. Stability of structures**  
 Timothy Healey (USA)  
 Nicolas Triantafyllidis (France)

**SM15. Structural optimization (Co-sponsored by ISSMO)**  
 Tadeusz Burczynski (Poland)  
 Erik Lund (Denmark)

**SM16. Vibrations and control of structures**  
 Felix Chernousko (Russia)  
 Marian Wiercigroch (UK)



**SM08. Mechanics of multi-component materials and composites**

Shanyi Du (China)  
Anthony Waas (USA)

**SM09. Mechanics of phase transformations**

Ferdinando Auricchio (Italy)  
Eliot Fried (Canada)

**SM17. General solid mechanics**

Bob Svendsen (Germany)  
Witold Kosinski (Poland)  
Pauli Pedersen (Denmark)  
David Néron (France)

**Topics involving both fluid mechanics and solid mechanics****FS01. Acoustics**

Ricardo Musafir (Brazil)  
Yuesheng Wang (China)

**FS02. Computational methods in mechanics**

Petros Koumoutsakos (Switzerland)  
Stefanie Reese (Germany)

**FS03. Experimental methods in mechanics**

Arun Shukla (USA)  
Jerry Westerweel (Netherlands)

**FS04. Chaos and pattern formation**

Dwight Barkley (UK)  
Lev Truskinovsky (France)

**FS05. Electro- and magnetomechanical systems**

Yonggang Huang (USA)  
Zheng Zhong (China)

**FS06. Fluid structure interactions**

Roger Ohayon (France)  
Yinlu Young (USA)

**FS07. Smart materials**

Daining Fang (China)  
Robert McMeeking (USA)

**FS08. Granular materials and flows**

Joe Goddard (USA)  
Detlef Lohse (Netherlands)

**FS09. Mechanics of materials processing**

Francisco Chinesta (France)  
Gabor Stepan (Hungary)

**FS10. Porous media**

Xikui Li (China)  
Dominique Salin (France)

**FS11. Foams and cellular materials**

Andrew Kraynik (USA)  
Stelios Kyriakides (USA)

**FS12. Education in mechanics**

Haiyan Hu (China)  
Keith Moffatt (UK)

All contributed papers were peer reviewed. Recommendations were received from Pre-selection Committees of the National Committees of the eight countries: Canada, France, Germany, China, Poland, Russia, UK and USA. Recommendations

were also received from the Chairs of the Mini-Symposia and of the Pre-nominated Sessions. During its deliberations the International Papers Committee paid careful attention to these recommendations. At the end of their meetings 1577 (84%) of the 1887 eligible submissions were invited by the IPC for presentation at the Congress. Finally 1225 contributed papers and 46 invited talks were given in Beijing.

Of the total 1225 papers, 430 of these were in the area of Fluid Mechanics, 453 in the area of Solid Mechanics and 342 were at the Fluid-Solid Mechanics interface. The total number of participants, accepted papers relative to the previous congresses is given in Table 1. Table 2 displays country statistics of the presentations.

As has been the tradition since ICTAM 1988 in Grenoble the IUTAM Bureau selected 3 outstanding young scientists for Bureau prizes, based upon their papers, and their presentations at the Congress. The recipients of the prizes at ICTAM 2012 were

Mr. Mickael Bosco of Institut de Recherche sur les Phénomènes Hors Equilibre, France, for his paper entitled *Instabilities of a cylinder wake in a stratified fluid*, presented during a Lecture (fluid mechanics)

Prof. Dennis Kochmann of California Institute of Technology, USA, for his paper entitled *Ultra-high stiffness and damping composites and structures due to constrained mechanical instabilities*, presented during a Lecture (solid mechanics)

Ms. Huachuan Wang of The George Washington University, USA, for her paper *Molecular Simulations of the Formation of Gold-molecule-gold Junctions in Moletronics Device*, presented during a Seminar.

ICTAM	Submitted Papers	Number of papers presented		Participants	
		All	Host Country	All	Host Country
Grenoble 1988	1262	573	n. a.	951	340
Haifa 1992	1183	420	n. a.	525	85
Kyoto 1996	1642	703	192	936	332
Chicago 2000	1953	1126	445	1430	587
Warsaw 2004	2086	1273	144	1515	194
Adelaide 2008	1517	901	109	1176	139
Beijing 2012	1887	1271	400	1561	612

Table 1. A comparison of the attendance figures for the past seven congresses

An e-only Proceedings will be published in the Elsevier Procedia IUTAM in 2013. This volume will contain full text of the Opening and Closing Lectures, Sectional Lectures, and the Introductory Lectures of the Mini-Symposia presented during the Congress.

Session Statistics			
Session	Lectures	Seminars	Total
FM01 Biological fluid dynamics	19	10	29
FM02 Boundary layers	16	5	21
FM03 Combustion and flames	10	7	17
FM04 Compressible flow	15	9	24
FM05 Convection	18	13	31
FM06 Drops, bubbles and multiphase flows	30	23	53
FM07 Flow instability and transition	29	22	51
FM08 Flow in thin films	14	7	21
FM09 Geophysical and environmental fluid dynamics	18	8	26
FM10 Low Reynolds number flow	17	7	24
FM11 Magnetohydrodynamics	7	7	14
FM12 Non-Newtonian and complex fluids	10	8	18
FM13 Stirring and mixing	4	6	10
FM14 Turbulence	17	8	25
FM15 Vortex dynamics	17	14	31
FM16 Waves in fluids	14	8	22
FM17 General Fluid Mechanics	8	5	13
SM01 Biomechanics and biomaterials	22	6	28
SM02 Contact and friction mechanics	17	8	25
SM03 Damage mechanics	13	8	21
SM04 Elasticity	24	7	31
SM05 Fracture mechanics	26	9	35
SM06 Geophysics and geomechanics	19	9	28
SM07 Impact mechanics and wave propagation	24	7	31
SM08 Mechanics of multi-component materials and composites	24	8	32
SM09 Mechanics of phase transformations	15	7	22
SM10 Mechatronics	7	4	11

SM11 Multibody and vehicle dynamics	12	7	19
SM12 Nanostructures and MEMS	21	5	26
SM13 Plasticity, viscoplasticity and creep	24	7	31
SM14 Stability of structures	18	8	26
SM15 Structural optimization (Co-sponsored by ISSMO)	26	7	33
SM16 Vibrations and control of structures	30	8	38
SM17 General Solid Mechanics	9	7	16
FS01 Acoustics	19	6	25
FS02 Computational methods in mechanics	19	12	31
FS03 Experimental methods in mechanics	13	6	19
FS04 Chaos and pattern formation	13	2	15
FS05 Electro- and magnetomechanical systems	11	8	19
FS06 Fluid structure interactions	14	12	26
FS07 Smart materials	18	8	26
FS08 Granular materials and flows	13	6	19
FS09 Mechanics of materials processing	9	4	13
FS10 Porous media	11	8	19
FS11 Foams and cellular materials	13	2	15
FS12 Education in mechanics	16	1	17
MS01 Mechanical challenges in energy	11	0	11
MS02 Mechanics of natural disasters	10	2	12
MS03 Fluid-structure interactions in biological systems	14	5	19
MS04 Mechanics of transport in microfluidic devices	6	7	13
MS05 Dynamics and control of morphing structures	8	6	14
MS06 Effects of small size scales in materials modeling	23	6	29
<b>Grand Total</b>	<b>835</b>	<b>390</b>	<b>1225</b>

*Table 2.* ICTAM 2012 SESSION STATISTICS: The table provides a breakdown of the numbers of papers presented in each pre-nominated session or mini-symposium (excluding invited talks of which there were 46).

Country/Region Statistics					
Country/Region	Number	Percentage	Country/Region	Number	Percentage
China	400	31.47%	Kazakhstan	5	0.39%
United States	153	12.04%	Mexico	5	0.39%
France	89	7.00%	South Africa	5	0.39%
Japan	76	5.98%	Belarus	4	0.31%
Germany	64	5.04%	Estonia	4	0.31%
Russian Federation	64	5.04%	Hungary	4	0.31%
United Kingdom	51	4.01%	Portugal	4	0.31%
Denmark	26	2.05%	Latvia	3	0.24%
Italy	23	1.81%	New Zealand	3	0.24%
Australia	22	1.73%	Romania	3	0.24%
Canada	21	1.65%	Algeria	2	0.16%
Hong Kong, China	21	1.65%	Chile	2	0.16%
Netherlands	21	1.65%	Cyprus	2	0.16%
India	19	1.49%	Czech Republic	2	0.16%
Poland	19	1.49%	Georgia	2	0.16%
Spain	15	1.18%	Iran	2	0.16%
Israel	14	1.10%	Saudi Arabia	2	0.16%
Taiwan, China	14	1.10%	Serbia and Montenegro	2	0.16%
Sweden	12	0.94%	Turkey	2	0.16%
Brazil	10	0.79%	Armenia	1	0.08%
Singapore	10	0.79%	Bulgaria	1	0.08%
Ukraine	10	0.79%	Colombia	1	0.08%
Switzerland	9	0.71%	Croatia	1	0.08%
Austria	8	0.63%	Finland	1	0.08%
South Korea	8	0.63%	Macau, China	1	0.08%
Norway	7	0.55%	Malaysia	1	0.08%
Greece	6	0.47%	Qatar	1	0.08%
Ireland	6	0.47%	Trinidad and Tobago	1	0.08%
Belgium	5	0.39%	United Arab Emirates	1	0.08%

*Table 3. ICTAM 2012 COUNTRY STATISTICS: The table provides a breakdown of the number of papers presented from each of the 58 countries*

## Summary Record of the General Assembly Meeting 2012

### Summary Record of the General Assembly of IUTAM in Beijing, China, on 21 and 22 August 2012

The General Assembly of IUTAM convened at CNCC. The schedule of sessions was as follows:

#### Tuesday 21 August 2012

18:30 – 21:30 *General Assembly: 1<sup>st</sup> session*

#### Wednesday 22 August 2012

14:00 – 17:30 *General Assembly: 2<sup>nd</sup> session*

#### Attendance:

##### *Members with voting rights:*

J. Achenbach (USA, Member-at-Large), N. Aubry (USA), Y. Bai (China), A. Benallal (France), R. de Borst (Netherlands), T. Burczynski (Poland), D. van Campen (Netherlands, Member-at-Large), S. Candel (France), C.C. Chang (China-Taipei), F. Chernousko (Russia), M. Chong (Australia), F. Dias (France), J. Dual (Switzerland), P. Eberhard (Germany), N. Fleck (UK), J.M. Floryan (Canada), L. Franzoni (USA), B. Freund (USA), M. Gilchrist (Ireland), I. Goryacheva (Russia), J. Grue (Norway), N.K. Gupta (India), G. van Heijst (Netherlands), C. Herakovich (USA), H. Hu (China), T. Kambe (Japan), V. Karev (Russia), B. Karihaloo (UK), R. Kienzler (Germany), K. Kishimoto (Japan), A. Kluwick (Austria), S. Kok (South Africa), S. Kyriakides (USA), A. Leung (China-Hong Kong), J. Li (China), F. Lund (Chile), S. Lundstrom (Sweden), G. Maier (Italy), N. Makris (Greece), I. Marusic (Australia), Y. Matsumoto (Japan), S. Mittal (India), K. Moffatt (UK, Member-at-Large), A. Molinari (France), M. Morozov (Russia), N. Nishimura (Japan), C. Niordson (Denmark), N. Olhoff (Denmark), J. Paavola (Finland), T. Pedley (UK), H. Petryk (Poland), P. Podio-Guidugli (Italy), A. Prata (Brazil), S. Radev (Bulgaria), G. Rega (Italy), M. Rubin (Israel), A. Salupere (Estonia), W. Schiehlen (Germany, Member-at-Large), S. Shrivastava (Canada), J.N. Sorensen (Denmark), P. Stahle (Sweden), R. Stenberg (Finland), G. Stepan (Hungary), H.J. Sung (Korea), Z. Suo (USA), A. Thess (Germany), G. Turkalj (Croatia), W.C. Wang (China-Taipei), G. Weir (New Zealand), W. Yang (China)

##### *Non-voting observers:*

M. Berg (Sweden; repres. of IAVSD), H. Choi (Korea; Fluid Symposia Panel), P. Christodoulides (Cyprus), R. Cotta (Brazil), G.A. Holzapfel (Austria; chair WP6), K. Karumuna (USA), J. Magnaudet (France), R. McMeeking (USA; repres. of ICF), G. Rozvany (Hungary; repres. of ISSMO), B. Schrefler (Italy; repres. of

EUROMECH), V. Tvergaard (Denmark; chair Solid Symposia Panel), L. Wakaba (South Africa), H.Y. Yabuno (Japan; chair WP2)

*Members with voting rights represented by proxies:*

A. Acrivos (USA, Member-at-Large), represented by C. Herakovich  
F. Arruda (Brazil), represented by A. Prata  
F. Charru (France), represented by S. Candel  
G. Jaiani (Georgia), represented by R. Kienzler  
P. Monkewitz (Switzerland), represented by J. Dual  
A. Morro (Italy), represented by G. Maier  
M. Oberlack (Germany), represented by A. Thess  
N. Peake (UK), represented by B.L. Karihaloo  
S. Savage (Canada), represented by S. Shrivastava  
L. van Wijngaarden (Netherlands, Member-at-Large), represented by G. van Heijst  
Z. Yosibash (Israel), represented by M. Rubin  
J. Zu (Canada), represented by S. Shrivastava

**Agenda Tuesday 21 August 2012, 18:30 – 21:30**

1. Opening of the meeting by the President  
Minutes of the General Assembly in Paris, France, on 17-18 July 2010  
(IUTAM Report 2010, pp. 75 – 94)
2. Report by the Secretary-General
3. Report by the Treasurer on financial matters
4. Preliminary discussion on annual dues
5. Report by the Secretary of the Congress Committee
6. Matters concerning Adhering Organizations
7. Matters concerning Affiliated and Associate Organizations
8. Reports and preliminary discussions on Working Parties
9. Report of the Electoral Committee
10. Proposals for election of Members-at-Large
11. Proposals for election of members of Symposia Panels
12. Preliminary discussion on future IUTAM Symposia. Reports from Symposia Panels
13. Preliminary discussion on future International Summer Schools on Mechanics
14. Preliminary discussion on a resolution for the eligibility for election as Bureau Officer and as Bureau member
15. Preliminary discussion on a change of statutes concerning the Congress Committee
16. Publication of Proceedings
17. IUTAM Prizes for Fluid Mechanics and for Solid Mechanics

**Agenda Wednesday 22 August 2012, 14:00 – 17:30**

18. Presentation of ICSU by Prof. Dov Jaron, member of ICSU Executive Board
19. Matters concerning Inter-Union Committees
20. Matters concerning non-ICSU Organizations
21. Future IUTAM co-sponsored events
22. Continued discussion and final decision regarding future IUTAM Symposia
23. Continued discussion and final decision regarding future International Summer Schools on Mechanics
24. Continued discussion and final decision regarding annual dues
25. Continued discussion and final decision regarding Working Parties
26. Election of Officers and members of the Bureau
27. Election of Members-at-Large
28. Election of members of the Congress Committee of IUTAM
29. Final decision on re-appointment of four members of Symposia Panels and the election of two new members for the Solid Panel
30. Continued discussion and final decision regarding the resolution for the eligibility for election as Bureau Officer and as Bureau member
31. Continued discussion and final decision regarding the change of statutes concerning the Congress Committee
32. Date and venue of the next General Assembly
33. Any other business

**Proceedings of the General Assembly****Item 1 – Opening of the meeting by the President**

The President, Professor T. Pedley, welcomed all members and observers. Then the President formally opened the meeting. The minutes of the General Assembly held in Paris, France, in 2010 were adopted. The President paid a tribute to Professor Hassan Aref, who had died suddenly. Hassan Aref was elected Secretary of the Congress Committee of IUTAM during the 2008 General Assembly in Adelaide.

**Item 2 – Report by the Secretary-General**

The Secretary-General, Professor F. Dias, submitted the following report to the General Assembly on the activities of IUTAM since the last General Assembly in Paris, France, on 17 and 18 July 2010:

*Adhering Organizations*

There are 50 Adhering Organizations. IUTAM is pursuing contacts with several countries, which might result in the establishment of new Adhering Organizations in the future.



*Associate Organizations*

There is one Associate Organization: Cyprus. IUTAM is pursuing contacts with several countries, which might result in the establishment of new Associate Organizations in the future.

*Affiliated Organizations*

The reports presented by the Affiliated Organizations in the past two years are included in the IUTAM Reports 2010 and 2011.

*Symposia and Summer Schools*

There were seven IUTAM Symposia in 2010, which were all well attended. The average attendance was 68. There were two Spring/Summer School in 2010, one held at CISM, Udine, Italy, with 60 participants and one held at Northwestern University, USA, with 90 participants. In 2011 there were eight IUTAM Symposia, which were all well attended. The average attendance was 78. For 2012 eleven IUTAM Symposia and two Summer Schools are being organized, whereas six Symposia are scheduled for 2013.

*Sponsorship*

The Bureau agreed to co-sponsor without financial support the ECCOMAS Multibody dynamics conference to be held in Zagreb from July 1 to July 4, 2013, the International Conference on Nonlinear Mechanics (ICNM) to be held in Shanghai from August 12 to August 15, 2013, the International Conference on Multibody System Dynamics to be held in Pusan, Korea in 2014, and finally, with financial support, the Conference “Modern mechanics: mathematical models of flows in nature, technology and living organisms” to be held at Moscow State University in August 2013. For these events the procedure for co-sponsoring by IUTAM of non-IUTAM events as set by the Bureau has been applied.

*IUTAM website*

The new IUTAM website, designed by TxtNet, was launched at the end of 2009. The 2012 call for proposals for IUTAM Symposia and Summer Schools was completely handled through the website.

*IUTAM Newsletter*

The IUTAM Newsletter is published twice a year.

*Publications*

Since January 2011, the preferred publication route for IUTAM Symposia Proceedings is *Procedia IUTAM*. Five Proceedings have now been published. Some difficulties have been encountered and will be discussed under Item 16 of the agenda.

The report by the Secretary-General was adopted.

**Item 3 – Report by the Treasurer on financial matters**

The Treasurer, Professor N. Olhoff, submitted the following report to the General Assembly.

Mr. President and colleagues in the General Assembly,

Our Union's financial matters since the previous GA 2010 in Paris are described in the IUTAM Reports 2010 and 2011. With reference to the Accountants' Report 2011, IUTAM's assets as of 31 December 2011 stood at 375,388 USD. This reflects of an excess of expenses paid over cash revenues collected, amounting to 13,131 USD in 2010 and 9,772 USD in 2011.

The main source of cash revenue for our Union is subscription dues. Adhering Organizations which are represented in the General Assembly continue to pay dues on a more or less regular schedule. In the invoices we request that the dues be transferred before June 30 of the current year, but some countries run different schemes and transfer the dues in December of the current year. The total income from dues in 2011 was 118,971 USD which included also 11,511 USD from previous years. In 2012, the sum of dues collected as of July 31 is quite satisfactory, namely 102,404 USD. However, regrettably there is one Adhering Organization for which the dues are very seriously in arrears, and two Organizations have not paid their dues since 2008 and 2009. These and some related problems will be discussed under Item 6 of the agenda.

The cash reserves of the Union earned interest in the amount of 2,887 USD in 2010 and 4,264 USD in 2011. This interest income is derived from a savings account held in a bank in the U.S. and running accounts in USD, Euros and DKK held in a Danish bank.

In 2011, IUTAM sponsored 8 Symposia by a total amount of 44,000 USD. An additional Symposium held in 2011 did not request financial support. The GA decided at its meeting in Adelaide in 2008 to increase the IUTAM Grant for Symposia and Summer Schools up to a maximum of 6,000 USD from 2010, and all the organizers of 7 Symposia and 2 Summer schools held in 2010 received this maximum support.

The annual dues paid by IUTAM for its membership of ICSU were 4,363 USD in 2011 and 4,301 USD in 2010.

The cost of travel totalled 36,165 USD for 2011. The cost was incurred by participation in annual IUTAM business meetings held in Cambridge, UK, by members of the Bureau and of the Executive Committee of the Congress Committee (XCCC), and by participation of representatives of IUTAM appointed by the Bureau, in ICSU related ENHANS meetings held in South Africa and Australia. In 2010, the travel cost totalled 21,397 USD and mainly covered expenses incurred by participation in the GA, Bureau and XCCC meetings in Paris, of members of these bodies.

The cost of the administration is principally the cost of operating the office of the Secretary-General and maintaining IUTAM's website. In 2011, the former cost, which includes a minor expense for printing and mailing of the annual IUTAM Reports, totalled 29,666 USD, and in 2010 slightly less.

As a matter of fact, the website expenses listed, 15,407 USD in 2011 and 6,494 USD in 2010, totalling 21,901 USD, are not costs of website maintenance, but costs of investment incurred by the final phase of the development and design of a new, modern IUTAM website by a French company. The cost of the initial phase in 2009 was 18,345 USD (while a running cost for maintenance of the old website was paid in 2008). The investment in the new website was decided by the members of the old and the new Bureau when they convened just after the closure of ICTAM 2008 in Adelaide, and they agreed that the expenses for the investment should be covered by IUTAM's cash reserves.

The financial records of the Union are subject to an audit by an independent international accounting firm each year. This firm must submit a formal report and certification to ICSU by March of each year. For several years, this audit has been conducted by UWP Unitreu GmbH in Eschborn, Germany with great care and helpfulness. The fee for the audit was 3,352 USD in 2011 and 3,203 USD in 2010.

The amounts 471 and 369 USD shown as bank fees for 2011 and 2010 represent per transaction costs charged by banks for receiving dues payments, transfer of symposium grants and conducting other business.

In summary, the total financial result for the years 2011 and 2010 is a net deficit of 22,903 USD in terms of net revenues minus expenses, and a corresponding reduction of IUTAM's assets such that these stood at 375,388 USD as of 31 December 2011. It is worth noting that this net deficit of 22,903 USD for the years 2011 and 2010 is very similar to the investment of 21,901 USD (cf. above) during the same two years (the final phase) of the development of IUTAM's new website.

Finally, it is a pleasure to warmly acknowledge the great help and advice provided by Assistant Treasurer, Professor Ben Freund.

Respectfully submitted,  
N. Olhoff, Treasurer

The report by the Treasurer was adopted.  
The President thanked the Treasurer for his report.

#### **Item 4 – Preliminary discussion on annual dues**

Following his report the Treasurer led a brief discussion on the annual dues as follows:

Our dues in USD have developed as follows (see previous reports):

Year	2008	2009	2010	2011	2012	2013
Unit dues	710	726	752	778	794	810
Increase		2.2%	3.6%	3.5%	2%	2%

The Treasurer proposed to increase the dues in USD for 2014 and 2015 as follows:

Year	2013	2014	2015
Unit dues	810	838	866
Increase	2%	3.4%	3.4%

The dues of equal amounts (Payment Schedule B) for the years 2014 and 2015 will then be 852 USD.

Of the 3.4% increase of unit dues for each of the years 2014 and 2015, 2.53% corresponds to the average annual deficit rate over the four-year period 2008-2011, and the remainder 0.87% is expected to meet inflation in 2014 and 2015.

*It was noted that the final decision regarding annual dues would be made in the second session of the General Assembly, see item 24 below.*

### **Item 5 – Report by the Secretary of the Congress Committee**

The Acting Secretary of the Congress Committee for the CC and XCCC meetings in Beijing, Professor D.H. van Campen, submitted the following report:

Mr President and Colleagues,

On 13 and 14 August 2011, the Executive Committee of the Congress Committee (XCCC) met in Cambridge, UK. That meeting was entirely concerned with the preparations for the present ICTAM.

After the unexpected and sad passing away of the CC Secretary, Prof. Hassan Aref, it was agreed that Prof. Viggo Tvergaard would deal with all matters related to the IPC meeting in March 2012, while Prof Tim Pedley would treat all matters related to the bids for ICTAM-2016 and Prof. Dick van Campen would deal with all remaining matters related to the CC and XC meetings in Beijing.

The full Congress Committee (CC) met two days ago (19 August) and the following items were on the agenda:

1. First, the preparations for the 23<sup>rd</sup> ICTAM by the Local Organizing Committee (LOC), led by the Congress President, Prof. Yilong Bai, and its Secretary-General, Prof. Jianxiang Wang, have been going very well. The Congress is going very smoothly and our Chinese hosts are to be congratulated with having put everything together so well.

2. At ICTAM 2012 the two major prizes are being awarded for the second time: the G K Batchelor Prize for Fluid Mechanics and the Rodney Hill Prize for Solid Mechanics. Each prize is awarded for major research achievements in the previous 10 years and is worth USD 25000. We are all very grateful to the sponsors of the prizes, Cambridge University Press, publishers of the Journal of Fluid Mechanics, and Elsevier, publishers of the Journal of the Mechanics and Physics of Solids and other solid mechanics journals. The committees to select the prizewinners were set up, nominations were invited, and the results were announced in December 2011. The prize winners are Professor Detlef Lohse of the University of Twente and Professor Huajian Gao of Brown University.

3. The paper selection procedure for the ICTAM. At the meeting in Paris in 2010 the CC agreed to allow the Secretary, in consultation with the members of the IPC and with the President and Secretary-General of the Congress, to have discretion in choosing the site of the IPC meeting in the future. During last year's meeting of the XCCC it was agreed to have the IPC meeting for the selection of papers from 24 to 27 March 2012 at the Technical University of Denmark. As usual recommendations had been received from Pre-selection Committees of a number of countries, as well as from the Chairs of the Mini-Symposia and of the Prenominated Sessions (PNS). Chairs of Mini-Symposia had been given the right to select up to three contributed papers, and PNS chairs two, which would definitely be accepted without fear of being overruled by the IPC. In addition the MS chairs had selected 3 to 5 introductory lectures. 1887 papers had been submitted and 1577 papers were accepted, which is a fairly large percentage. This was due to the possibility to have 22 sessions in parallel, leaving quality of the submissions as the prevailing criterion.

4. Selection of the site of ICTAM-2016, to be made during the second session of the CC on Thursday afternoon and to be announced at the banquet on Thursday evening. There are four strong bids from the cities of Hyderabad (India), Lund (Sweden, on behalf of the Scandinavian countries), Milano (Italy) and Montreal (Canada).

5. Election of CC members. The CC has drawn up a shortlist of candidates for election by the GA to serve on the CC in place of those who have come to the end of their terms. This has been done following the rules of operation, put into service in 2010:

- People who are midway through their first or second term would normally continue on the CC.
- If people have served just one four-year term on the CC or the XCCC, they should in principle be re-elected for a second term. These are Professors L. Banks-Sills, D. van Campen, F. Dias, N. Gupta, Y. Kaneda, J. Magnaudet, R. McMeeking. The CC recommends to re-elect these members.

There are CC members who have served more than one term and who would normally retire from the CC. These are Professors N. Aubry, D. Barthès-Biesel, M. Bendsoe, A. Carpinteri, G. Cheng, I. Goryacheva, T. Kowalewski, S. Kyriakides, P. Ladevèze, G. Leal and A. Thess.

I am sure we would like to record our gratitude to the retiring CC members for their cooperation in the work of the CC over at least 8 years. This holds in particular for those members who have served on the XCCC, namely Professors M. Bendsoe and T. Kowalewski.

Only 15 nominations for new CC members were received, which is less than usual. It was agreed that next time the rules for nomination of CC members should become less strict and that only a short nomination statement should be sufficient.

The Nominations Subcommittee (NC) drew up a recommendation to the CC, based on the following three criteria:

- a. An undisputable scientific visibility
- b. The preservation of a balance (or are least a minimization of the imbalance) between Fluids and Solids, so that the CC may be a real support in both fields
- c. A balanced representation of countries and the involvement of as many countries as possible

Starting from the NC recommendations and after in-depth discussions, the CC decided to recommend to the GA to elect the following candidates to the CC:

Professors P. Huerre, A. Karagozian, R. Piva, E. Shaqfeh, J. Walther, H. Espinoza, H. Gao, D. Kondo, T. Lu, N. Makris and V. Matveenko.

6. Appointment of a Secretary of the CC. The CC decided to appoint Prof. B. McMeeking for the position of Secretary of the CC. The criteria were: scientific stature, experience in scientific bodies and experience with matters related to the CC to the largest possible extent. It proved to be impossible to find a candidate having served on the XC. Hence, Prof. Mc Meeking has to undergo a steep learning curve and he is prepared to do this. Moreover, current and former XC members will offer all support needed.

Mr. President and Colleagues, this concludes my report.

D.H. van Campen, Acting Secretary for CC and XC meetings in Beijing

The report by the Acting Secretary of the Congress Committee was adopted.

The President thanked the Acting Secretary for his report.

## **Item 6 – Matters concerning Adhering Organizations**

### **6.1 Argentina**

Argentina has not paid its dues for several years. Several letters have been sent by either the Treasurer or the Secretary-General, without response.

*It was agreed to suspend the membership of Argentina.*

**Item 7 – Matters concerning Affiliated and Associate Organizations**

*Nothing to report.*

**Item 8 – Reports and preliminary discussion on Working Parties****8.1. *Change of Chairperson of WP5***

The Chairperson of the WP-5 (Computational Fluid and Solid Mechanics) has informed the Secretary-General that he wishes to resign in this capacity. Prof. Jacob Fish has kindly accepted to be “acting chair” of the WP-5.

**8.2. *Survey of Working Parties***

At the request of the Secretary-General a committee was formed to assess the current functioning of the WPs. In consultation with the General Secretary a questionnaire was prepared and circulated to all chairs and members of the WPs. Responses were received from 11 members. The committee discussed these responses and made the following observations.

1. There is a general lack of enthusiasm for the WPs. This is clear both from the number of responses and also the specific answers to the questions. It is particularly telling that even the possibility of funding did not evoke much interest.

2. Despite this some working parties, especially WP9 Education and to a lesser extent WP5 Computational mechanics have been relatively active. Both of these WPs have pan-IUTAM roles and therefore can draw on activities across the whole field of applied mechanics.

3. There is a general perception that the WPs do not have well defined roles. The committee recommends that IUTAM revisit the remit of the WPs and, if they are to be continued, lay down specific roles. Examples of possible functions are

- a. To promote emerging areas within the field of applied mechanics.
- b. To promote and maintain links with sister organizations.
- c. To propose topics for symposia and sessions for the Congress
- d. To represent the related scientific community found in many fields of mechanics today.

The committee recommends that there should be a review of each WP and that their continuation be subject to periodic review, in the light of a revised remit as outlined in 3. Moreover, it might be useful to rename the WPs as Standing Scientific Committees (SSC) to underline large and/or new fields of mechanics. Keith Moffatt suggested that an explanation of the Working Parties be given in the Annual Report.

**Item 9 – Report of the Electoral Committee**

At its meeting in Cambridge on 17 and 18 April, 2012, and after reviewing all the nominations received, the Electoral Committee made the following recommendations to

the IUTAM General Assembly for Officers and for the slate of nominations for the other members of the Bureau:

Officer positions:

President: Professor Viggo Tvergaard (Denmark)

Secretary-General: Professor Frederic Dias (France)

Treasurer: Professor Peter Eberhard (Germany)

Non-Officer positions (one for each slot to be chosen by the General Assembly):

W: Prof. Felix Chernousko (Russia) and Prof. Bernhard Schrefler (Italy)

X: Prof. Fernando Lund (Chile) and Prof. Nadine Aubry (USA)

Y: Prof. Narinder Gupta (India) and Prof. Miles Rubin (Israel)

Z: Prof. Wei Yang (China) and Prof. Yoichiro Matsumoto (Japan)

Everyone on the above list is willing to accept nomination. The above nominations were unanimous.

After having concluded his report, the President pointed out that the nominations for each of the positions will be put to a vote in the second session of the General Assembly under Item 26.

#### **Item 10 – Proposals for election of Members-at-Large**

The Secretary-General reported that there are currently 105 voting members of the General Assembly. Hence, according to article 3 of the Procedure for electing Members-at-Large (MaLs) of the GA, the total number of MaLs should not exceed approximately 1/8 of 105, i.e. 13. Currently there are 10 MaLs. Besides the "ordinary" MaLs, who are elected for four years and could be re-elected, there are still "Members elected by the General Assembly" who might be viewed as "life members". The present MaLs Prof. B. Boley and Prof. J. Hult belong to this category.

The Secretary-General had received eight proposals for re-election of MaLs and three proposals for election of new MaLs.

Taking account of the above, the Bureau recommended to the General Assembly to re-elect Prof. J. Achenbach, Prof. A. Acrivos, Prof. D. van Campen, Prof. K. Moffatt, Prof. R. Narasimha, Prof. W. Schiehlen, Prof. T. Tatsumi and Prof. L. van Wijngaarden as MaLs for the period 2012-2016, and to elect Prof. B. Freund, Prof. G. Maier and Prof. N. Olhoff as MaLs for the period 2012-2016.

*It was noted that the final decision regarding this proposal would be made in the second session of the General Assembly, see Item 27 below.*



**Item 11 – Proposals for election of members of Symposia Panels**

The Secretary-General reported that a new chair for the Solid Mechanics Panel should be appointed. Additionally, two members of the Solid Mechanics Panel have served for two consecutive terms and should be replaced.

The Bureau proposed to the General Assembly to appoint Prof. Norman Fleck (UK) as new chair of the Solid Mechanics Panel. Furthermore, the Bureau proposed to the General Assembly to appoint Prof. Jean-Baptiste Leblond (France) and Prof. Alberto Corigliano (Italy) as new members to the Solid Mechanics Panel.

*It was noted that the final decision regarding these proposals would be made in the second session of the General Assembly, see Item 29 below.*

**Item 12 – Preliminary discussion on future Symposia. Reports from Symposia Panels**

The call for proposals for IUTAM Symposia in 2014/2015 has resulted in 32 proposals, listed below (FL stands for Fluids, FS for Fluid/Structure and SO for Solids).

- FL.01 *Dynamics of bubbly flows* (Mexico, Mexico)
- FL.02 *8<sup>th</sup> IUTAM Symposium on laminar-turbulent transition* (Sao Paulo, Brazil)
- FL.03 *N-vortex and N-body dynamics: common properties and approaches* (Rio, Brazil)
- FL.04 *Interfacial instabilities in fluid flows* (Madras, India)
- FL.05 *Natural convection in industrial applications* (Gandhigram, India)
- FL.06 WITHDRAWN
- FL.07 *Multiscale modeling for complex fluids and complex flows* (Bangalore, India)
  
- FL.08 *Transition and turbulence in flow through deformable tubes and channels* (Bangalore, India)
- FL.09 *Hyperbolic waves* (Hyderabad, India)
- FL.10 *Multiphase continuum modeling of particulate flows* (Gainesville, USA)
- FL.11 *Advances in computation, modeling and control of transitional and turbulent flows* (Kanpur, India)
- FL.12 *Multiphase flows with phase change: challenges and opportunities* (Hyderabad, India)
- FL.13 *Flows of mixtures and wave propagation* (New Delhi, India)
- FL.14 *Dynamics of vesicles, capsules and cells in flow* (Compiègne, France)
- FS.01 *Bearing technologies in rotor dynamics* (Darmstadt, Germany)
- FS.02 *Mechanics for resiliency and sustainability* (Los Angeles, USA)
- FS.03 *Recent advances in the modeling of geothermal systems* (Lower Hutt, New Zealand)
- FS.04 *Complexity of nonlinear waves* (Tallinn, Estonia)
- SO.01 *Advanced sandwich and cellular materials* (Xanthi, Greece)

- SO.02 *Mechanics of thin-walled structures: from macro to nano and bio and back* (Tbilisi, Georgia)
- SO.03 *The dynamical analysis of multibody systems with design uncertainties* (Stuttgart, Germany)
- SO.04 *Connecting multiscale mechanics to material complexes design* (Evanston, USA)
- SO.05 *Applied non-smooth dynamics* (Harbin, China)
- SO.06 *Advances in modeling composite materials and structures* (Bangalore, India)
- SO.07 *Growing solids* (Moscow, Russia)
- SO.08 *Micromechanics of defects in solids* (Sevilla, Spain)
- SO.09 *Mechanics of soft active materials* (Haifa, Israel)
- SO.10 *Thermomechanical – Electromagnetic coupling in solids: Microstructural and stability aspects* (Palaiseau, France)
- SO.11 *Analytical methods in nonlinear dynamics* (Darmstadt, Germany)
- SO.12 *Innovative numerical approaches for materials and structures in multi-field and multi-scale problems* (Siegen, Germany)
- SO.13 *Plastic localization and ductile failure* (Palaiseau, France)
- SO.14 *Lightweight materials and structures for vehicle crash safety design* (Bangalore, India)

These proposals have been reviewed by the two Symposia Panels. All proposals and the preliminary reports of the Panels have been enclosed in the material distributed to the members of the General Assembly. The recommendations of the two Panels were reported by Prof. H. Choi, representing the Chairman of the Fluids Symposia Panel, and Prof. V. Tvergaard, Chairman of the Solids Symposia Panel.

*It was agreed to accept altogether no more than 17 Symposia for the years 2014 and 2015.*

After preliminary discussion the twelve proposals coded FL.08, FL.10, FL.11, FL.12, FL.14, SO.04, SO.08, SO.09, SO.10, SO.12, SO.13, FS.03 were ranked “alpha”, the twelve coded FL.01, FL.02, FL.03, FL.07, FS.01, FS.04, SO.01, SO.03, SO.05, SO.06, SO.07, SO.11 were ranked “alpha minus or beta”, whilst the seven remaining proposals, coded FL.04, FL.05, FL.09, FL.13, SO.02, SO.14 and FS.02 were ranked “gamma”.

*It was agreed that the proposals ranked “alpha” would be accepted in the second session, whereas those ranked “gamma” would not be accepted. The proposals ranked “beta” would be further considered at the second session.*

**Item 13 – Preliminary discussion on future International Summer Schools on Mechanics**

The Call for proposals has resulted in 3 proposals for IUTAM Summer Schools:

SSFL *Low Reynolds number flows to permeable media* (Kharagpur, India)

SSFS.01 *Variational approaches of damage in continua and interface* (Udine, Italy)

SSFS.02 *Multiscale regulation of bone remodeling and adaptation* (Udine, Italy)

The proposals coded SSSO.01 and SSSO.02 were reviewed by the Solids Symposia Panel and ranked “alpha”. The proposal coded SSFL.02 was ranked “gamma”.

*It was agreed that the proposals ranked “alpha” would be accepted in the second session. The proposal ranked “gamma” would not be accepted.*

The President thanked the two Panels and their Chairmen on behalf of the General Assembly for their careful scrutiny of the proposals for IUTAM Symposia and IUTAM Summer Schools.

*It was agreed that the final decision on future IUTAM Symposia and Summer Schools would be made in the second session under Items 22 and 23, respectively.*

**Item 14 – Preliminary discussion on a resolution for the eligibility for election as Bureau Officer and as Bureau member**

The Article XII of the statutes as it stands:

*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.*

Amendment proposed by the US National Committee

*The Bureau consists of the officers (President, the retiring President who serves as Vice-President, Secretary-General, and Treasurer) and four other persons. The candidates for all eight positions must have been full, voting members of the General Assembly at some time within the four years preceding the time of election to the Bureau.*

Amendment proposed by the IUTAM Bureau

*The Bureau consists of the officers (President, the retiring President who serves as Vice-President, Secretary-General, and Treasurer) and four other persons. The candidates for all eight positions must have been full, voting members or observers of the General Assembly, or members of the Executive of the Congress Committee at some time within the four years preceding the time of election to the Bureau.*

*It was agreed that the final decision on this resolution would be made in the second session under Item 30.*

**Item 15 – Preliminary discussion on a change of statutes concerning the Congress Committee**

The Congress Committee went through an exercise to address the procedures for nomination and election to the Congress Committee. Consequently a revision of the IUTAM statutes and rules of procedure regarding the Congress Committee has been prepared. Since the proposal for alteration of the Statutes was not sent on time to the Members of the General Assembly, it was agreed to postpone this item until the next General Assembly.

**Item 16 – Publication of Proceedings**

It was agreed to postpone this Item until the second session.

**Item 17 – IUTAM Prizes for Fluid Mechanics and for Solid Mechanics**

See Item 2 in the Report by the Secretary of the Congress Committee.

The meeting then adjourned.

**The meeting reconvened on 22 August 2012.****Item 18 – Presentation of ICSU by Prof. Dov Jaron, member of ICSU Executive Board**

Prof. Dov Jaron gave a short presentation of ICSU. The strategic challenges for the coming years (2012-2031) are the need to broaden the disciplinary base, the strategic choices to be made on research portfolio, whether to develop new areas or to continue the current focus on sustainable development, to maintaining excellence and legitimacy and to reconsider the structure and the size of the ICSU Secretariat.

Prof. Frederic Dias emphasized the involvement of IUTAM such as the endorsement of the International Year of Light 2015 and the submission of joint proposals with other Unions.

**Item 19 – Matters concerning Inter-Union Committees**

As part of the global program Mathematics of Planet Earth 2013, the three Unions IMU, IUTAM and IUGG are organizing an educational and capacity-building workshop “Mathematical Methods in Geosciences: Natural Hazards, Climate Change and Related Risks”. The workshop will take place in Guanajuato, Mexico during July 29 – August 2, 2013 and will be a satellite of the 2013 Mathematical Congress of the Americas.

A replacement of Prof. Chernyi is being sought as IUTAM Representative for COSPAR, the Committee on Space Research.

**Item 20 – Matters concerning non-ICSU organizations**

*Nothing to report.*

**Item 21 – Future IUTAM co-sponsored events**

See above the Report by the Secretary General.

**Item 16 – Publication of Proceedings**

(postponed from the first session)

In Paris in 2010, the General Assembly unanimously approved the Elsevier proposal for Procedia IUTAM for the publication of Proceedings. The most important feature of Procedia IUTAM is the open access for a cost of 3,750 USD per Proceedings. The series was launched successfully in January 2011. Since then, several organizers of IUTAM Symposia have faced some difficulties with the templates and with the production. Two representatives of Elsevier, Louise Curtis and Philippe Terheggen, came to answer questions and to apologize for the inconvenience.

**Item 22 – Continued discussion and final decision regarding future IUTAM Symposia**

*The General Assembly decided to accept the 12 symposia proposals, rated “alpha”, and coded FL.08, FL.10, FL.11, FL.12, FL.14, SO.04, SO.08, SO.09, SO.10, SO.12, SO.13 and FS.03. Furthermore, the General Assembly decided to reject the 7 symposia proposals, rated “gamma”, and coded FL.04, FL.05, FL.09, FL.13, SO.02, SO.14 and FS.02.*

After further discussion of the remaining 12 proposals, rated “alpha minus or beta”, a vote was taken.

*The following further 5 proposals were finally accepted: FL.01, FS.04, SO.03, SO.07 and SO.11.*

**Item 23 – Continued discussion and final decision regarding future International Summer Schools on Mechanics**

*The General Assembly decided to accept the Summer Schools coded SSSO.01 and SSSO.02 and rated “alpha”.*

**Item 24 – Continued discussion and final decision regarding annual dues**

Following discussions, *the General Assembly voted in favor of the following amounts for the units of dues (no increase):*

*US \$ 810 in 2014*

*US \$ 810 in 2015*

**Item 25 – Continued discussion and final decision regarding Working Parties**

*With reference to item 8, the General Assembly appointed:*

Prof. Fish as chairman of the WP-5 on Computational Fluid and Solid Mechanics.

The Bureau will continue to discuss the future of Working Parties.

**Item 26 – Election of Officers and members of the Bureau**

*The General Assembly elected unanimously by raising hands the following persons to the three vacant Officer positions P, S and T for the period 2012-2016:*

President: Prof. V. Tvergaard (Denmark)

Secretary-General: Prof. F. Dias (France)

Treasurer: Prof. P. Eberhard (Germany)

(according to Article XI of the Statutes, the retiring President, Prof. T. Pedley, will serve as Vice-President)

*The General Assembly elected by secret ballot the following persons to the four vacant non-Officer positions W, X, Y, and Z for the period 2012-2016:*

Position W: Prof. B. Schrefler (Italy)

Position X: Prof. N. Aubry (USA)

Position Y: Prof. M. Rubin (Israel)

Position Z: Prof. W. Yang (China)

**Item 27 – Election of Members-at-Large**

*The General Assembly re-elected Prof. J. Achenbach, Prof. A. Acrivos, Prof. D. van Campen, Prof. K. Moffatt, Prof. R. Narasimha, Prof. W. Schiehlen, Prof. T. Tatsumi and Prof. L. van Wijngaarden as Members-at-Large for the period 2012-2016.*

(The Members-at-Large Prof. B. Boley and Prof. J. Hult belong to the category of “life members”.)

*The General Assembly elected Prof. B. Freund, Prof. G. Maier and Prof. N. Olhoff as Members-at-Large for the period 2012-2016.*

**Item 28 – Election of members of the Congress Committee of IUTAM**

*The General Assembly decided to re-elect the following persons as members of the Congress Committee for the period 2012 through 2016:*

Prof. L. Banks-Sills, Israel  
Prof. D.H. van Campen, Netherlands  
Prof. F. Dias, France  
Prof. N. Gupta, India  
Prof. Y. Kaneda, Japan  
Prof. J. Magnaudet, France  
Prof. R. McMeeking, USA

*The General Assembly decided to elect the following persons as members of the Congress Committee for the period 2012 through 2016:*

Prof. H. Espinoza (USA)  
Prof. H. Gao (USA)  
Prof. P. Huerre (France)  
Prof. A. Karagozian (USA)  
Prof. D. Kondo (France)  
Prof. T. Lu (China)  
Prof. N. Makris (Greece)  
Prof. V. Matveenko (Russia)  
Prof. R. Piva (Italy)  
Prof. E. Shaqfeh (USA)  
Prof. J. Walther (Denmark)

*The new membership of the Congress Committee is recorded in the following list:*

Prof. L. (Leslie) Banks-Sills, Israel, 2016  
Prof. D.H. (Dick) van Campen, Netherlands, 2016, member of XCCC  
Prof. R. (Renato) Cotta, Brazil, 2014  
Prof. F. (Frédéric) Dias, France, 2016  
Prof. P. (Peter) Eberhard, Germany, 2014  
Prof. B. (Bruno) Eckhardt, Germany, 2014, member of XCCC  
Prof. H. (Horacio) Espinosa, USA, 2016  
Prof. M. (Maciej) Floryan, Canada, 2016, member of XCCC (ex officio)  
Prof. H. (Huajian) Gao, USA, 2016  
Prof. N.K. (Narinder) Gupta, India, 2016  
Prof. G. (GertJan) van Heijst, Netherlands, 2014  
Prof. C.T. (Carl) Herakovich, USA, 2014  
Prof. P. (Patrick) Huerre, France, 2016  
Prof. Y. (Yukio) Kaneda, Japan, 2016  
Prof. A. (Ann) Karagozian, USA, 2016  
Prof. D. (Djimedjo) Kondo, France, 2016  
Prof. J.B. (Jean-Baptiste) Leblond, France, 2014  
Prof. T. (Tianjian) Lu, China, 2016  
Prof. J. (Jacques) Magnaudet, France, 2016, member of XCCC  
Prof. N. (Nichos) Makris, Greece, 2016

Prof. V. (Valery) Matveenko, Russia, 2016  
Prof. R.M. (Robert) McMeeking, USA, 2016, Secretary, member of XCCC  
Prof. N.F. (Nikita) Morozov, Russia, 2014  
Prof. N. (Nigel) Peake, UK, 2014  
Prof. R. (Renzo) Piva, Italy, 2016  
Prof. K. Ravi-Chandar, USA, 2014  
Prof. E. (Eric) Shaqfeh, USA, 2016  
Prof. G. (Gabor) Stépan, Hungary, 2014, member of XCCC  
Prof. H. (Howard) Stone, USA, 2014  
Prof. K. (Kazuo) Tanishita, Japan, 2014  
Prof. V. (Viggo) Tvergaard, Denmark, 2016, President, member of XCCC  
Prof. J. (Jens) Walther, Denmark, 2016  
Prof. G. (Genki) Yagawa, Japan, 2014

**Item 29 – Final decision on re-appointment of four members of Symposia Panels and the election of two new members for the Solid Panel**

*With reference to the discussion under Item 11, it was agreed:*

- to appoint on the Symposia Panel for Solid Mechanics Prof. J.B. Leblond and Prof. A. Corigliano
- to appoint Prof. N. Fleck as chair of the Symposia Panel for Solid Mechanics
- to re-appoint Profs G. Leal, N. Peake and H. Gao

**Item 30 – Continued discussion and final decision regarding the resolution for the eligibility for election as Bureau Officer and as Bureau member**

*No final decision was reached. The Bureau will appoint a subcommittee.*

**Item 31 – Date and venue of the next General Assembly**

*The General Assembly agreed to hold its next meeting in Copenhagen in 2014.*

**Item 32 – Any other business**

Nothing to report.

Then, the President closed the meeting.

*Frédéric Dias, Secretary-General*



**2012 Treasurer's Report**

<b>Statement of Change in Fund Balance</b>	<b>USD</b>
<b>Balance, 31 December 2011</b>	375,388
Net revenues minus expenses for 2012	-3,034
<b>Balance, 31 December 2012</b>	<b>372,354</b>

**Statement of Cash Revenues Collected over Expenses Paid****Revenues collected during 2012:**

Subscription dues	106,544
Return of Symposia grants	0
Interest income	4,838
<b>Total</b>	<b>111,382</b>

**Expenses paid during 2012:**

Symposia	35,910
Summer school	6,000
Contribution to ICSU	4,290
Travel, Bureau	6,232
Travel, Congress Committee and Executive Committee	1,900
Travel, others	18,986
Website	4,521
Administration & Printing	34,107
Auditor's fee	3,126
Bank fees	1,300
<b>Total</b>	<b>116,372</b>

<b>Revenues minus expenses for 2012</b>	<b>-4,990</b>
Gain (loss) from exchange of currency	1,956
<b>Net revenues minus expenses for 2012</b>	<b>-3,034</b>

**Statement of IUTAM Bank Accounts  
(1 January 2012 through 31 December 2012)**

Bank (Running Accounts)	Balance 31 Dec 11	Withdrawals 2012	Deposits 2012	Balance 31 Dec 12	Currency
Spar Nord Bank Aalborg 9236 457 73 07097	203,074.45	495,520.56	450,896.59	158,450.48	USD
Spar Nord Bank 9236 457 73 07089	1,034.81	3,865.75	3,088.34	257.40	EUR
Spar Nord Bank 9236 457 22 92520	1,151.97	15828,31	15,431.20	754.86	DKK
Nordea Bank Horsholm 6887 390 760	0.00	0.00	0.00	0.00	DKK
Nordea Bank 0745 417 701	0.00	0.00	0.00	0.00	DKK

Bank (Savings Accounts)	Balance 31 Dec 11	Withdrawals 2012	Deposits 2012	Balance 31 Dec 12	Currency
Citizens Bank Providence (closed)	170,776.59	-172,785.53	2,008.94	0.00	USD
Spar Nord Bank Aalborg (newly opened)	0.00	0.00	80,000.00	80,000.00	USD
Nordea Bank Horsholm (newly opened)	0.00	0.00	750,000.00	750,000.00	DKK

**Treasurer:**

Prof. P. Eberhard, Institute of Engineering and Computational Mechanics,  
University of Stuttgart, Pfaffenwaldring 9, 70569 Stuttgart, Germany

**Assistant Treasurer:**

Professor N. Olhoff, Department of Mechanical and Manufacturing Engineering, Aalborg  
University, Fibigerstraede 16, DK-9220 Aalborg East, Denmark

**Subscription Dues Paid in Membership Units**

<i>Adhering Organization</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>	<i>2012</i>
Argentina*****	–	–	–	–	–	–
Australia	3	3	3	3	3	3
Austria	1	1	1	1	1	1
Belgium	5	5	5	5	5	5
Brazil*	1	3	3	3	3	3
Bulgaria**					1	1
Canada	8	8	8	8	8	8
Chile	1	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	–
Cyprus***						
Czech Republic	1	1	1	1	1	1
Denmark	3	3	3	3	3	3
Egypt	1	1	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	1	1	–
Germany	8	8	8	8	8	8
Greece	1	1	1	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
Latvia	1	1	1	–	–	–
Mexico*****					–	–
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	1	1
Romania	1	1	1	1	1	1
Russia	8	8	8	8	8	8
Saudi Arabia*****	1	1	1	–	1	(1)
Serbia	1	1	1	1	1	–
Slovakia	1	1	–	–	–	–
Slovenia	1	1	1	1	1	1
South Africa	1	1	1	1	1	1
Spain	1	–	1	–	1	–
Sweden	5	5	5	5	5	5
Switzerland	3	3	3	3	3	3

Turkey	1	1	1	1	1	–
Ukraine	1	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 2012. Dues are expressed in membership units of 1, 3, 5, 8 or 12, corresponding to category of membership from I through V, respectively.

\* Brazil decided to pay 3 units of dues from 2008.

\*\* According to the agreement with IUTAM, Bulgaria has resumed payment of dues from 2011 after accumulation of debt in preceding years. The annual payment is set as one unit due plus a percentage of the debt.

\*\*\* Cyprus' Mathematical Society entered IUTAM as an Associate Adhering Organization in 2011.

\*\*\*\* Korea's Adhering Organization in IUTAM shifted to be the newly formed Korean Committee on Theoretical and Applied Mechanics (KCTAM), and dues payment resumed in 2011.

\*\*\*\*\* Mexico has entered IUTAM as an Adhering Organization, and the first dues payment was invoiced in 2011 but not paid.

\*\*\*\*\* Saudi Arabia, France and India paid their 2012 dues in 2013.

\*\*\*\*\* Argentina's membership was suspended in 2012.

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## **Reports on Affiliated Organizations**

### **AFMC (Asian Fluid Mechanics Committee)**

The 14<sup>th</sup> Asian Congress on Fluid Mechanics, which is a significant event of AFMC, will be held in Hanoi, Vietnam on October 15 – 19, 2013. The meeting is sponsored by the Vietnamese Academy of Science & Technology (VAST), the Ministry of Science and Technology of Vietnam (MOST), the Vietnam Association of Mechanics (VAM) and organized by the Institute of Mechanics (IMech) and the Vietnam Association of Fluid Mechanics (VAFM). Up to now, more than 200 researchers from Australia, Bangladesh, China, Hong Kong, India, Indonesia, Iran, Japan, Korea, Singapore, Sri Lanka, Russia, Vietnam and other continents will participate in the coming meeting. 12 plenary and invited presentations and 3 mini-symposia (New Energy Sources: Solar, Wind, Tidal and Wave; Water Resources, Flooding, Coastal Management and Control; Typhoon, Tsunami, Weather Simulation and Forecasting) will be arranged on the occasion. The local organizing committee led by Professor Duong Ngoc Hai, AFMC member, has made great efforts in the undergoing preparatory works. The 14<sup>th</sup> ACFM will play active roles in promoting fluid mechanics research in Asia and enhancing academic exchange with scientists all over the world.

### **Report composed by Jiachun Li**

### **BICTAM (Beijing International Center for Theoretical and Applied Mechanics)**

- **International Visiting Scholars Program**

The regular program of international visiting scholars, organized by the Scientific Committee of the Center, attracted a number of well-known scientists and leading scholars from various countries and regions. Eight scientists from, for examples, United States, Canada, Spain, France, Australia, Hong Kong of China, visited the Center as guest scholars in 2012. They worked at the Center for a period and closely contacted relevant scientists in China with common research interests and efficiently exchanged their most recent research achievements.

- **Courses and Seminars**

The program of courses and seminars in 2012, planned by the Scientific Committee of the Center, ran smoothly in China. The topics included different fields of mechanics and related sciences listed as below.

Mechanics of soft matter

Optimization of structural and mechanical systems

Multibody dynamics

Hypersonic and high temperature gas dynamics

Natural hazards – tsunami

### ● Other Events

During the 23rd International Congress of Theoretical and Applied Mechanics (ICTAM2012), the meeting of the Scientific Committee and Advisory Committee was held to discuss the further developments and other issues of the Center. More members were invited to join the Center to increase the international influence of the Center. See the member list of the new organization at

<http://www.bictam.org.cn/organization/>.

### Report composed by Jie Chen

## CISM (International Centre for Mechanical Sciences)

### *1. Courses and Seminars*

The regular programme of courses and seminars, planned for the Centre for 2012 by the Scientific Council, took place in two Scientific Sessions, the Cercignani Session (May-July 2012) and the Nowacki Session (September-October 2012). The topics, always at an advanced level, included different fields of mechanics and related sciences, both at a basic and applied level.

#### *The Cercignani Session*

Multiscale Modelling of Complex Materials

Materiomics: Multiscale Mechanics of Biological Materials and Structures

Dynamic Localization Phenomena in Elasticity, Acoustics and Electromagnetism

Topology Optimization in Structural and Continuum Mechanics

Modal Analysis of Nonlinear Mechanical Systems

Stochastic Methods in Fluid Mechanics

Analysis, Modeling and Simulation of Collective Dynamics from Bacteria to Crowds

Constitutive Relations of Materials under Impact Loadings: Experiments, Theoretical and Numerical Aspects

*The Nowacki Session*

Multiscale Mechanics of Granular Materials

Dynamics of Mechanical Systems with Variable Mass

Theories and Computational Models for Multilayered Composite Structures

## **2. Other Events**

Besides the above courses, the following other meetings were organized or hosted by CISM in 2012

- School on “Particle Physics, Astrophysics and Cosmology” 2th Joint School on the International Doctorate Network
- ETPFGM 12 - 50th European Two Phase Flow Group Meeting 2012
- CEPET 12th Workshop (Central European Programme. in Economic Theory)
- Romansy 2012 - 19th CISM-IFTtoMM Symposium on Robot Design, Dynamics, and Control
- 8th International Conference on f-Elements
- Cancer Nanotechnology - The First NEMB Venice Workshop
- SNP 2012, 50<sup>th</sup> Annual Meeting “New Materials and New Problems in Continuum Mechanics”

## **3. National APT Courses**

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.

## **4. Editorial Activities**

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

The following books were published in 2012:

F. Romeo - M. Ruzzene: “Wave Propagation in Linear and Nonlinear Periodic Media”

I. Elishakoff - Ch. Soize: “Nondeterministic Mechanics”



R. Mauri: “Multiphase Microfluidics: The Diffuse Interface Model”

C. Sansour - S. Skatulla: “Generalized Continua and Dislocation Theory”

D. Wagg - V. Lawrence: “Exploiting Nonlinear Behavior in Structural Dynamics”

The international journal for rapid communication “Mechanics Research Communications” (bimonthly) created by CISM and Pergamon Press, Oxford-New York in 1973, published in 2012 its thirty-nine volume. It contains short communications on research related to a wide domain of both theoretical and applied mechanics.

### **5. Scholarships**

A number of scholarships, including free lodging and board or exemption from registration fee, were offered 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.

### **6. International Participation**

In 2012, 68 lecturers from 21 countries delivered lectures in the Cercignani and Nowacki Sessions. The courses were attended by 321 participants coming from 40 countries.

**Report composed by Bernhard 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 2012*

514. *New trends in Contact Mechanics, 27-31 March 2012, Cargese, Corsica, France*

524. *Multibody system modelling, control and simulation for engineering design, 27 February-1 March 2012, Enschede, The Netherlands*

528. *Wind Energy and the impact of turbulence on the conversion process, 22-24 February 2012, Oldenburg, Germany*

532. *Time-periodic structures: current trends in theory and application, 27-30 August 2012, TU Darmstadt, Germany*

534. *Advanced experimental approaches and inverse problems in tissue biomechanics, 29-31 August 2012, Saint-Etienne, France*

535. *Similarity and Symmetry Methods in Solid Mechanics, 6 - 9 June 2012, Varna, Bulgaria*

536. *Nanobubbles and micropancakes, 13 - 17 February 2012, Les Houches, France*

537. *Multi-scale Computational Homogenization of heterogeneous structures and materials, : 26-28 February 2012, Université Paris-Est, France*

538. *Physics of Sports, 3-6 April 2012, Ecole Polytechnique, Paris, France*

539. *Mechanics of Unsaturated Porous Media: Effective stress principle from micromechanics to thermodynamics, 27-30 August 2012, Utrecht University, The Netherlands*

540. *Advanced Modelling of Wave Propagation in Solids, 1-3 October 2012, Prague, Czech Republic*

#### *EUROMECH CONFERENCES in 2012*

*8th European Solid Mechanics Conference, 9 – 13 July 2012, Graz, Austria.*

*9th European Fluid Mechanics Conference, 9 – 13 September 2012, Rome, Italy*

For more details see [www.euromech.org](http://www.euromech.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 field, 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://www.hydromag.eu/wp/>

This site contains information on membership, forthcoming conferences and the electronic HYDROMAG newsletter. During the year 2012 several workshops and scientific meetings have been conducted involving the active participation of HYDROMAG and its members.

#### **Report composed by André Thess**

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

The International Association for Boundary Element Methods (IABEM) has been revitalized in 2011 with a symposium held in Brescia, Italy. In 2012, the structure of the organisation has been defined and some rules have been suggested. The details can be found on the homepage of the organisation <http://www.iabem.org>. Essentially, besides the scientific committee an executive committee has been

established. It must be remarked that IABEM is an open community, where everybody working on boundary element methods or boundary integral equations is welcome independent of her/his scientific field. Consequently, there is no official membership or any fees.

The scientific activities of IABEM are shown in organising minisymposia on related conferences or holding workshops in the field of BEM. In 2012 this was:

- NSF Workshop on the BEM: Bridging Education and Industrial Applications, Minneapolis, USA
- BEM on the Saar, Saarbrücken, Germany
- Fast boundary element methods: analysis, numerics and applications, Minisymposium at ECCOMAS 2012
- Söllerhaus workshop: Fast Boundary Element Methods in Industrial Applications.

Links to these activities can be found on the homepage. The organisation has decided to hold the IABEM symposia in a biannual fashion. Hence, in January 2013 a symposium has been held in Santiago, Chile at the Pontificia Universidad Católica de Chile (PUC). To give an outlook on 2014, the next symposium will be held in Zhengzhou, China from 13th - 15<sup>th</sup> August, 2014.

**Report composed by Martin Schanz**

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

### *The 10th IACM World Congress*

IACM organized in 2012 the 10th World Congress on Computational Mechanics (WCCM 2012). It took place in the city of São Paulo, Brazil, on July 8 – 13, 2012.

This tenth edition was an opportunity to meet distinguished colleagues, have a fruitful exchange of ideas and also feel the Brazilians' reputation as a warm and friendly people. With over 1800 quality papers from 92 different countries, we are sure that it was an outstanding, enjoyable and memorable congress.

Moreover, the Congress included seven plenary lectures and twenty-six semi-plenary lectures, addressed by scientists of international reputation in the fields of the congress, complemented by over one hundred and seventy minisymposia.

Further details are available at: <http://www.wccm2012.com/>

### *Next IACM World Congress*

IACM is currently organizing the 11th World Congress on Computational Mechanics (WCCM 2014). It will take place in Barcelona, Spain, on July 20 – 25, 2014, in conjunction with the European Conference on Computational Methods

(ECCM V) and the 6th European Conference on Computational Fluid Dynamics (ECFD VI).

In accordance with the tradition of IACM and ECCOMAS events, the congress will be open to the latest developments in all aspects of computational mechanics, and is especially intended to broaden the fields of application of the discipline to include new computation oriented areas in engineering and sciences.

The expected number of participants is 3.500, which is a new record.

Further details are available at: [www.wccm-eccm-ecfd2014.org](http://www.wccm-eccm-ecfd2014.org)

*The following IACM supported event took place in 2012:*

7th International Conference on Computational Mechanics for Spatial Structures 2 - 4 April 2012, University of Sarajevo, Sarajevo, Bosnia and Herzegovina

*Upcoming IACM supported events:*

V International Conference on Computational Methods in Marine Engineering (MARINE 2013) 29 - 31 May 2013, Hamburg, Germany

VI International Conference on Adaptive Modeling and Simulation (ADMOS 2013) 3 - 5 June 2013, Lisbon, Portugal

Computational Modeling of Fracture and Failure of Materials and Structures (CFRAC-2013) 5 - 7 June 2013, Prague, Czech Republic

4th International Conference on Computational Methods in Structural Dynamics and Earthquake Engineering (COMPDYN 2013) 12 - 14 June 2013, Kos Island, Greece

V International Conference on Coupled Problems in Science and Engineering (COUPLED 2013). A Conference Celebrating the 60th. Birthday of Eugenio Onate 17 - 19 June 2013, Ibiza, Spain

XII International Conference on Computational Plasticity (COMPLAS XII) 3 - 5 September 2013, Barcelona, Spain

III International Conference on Particle-based Methods (PARTICLES 2013) 18 - 20 September 2013, Stuttgart, Germany

VI Internacional Conference on Textile Composites and Inflatable Structures (STRUCTURAL MEMBRANES 2013) 9 - 11 October 2013, Munich, Germany

Workshop: Reduced Basis, POD and PGD Model Reduction Techniques: a Breakthrough in Computational Engineering? 3 - 6 November 2013, Blois Castle, France

**Report composed by Antonio Huerta**

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

Following the successful experience of the 2010 Rolling Stock Summer School, the 2012 Rolling Stock Summer School (RSSS 2012) was held in Cracow, Poland, from the 3rd to the 7<sup>th</sup> of September 2012, with Professor Marek Sitarz (The Silesian University of Technology), Professor Simon Iwnicki (University of Huddersfield) and Professor Stefano Bruni (Politecnico di Milano) as the organizers. The School was held in the form of an intensive short course, with one week duration, directed to students starting a postgraduate degree in a Rolling Stock related topic and people from the railway industry working in R&D departments. The lectures were given by experts from Universities across Europe and industry guests, speaking on topics related to their expertise and experience.

The aims of the course were:

- For students to gain a broad background knowledge of the field outside their area of specialism at or near the start of their postgraduate studies;
- For industrial R&D to be presented with typical mathematical models (and simulation techniques) in the field of railway dynamics;
- To give students an overview of the latest research being carried out in relevant areas from the academic experts;
- To set up links between students from different institutions and thus encourage future networking

**Report composed by Hans True**

**ICA (International Commission for Acoustics)**

At the ICA General Assembly in August 2010 Michael Vorländer was elected as the President till 2013. The Vice President is Charles Schmid and Antonio Perez-Lopez takes care of all financial issues while Marion Burgess continues to serve as the Secretary General.

The major activity for the ICA is the congress held every 3 years. The last was held in Sydney, Australia in 2010. The 2013 congress in Montreal, Canada in early June will be a very large event with close to 2,000 delegates. This is being hosted jointly by the Canadian Acoustical Society and the Acoustical Society of America.

The Board of the International Commission for Acoustics is continuing to work on several other activities of international relevance and political impact. One task is to obtain a greater acknowledgement of the role of acoustics and our longer term goal is to have an International Year of Sound in 2019. We look forward to the support of IUTAM in our work to achieve this goal.

Within our own organization we are making changes to the election process for the Board to encourage greater participation by all the member societies. The changes to our by laws will be proposed at the AGM in June and immediately applied in the voting for the new board. Another is to strengthen the role of its International Conference Coordination Committee. The welcoming of two new international affiliate organizations, thereby increasing the number to eight, will provide further enhance opportunities for better communication between these bodies. In many developing countries Acoustics is an emerging and expanding field and the ICA is taking particular interest to assist and guide those countries in the formation of a national Acoustical Society.

The ICA allocates the majority of its annual budget to encourage acoustics activities. The Early Career recognizes excellence in acoustics and the Young Scientist Awards encourage participation in the congress to enhance the experience of acoustics research environment.

Annually the ICA provides support for specialist symposia which provide opportunities for those working in particular areas of acoustics to meet. The guidelines for selection require some international involvement and there is priority for developing countries. The meetings supported in 2012 include:

- **European Symposium on Environmental Acoustics**, October 1 – 3, 2012 (Evora Portugal)
- **IAA Conference on Research in Audio and Acoustics**, September 13, 2012 (Tel-Aviv, Israel)
- **SOBRAC 2012**, May 29 – June 1, 2012 (Belem, Brazil)

And support proposed for 2013 includes

- **Acoustics 2013 New Delhi (Indo-French Conference)**, November 10 – 15, 2013 (New Delhi, India)
- **International Symposium on Room Acoustics (ISRA)**, June 9 – 11, 2013 (Toronto, Canada)
- **European Symposium on Environmental Acoustics and Noise Mapping**, October 1 (Valladolid, Spain)
- **Winter School on Therapeutic Ultrasound**, October 1 (Les Houches, France)

The ICA also provides a number of travel support grants for young scientists to attend the congress. There over 70 outstanding applications for the grant to attend the ICA 2013 and the selection committee had quite a challenging task to select only half of these for the award.

The ICA acknowledges the ongoing collaboration with IUTAM and appreciated the participation of the IUTAM representative at the annual board meeting and looks forward to further strengthening this link in the future.

**Report composed by Marion Burgess and Michael Vorländer**

### **ICF (International Congress on Fracture)**

No report has been submitted by ICF.

### **ICHMT (International Centre for Heat and Mass Transfer)**

ICHMT organized four international symposia and sponsored six in 2012. Details of these meetings can be found on the web site, <http://www.ichmt.org>.

#### *Meetings Organized by ICHMT:*

**“Sustainable Energy in Buildings and Urban Areas, SEBUA-12”**, 12-20 October 2012, in Kusadasi, Turkey. The symposium was Chaired by Professor Emilia-Cerna Mladin, University Politehnica of Bucharest, Romania.

**“7th International Symposium on Turbulence, Heat and Mass Transfer, THMT-12”**, 24-27 September 2012, in Palermo, Sicily, Italy. The symposium was Chaired by Professor Kemal Hanjalic, Delft University of Technology, The Netherlands. The Symposium Co-Chairmen were Professor Yasutaka Nagano, Nagoya Institute of Technology, Japan and Professor Franco Rispoli, University of Rome "La Sapienza", Italy.

**“International Solar Engineering Program – 2012, ISEP 2012”**, June 23 to August 10, 2012 (1-week orientation and 6-week course), in METU, Ankara, Turkey. Instructor of this program was Dr. Derek Baker.

**“Advances in Computational Heat Transfer, CHT-12”**, 1-6 July 2012, in Bath, England. The Symposium Co-Chairmen were Graham de Vahl Davis, The University of New South Wales, Australia and Dr. D. A. S. Rees, University of Bath, UK.

#### *Meetings Co-Sponsored by ICHMT:*

**“The 23th International Symposium on Transport Phenomena, ISTP-23”**, 19-22 November 2012, in the University of Auckland, New Zealand. The symposium was chaired by Professor Gordon Mallinson, The University of Auckland, New Zealand. The symposium was Co-Chaired by Professor Kenichiro Takeishi, Osaka University, Japan.



**“The Third International Forum on Heat Transfer, IFHT2012”**, 13-15 November 2012, in Nagasaki, Japan. The symposium was chaired by Professor Y. Takata, Kyushu University, Japan.

**“7th International Symposium on Multiphase Flow, Heat Mass Transfer and Energy Conversion, ISMF-2012”**, 26-30 October 2012, in Xi’an, China. The symposium was chaired by Professor L. J. Guo, China.

**“International Workshop on Nano-Micro Thermal Radiation”**, 23-25 May 2012, in Matsushima bay area, Miyagi, Japan. Conference Co-Chairmen were Professor Shigenao Maruyama, Tohoku University, Japan and Professor Zhuomin Zhang, Georgia Institute of Technology, USA.

**“International Symposium on Multiphase Flow and Transport Phenomena, MFTP-2012”**, 22-25 April 2012, in Agadir, Morocco. The Symposium Co-Chairmen were Julien Réveillon, Rouen University, France; Brahim Benhamou, Cadi Ayyad University, Morocco; M'barek Feddaoui, Ibn Zohr University, Morocco.

**“4th Conference on Computational Thermal Radiation in Participating Media IV, CTRPM-4”**, 18-20 April 2012, in Nancy, France. Conference Chairmen were Professor, P. Boulet, LEMTA, Nancy, France; D. Lemonnier, Institut P', Poitiers, France; P. Lybaert, Faculté Polytechnique de Mons, Belgium; N. Selçuk, Middle East Technical University, Ankara, Turkey.

*The organization of several future meetings have continued. These are:*

**“7th International Symposium on Radiative Transfer, RAD-13”**, 2-8 June 2013, in Kuşadası, Turkey. The Symposium Co-Chairmen are Professor Brent W. Webb, Brigham Young University, USA and Dr. Denis Lemonnier, LET-ENSMA, France. Detailed information can be found on the Web site: <http://www.ichmt.org/rad-13/>.

**“8th Mediterranean Combustion Symposium, MCS-13”**, 8-13 September 2013, in Çeşme, Izmir, Turkey. The Symposium Co-Chairmen are Dr. Federico Beretta, Istituto di Ricerche sulla Combustione Consiglio Nazionale delle Ricerche, Italy; Professor Nevin Selcuk, Middle East Technical University, Turkey; Professor Mohy S. Mansour, Cairo University, Egypt; Professor Andrea d’Anna, University Federico II, Italy. Detailed information can be found on the Web site: <http://www.ichmt.org/mcs-13/>.

**“8th World Conference on Experimental Heat Transfer, Fluid Mechanics and Thermodynamics, ExHFT-8”**, 17-20 June, 2013, in Lisbon, Portugal. The Symposium Co-Chairmen are Pedro Coelho, Instituto Superior Técnico, Lisboa, Portugal and Mário Costa, Instituto Superior Técnico, Lisboa, Portugal. Detailed information can be found on the symposium Web site: <http://www.exhft8.org/>.

**“ASME-ATI-UIT 2014 Conference on Thermal Energy Systems: Production, Storage, Utilization and the Environment”**, 18-21 May 2014, in Palermo, Italy. Webpage is under construction.

**“15th International Heat Transfer Conference, IHTC-15”**, 10-16 August 2014, in Kyoto, Japan. Webpage is under construction.

**Report composed by Tugba Gun**

### **ICM (International Congress on the Mechanical Behaviour of Materials)**

The 11<sup>th</sup> International Conference on Mechanical Behavior of Materials (ICM11) was held at Villa Erba, Como, Italy from June 5 to June 9, 2011. The objectives of ICM11 were to foster research on the mechanical behavior of materials, to promote related international cooperation among scientists and engineers and to provide means for the public dissemination of the results from these efforts. The conference chairman was Prof. Mario Guagliano.

**Report composed by Frederic Dias**

### **ICR (International Committee on Rheology)**

The XVI<sup>th</sup> International Congress on Rheology was held at Lisbon, August 5-10, 2012, organized jointly by the Portuguese, Spanish and Slovenian Rheology Societies. Local Organizer was João Maia, now at Case Western Reserve University, Technical Program Organizer Crispulo Gallegos, University of Huelva, and Technical Program Organizer Igor Emri, University of Ljubljana. The Congress was held at the modern Belém Cultural Centre (inaugurated in 1992) located by the estuary of the Tagus River, across from the sixteenth century Jerónimos Monastery, a short distance from the iconic Belém Tower. The opening plenary was delivered by Paula Moldenaers of KU Leuven, Belgium. Over the five days of technical talks, 902 papers were presented, including five additional plenary lectures: Masao Doi (University of Tokyo, Japan), Gareth McKinley (Massachusetts Institute of Technology, USA), Gerald Fuller (Stanford University, USA), Han Meijer (University of Technology, Eindhoven, The Netherlands), and Wolfgang Knauss (California Institute of Technology, USA). The technical program also included 59 keynote lectures, which anchored the technical sessions by providing an opportunity for additional depth in the sessions' topics. Two optional short courses were offered as part of the International Congress on Saturday and Sunday, 4-5 August (total enrolment 52): Colloidal Suspension Rheology (Instructors: Norman Wagner and Jan Mewis), and IRIS: Synergy of Rheological Data Analysis and Modelling

(Instructors: Henning Winter and Manfred H. Wagner). The Congress banquet was held at yet another spectacular venue, the historic Convento do Beato.

The XVII<sup>th</sup> International Congress on Rheology will be held in 2016 (August 8-13) at Kyoto, Japan, jointly organized by the Japanese Society of Rheology, the Japanese Society of Biorheology, and the Japanese Society of Polymer. Chairman of the Organizing Committee is Hiroshi Watanabe (Kyoto University).

**Report composed by Manfred H. Wagner**

### **ICTS (International Congresses on Thermal Stresses)**

In the year 2012, the activity of the ICTS organization was concentrated on the preparation of the 10th International Congress on Thermal Stresses that is scheduled to be held on the campus of the Nanjing University of Aeronautics and Astronautics, in Nanjing, China, from May 31 to June 4, 2013. This will be the first time that the ICTS is held on the mainland China, although in 2007, it was held in Taipei, Taiwan. Because of the location, a large number of Chinese scientists, professors, and students are expected to participate, and there is hope that research in this area of Mechanics will be strengthened by organizing the Congress.

Chair of the 10th Congress is Professor Cun-Fa Gao; Co-Chairs are: Richard B. Hetnarski and Naotake Noda.

A number of meetings are scheduled during the Congress days, among them:

- The meeting of the Editorial Board of the Journal of Thermal Stresses;
- The meeting of two Committees that govern the activities of the ICTS organization;
- The Launching Ceremony of the Encyclopedia of Thermal Stresses, a 7-volume publication of Springer, edited by Richard B. Hetnarski, and 30 Section Editors.
- The presentation of a new book, "Theory of Elasticity and Thermal Stresses - Explanations, Problems and Solutions," by M. Reza Eslami, Richard B. Hetnarski, Józef Ignaczak, Naotake Noda, Naobumi Sumi, and Yoshinobu Tanigawa; the book is published by Springer.
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The webpage of the Congress is <http://ts2013.nuaa.edu.cn>.

The detailed description of the Congress will be presented in the Report 2013.

**Report composed by Richard B. Hetnarski**

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**IIAV (International Institute of Acoustics and Vibration)**

No report has been submitted by ICF.

**ISIMM (International Society for the Interaction of Mechanics and Mathematics)*****1. STAMM XVII***

The STAMM meeting was held at the Faculty of Aerospace Engineering of the Technion, Israel Institute of Technology, Haifa, on September 3-6, 2012. The focus of the meeting has been mathematical modeling applied to a variety of number of problems originating from physics, engineering and other disciplines. On September 1 there has been a special workshop celebrating Prof. Ingo Müller as the Winner of the ISIMM PRIZE 2012. The award was given in recognition of his outstanding contributions to mathematics and mechanics.

Below is a list of some of the lectures delivered at the Symposium:

1. Daniel Weihs Learning from Nature – A Grand Challenge
2. Marcelo Epstein Remodelling, Aging and Growth
3. Hans Herrmann, Norbert Stoop, Roman Vetter, Falk Wittel Packing of wires in Cavities and Growing Surfaces
4. Andrea Braides Asymptotic Analysis of Atomistic Systems
5. Per Stahle Modelling of Stress Corrosion
6. Leslie Banks-Sills, Maya Gohfeld, Rami Eliasi Delaminations in Multi-Directional and Woven Composites
7. Marc-Andre Keip, Jorg Schroder Two-Scale Homogenization of Functional Materials with Electromechanical Coupling
8. Ingo Müller Thermodynamics of Flames and Detonations
9. Wolfgang Dreyer On the 2nd Law of Thermodynamics
10. Ratul Dasgupta, H. George, E. Hentschel, Itamar Procaccia The Fundamental Physics of Shear Bands in Amorphous Solids
11. Y. Benveniste Two Models of Three-Dimensional Thin Interphases and their Fulfillment of the Reciprocal Theorem
12. Oded Gottlieb Self-Excited Chaotic Dynamics in Nonlinear Thermo-Visco-Elastic Mechanical Systems
13. Baruch Karp Mathematical and Engineering Aspects of Dynamic Saint-Venant's Principle
14. Stuart S. Antman Heavily Burdened Bodies
15. Reuven Segev, Joe Goddard Notes on Radiation and Flux Theory
16. D. Bigoni, D. Misseroni, G. Noselli, D. Zaccaria Effects of the Constraint's Curvature on Structural Instability of Simple Elastic Structures

17. Massimiliano Lucchesi, Miroslav Silhavy, Nicola Zani Dual Variational Problems and Limit Analysis for Masonry Bodies
19. Tomas Roubicek Modelling of Phase Transformations in Magnetostrictive Materials like NiMnGa
20. Sefi Givli, Yair Adler A Theoretical Study of Lamellipodia Dynamics
21. L. Truskinovsky Mechanical Modeling of Cell Motility
22. Yoram Lanir Biological Tissues as Living Adaptive Composites
23. J. D. Goddard Edelen's Dissipation Potentials and the Viscoplasticity of Particulate Media
24. T. Cohen, D. Durban Longitudinal Shock Waves in Solids: The Piston Shock Analogue
25. Hans-Dieter Alber A Hybrid Phase Field Model for Phase Evolution in a Material with Three Phase States
26. Alexander Mielke Small-Strain Elastoplasticity is the Evolutionary Gamma Limit of Finite-Strain Elastoplasticity
27. M. B. Rubin Removal of Unphysical Arbitrariness in Constitutive Equations for Elastically Anisotropic Nonlinear Elastic-Viscoplastic Solids

***2. Professor Ingo Müller is the winner of the ISIMM Prize***

ISIMM Executive Board has chosen Professor Ingo Müller as the winner of the ISIMM prize. The prize is given every two years for exceptional contributions towards building new bridges between Mathematics and Mechanics. The prize will be awarded during the XVIII STAMM Meeting in Haifa (September 3-6, 2012).

*Professor Ingo Müller.*

Ingo Müller was born in Darmstadt in December 1936. He studied physics at the Technical University of Aachen, where he got his Ph.D. Between 1966 and 1975 he worked in the United States and Mexico, in particular, he served as a faculty in Baltimore at the Johns Hopkins University where his colleagues were professors J. Ericksen and C. Truesdell. In 1975 he returned to Germany as a professor of Theoretical Physics first in Düsseldorf, then in Paderbon. From 1979 up to his retirement in 2003, Ingo Müller held the chair of Thermodynamics at the Technical University of Berlin. Since 2005 he is Professor Emeritus.

In 1989 Ingo Müller and Kolumban Hutter founded the Springer journal "Continuum Mechanics and Thermodynamics", which they co-directed until 2003, making of it one of the leading journals of its sector. Ingo Müller served as president of the ISIMM in the years 2000–2004.

Prof. Müller is widely recognized as one of the leading and most authoritative researchers in Continuum Mechanics. His fundamental contributions are perceived by many as milestones in the modern development of this discipline. The work of

Prof. Müller has been always showing a rare combination of exquisite mathematical taste with unmatched physical insight.

Ingo Müller's most renowned result is the development of the Extended Thermodynamics, a topic that he had already pursued in his Ph.D. thesis. In particular, he obtained an original hyperbolic system, describing the kinetic behavior of rarefied gases, by proposing a nontrivial entropic closure for the system of moment equations. Ingo Müller is also known for his many ground-breaking contributions to the modeling of hysteresis phenomena in martensitic materials. In particular, he formulated an elegant theory of shape-memory alloys, which he supported by his own experiments. This theory has a number of interesting technical applications in different industrial domains ranging from aeronautics to medicine. Ingo Müller also made fundamental contributions to several other research areas including the objectivity principle, the thermodynamics of diffusion, the place of entropy inequality in continuum mechanics, the relativistic thermodynamics, the discrete theory of plasticity, the theory of rubber balloons, the theory of configurational forces, the role of surface tension in phase equilibrium and kinetics and, more recently, the applications of thermodynamical principles to sociology. Ingo Müller is known for his very popular scientific monographs and textbooks including: A rational extended thermodynamics (with T. Ruggeri); Entropy and energy: a universal competition (with W. Weiss); Rubber and rubber balloons: paradigms of thermodynamics (with P. Strehlow); Fundamentals of thermodynamics and applications (with W. H. Müller) and History of thermodynamics. As a teacher Ingo Müller has always been revered by his students. Many of his Ph.D. students have become outstanding researchers themselves, including I-Shih Liu, W. Dreyer, Y. Huo, W. Mueller, W. Weiss, P. Strehlow, H. Struchtrup, S. Seelecke and many others. The activity of Ingo Müller was widely recognized by the scientific community. In 1987 he was awarded the prestigious Leibniz prize of the Deutsche Forschungsgemeinschaft. He also received the Gili- Agostinelli prize of the Accademia delle Scienze di Torino and the Laurea Honoris Causa of the Darmstadt University. Recently Ingo Müller was honored with a membership in the Serbian Society of Mechanics. Endowed with a deep physical intuition, Ingo Müller combines a mastery of rigorous mathematical tools with an unusual focus on applications and a rare ability to perform sophisticated experiments. He is commonly respected for his uncompromising attitude towards science. His personal integrity served as a much copied example for generations of students and colleagues, however, it also did not make his life easy.

**Report composed by Lev Truskinovsky**

**ISSMO (International Society for Structural and Multidisciplinary Optimization)*****1. ISSMO Biennial World Congress on Structural and Multidisciplinary Optimization (WCSMO):***

WCSMO-10: The ISSMO World Congress will take place in Florida-Orlando, USA during May 19-24, 2013. Prof. Raphael Haftka chairs the organizing committee. Up-to-date information can be found at: <http://conferences.dce.ufl.edu/wcsmo-10/>

***2. ISSMO endorsed the following international scientific meetings during 2012:***

2.1. CJK-OSM7 – 7<sup>th</sup> China-Japan-Korea Joint Symposium on Optimization on Structural and Mechanical Systems, Huangshan, China, June 18-21, 2012. The conference attracted 219 participants, 126 from China and 93 from Japan, Korea and other Countries. The conference received a total of 204 abstracts, 127 from China, 38 from Japan, 36 from Korea and 3 from Europe and America. A wide spectrum of topics from traditional and modern interdisciplinary areas was covered.

2.2. CISM Advanced Course ‘Topology optimization in structural and continuum mechanics’, Udine, Italy, June 18-22, 2012. Coordinated by Prof. George I. N. Rozvany and Tomasz Lewinski. It was attended by 54 participants.

2.3. Engopt 2012, Rio de Janeiro, July 2012. Organized by J. Herskovits (UFRJ/Brasil). The conference attracted 308 participants, and 263 works were presented (Abstracts and Full Papers). It covered a wide range of Engineering Optimization topics for design optimization and inverse problems, basic numerical optimization techniques and industrial applications.

2.4. ICTAM 2012 Pre-Nominated Session SM15 - Structural Optimization, Beijing, China, August 2012. Organized by E. Lund and T. Burczynski. This special session had 28 oral and 10 poster presentations within different areas of structural optimization.

***3. ISSMO will endorse the following international scientific meetings:***

International Conference on Design, Fabrication and Economy of Metal Structures, DFE2013, 24-26 April 2013, University of Miskolc, Hungary

OPTI2014- International Conference on Engineering and Applied Sciences Optimization

Please consult the website <http://www.issmo.net> for more information about ISSMO.

**Report composed by H. C. Rodrigues**

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**LACCOTAM (Latin American & Caribbean Congress of Theoretical and Applied Mechanics)**

Our main activity during the year 2012 was our Second Congress (LACCOTAM 2012) which took place in Caracas, Venezuela during the period September 24 – 26, 2012. It was hosted by the Simon Bolivar University (USB) in association with the Central of Venezuela University (UCV). The programme included inter alia a Colloquium on Clean Energies, a Workshop on Multiphase Flow and a Symposium on Fluvial Mechanics. The latter to honor the late Professor Marco Falcon. Professor Falcon was a distinguished scholar who developed his academic work at the Fluid Mechanics Institute of the UCV, and also was one of the founders of LACCOTAM. Professor Cristina Amon, Dean of Applied Science and Engineering of the University of Toronto, presented the Opening Lecture: “*Educating Engineers for the 21<sup>st</sup> Century: Emerging Trends, Opportunities and Responsibilities*”.

Participants were from a number of countries including Brazil, Canada, Colombia, Italy, Mexico, Norway, Trinidad and Tobago, USA, United Kingdom and Venezuela.

The International Centre for Theoretical Physics (ICTP) was a major sponsor. Selected papers were submitted to the International Journal of Multiphysics for publication in a special issue related to LACCOTAM. The next Congress is scheduled tentatively for 2015 in Mexico.

We are now planning for the Second Symposium on “Lubricated Transport of Viscous Material”.

**Report composed by F. (Freddy) Malpica**



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## **Reports on ICSU and its Scientific Committees**

### **ICSU (International Council for Science)**

By agreement of the Bureau, IUTAM was a supporting applicant for an IMU proposal entitled “Mathematical Methods in Geosciences: Natural Hazards, Climate Change and Related Risks”, under the ICSU 2012 grants round (for which the submission deadline was 1 December 2012). The application was successful (see [http://www.icsu.org/what-we-do/projects-activities/icsu-grants-programme/?icsudocid=copy\\_of\\_grants-2012](http://www.icsu.org/what-we-do/projects-activities/icsu-grants-programme/?icsudocid=copy_of_grants-2012)), a grant of USD 30,000 being awarded to IMU. A workshop will take place in Guanajuato, Mexico during July 29 – August 2, 2013.

### **Report composed by Frederic Dias, Secretary General of IUTAM**

### **COSPAR (Committee on Space Research)**

No report has been submitted by COSPAR.

### **SCOR (Scientific Committee on Oceanic Research)**

No report has been submitted by SCOR.

## 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.

### **Règles 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*

### **Règles 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*

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**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 XII 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.

**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*

## 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 kept at the IUTAM Archive at CISM, Udine, Italy.

The IUTAM Annual Reports over the last eight years are available upon request from the IUTAM Secretariat and as pdf files 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. Electronic versions of IUTAM Newsletters are available from the IUTAM website.

**c) Proceedings of IUTAM Symposia**

Since 2011, the official publisher for proceedings of IUTAM Symposia is Elsevier, under the newly created Procedia IUTAM series. Procedia IUTAM is open access. All proceedings are freely available on the website of Procedia IUTAM

<http://www.journals.elsevier.com/procedia-iutam>

**d) Proceedings of the International Congresses on Theoretical and Applied Mechanics (ICTAM)**

Until 2008, they were only available by direct ordering from the publisher. The Proceedings of ICTAM 2012 will be published under the Procedia IUTAM series.

**e) Publications on the history of IUTAM**

**Proceedings of IUTAM Symposia**

The Proceedings of IUTAM Symposia published since 1998 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>.

**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.
- 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.

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**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 as a special issue of the International Journal of Solids and Structures, Volume 39, Issues 13-14, 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. Karihaloo, 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. Bajer 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, The Netherlands, 2008. ISBN: 978-1-4020-9089-9
- 08-2 *IUTAM Symposium on 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
- 08-7 *IUTAM Symposium on Turbulence in the Atmosphere and Oceans* (Cambridge, UK, December 8 – 12, 2008).  
The Proceedings of the Symposium edited by Dritschel, David have been published by Springer, 2010. ISBN:978-94-007-0359-9
- 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).  
The Proceedings of the Symposium have been published as a special issue of the International Journal of Fracture (Publisher: Springer), 2010 and by Springer (Ravi-Chandar, Krishnaswamy; Vogler, Tracy J. (Eds.) 2010) ISBN 978-90-481-9759-0
- 09-2 *IUTAM Symposium on Emerging Trends in Rotor Dynamics* (New Delhi, India, March 23 - March 26, 2009)  
The Proceedings of the Symposium edited by Gupta, K. have been published by Springer, 2011. ISBN 978-94-007-0019-2
- 09-3 *IUTAM Symposium on Recent Advances of Acoustic Waves in Solids* (Taipei, Taiwan, May 25-28, 2009)  
The Proceedings of the Symposium edited by Wu, Tsung-Tsong and Ma, Chien-Ching have been published by Springer, 2010  
ISBN 978-90-481-9892-4
- 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
- 09-5 *IUTAM Symposium on the Vibration Analysis of Structures with Uncertainties* (St. Petersburg, Russia, July 5-9, 2009)  
The Proceedings of the Symposium edited by Belyaev, Alexander K. and Langley, Robin S. have been published by Springer, 2011  
ISBN 978-94-007-0288-2
- 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
- 09-7 *IUTAM Symposium on Multiscale Modelling of Fatigue, Damage and Fracture in Smart Materials* (Freiberg, Germany, September 1-4, 2009)

The Proceedings of the Symposium edited by Kuna, Meinhard and Ricoeur, Andreas have been published by Springer, 2011. ISBN 978-90-481-9886-3

- 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

## 2010

- 10-1 *IUTAM Symposium on Computational Aero-Acoustics for Aircraft Noise Prediction* (Southampton, UK, March 29 – 31, 2010)  
The Proceedings of the Symposium edited by Astley, Jeremy and Gabard, Gwenael have been published by Elsevier, 2011, as the first issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 1**
- 10-2 *IUTAM Symposium on Nonlinear Stochastic Dynamics and Control* (Hangzhou, China, May 10-14, 2010)  
The Proceedings of the Symposium edited by Zhu, W.Q., Lin, Y.K. and Cai, G. Q. have been published by Springer, 2011. ISBN 978-94-007-0731-3
- 10-3 *IUTAM Symposium on Dynamics Modeling and Interaction Control in Virtual and Real Environments* (Budapest, Hungary, June 7-11, 2010)  
The Proceedings of the Symposium edited by Stépán, Gábor, Kovács, László L. and Tóth, András have been published by Springer, 2010 ISBN 978-94-007-1642-1
- 10-4 *IUTAM Symposium on Bluff Body Wakes and Vortex-Induced Vibrations* (Capri, Italy, June 22-25, 2010)  
The Proceedings of the Symposium edited by Leweke, Thomas and Williamson, Charles, have been published by Elsevier, as a special issue of the Journal of Fluids and Structures, Volume 27, Issues 5-6, Pages 637-884, July-August 2011.
- 10-5 *IUTAM Symposium on Nonlinear Dynamics for Advanced Technologies and Engineering Design (NDATED)* (Aberdeen, UK, July 27-30, 2010)  
The Proceedings of the Symposium edited by Marian Wiercigroch and Giuseppe Rega have been published by Springer, 2013 ISBN 978-94-007-5742-4
- 10-6 *IUTAM Symposium on Surface Effects in the Mechanics of Nanomaterials and Heterostructures* (Beijing, China, August 8-12, 2010)  
The Proceedings of the Symposium edited by Cocks, Alan and Wang, Jianxiang, have been published by Springer, 2012. ISBN 978-94-007-4910-8



- 10-7 *IUTAM Symposium on Human Movement Analysis and Simulation*  
(Leuven, Belgium, September 13-15, 2010)  
The Proceedings of the Symposium edited by Jonkers, Ilse and Vander Sloten, Jos, have been published online, 2010  
[www.mech.kuleuven.be/iutam2010/IUTAM\\_proceedings/index.html](http://www.mech.kuleuven.be/iutam2010/IUTAM_proceedings/index.html)  
ISBN 978-94-6018-247-1
- 2011**
- 11-1 *IUTAM Symposium on Mechanics of Liquid and Solid Foams*  
(Austin, USA, May 8-13, 2011)  
The Proceedings of the Symposium edited by Kyriakides, Stelios and Kraynik, Andrew, have been published by Elsevier, as a special issue of the International Journal of Solids and Structures, 2012, and of the Journal of Rheology, Volume 56, Issue 3, Pages i-665, May 2012.
- 11-2 *IUTAM Symposium on Linking Scales in Computations: From Microstructure to Macro-scale Properties* (Pensacola, USA, May 17-19, 2011)  
The Proceedings of the Symposium edited by Cazacu, Oana, have been published by Elsevier, 2012, as the third issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 3**
- 11-3 *IUTAM Symposium on Human Body Dynamics*  
(Waterloo, Canada, June 5-8, 2011)  
The Proceedings of the Symposium edited by McPhee, John and Kovacs, Jozsef, have been published by Elsevier, 2011, as the second issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 2**
- 11-4 *IUTAM Symposium on Full-field Measurements and Identification in Solid Mechanics* (Cachan, France, July 4-8, 2011)  
The Proceedings of the Symposium edited by Hild, F. and Espinosa, H.D., have been published by Elsevier, 2011, as the fourth issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 4**
- 11-5 *IUTAM Symposium on Impact Biomechanics in Sport*  
(Dublin, Ireland, July 7-9, 2011)  
The Proceedings of the Symposium edited by Michael Gilchrist and Manuel Forero Rueda have been published as a special issue of the Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology, Volume 226, No 3-4, 2012.
- 11-6 *IUTAM Symposium on Computer Models in Biomechanics*  
(Stanford University, USA, August 29 – September 02, 2011)

The Proceedings of the Symposium edited by Holzapfel, Gerhard A. and Kuhl, Ellen have been published by Springer, 2013. ISBN 978-94-007-5464-5

- 11-7 *IUTAM Symposium on 50 Years of Chaos: Applied and Theoretical* (Kyoto, Japan, November 28 – December 2, 2011)  
The Proceedings of the Symposium edited by Hikihara, Takashi have been published by Elsevier, 2012, as the fifth issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 5**

## 2012

- 12-2 *IUTAM Symposium on Advanced Materials Modelling for Structures* (Paris, France, April 23-27, 2012)  
The Proceedings of the Symposium edited by Altenbach, Holm and Kruch, Serge have been published by Springer, 2013. ISBN 978-3-642-35167-9
- 12-4 *IUTAM Symposium on Waves in Fluids: Effects of Nonlinearity, Rotation, Stratification and Dissipation* (Moscow, Russia, June 18-22, 2012)  
The Proceedings of the Symposium edited by Y. Chashechkin and D. Dritschel have been published by Elsevier, 2013, as the eighth issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 8**
- 12-5 *IUTAM Symposium on Multiscale Problems in Stochastic Mechanics* (Karlsruhe, Germany, June 25-28, 2012)  
The Proceedings of the Symposium edited by C. Proppe and J.-M. Bourinet have been published by Elsevier, 2013, as the sixth issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 6**
- 12-8 *IUTAM Symposium on Topological Fluid Dynamics: Theory and Applications* (Cambridge, UK, July 23-27, 2012)  
The Proceedings of the Symposium edited by H.K. Moffatt, K. Bajer and Y. Kimura have been published by Elsevier, 2013, as the seventh issue of the IUTAM e-Procedia series. **Procedia IUTAM Volume 7**

**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.

*22<sup>nd</sup> International Congress on Theoretical and Applied Mechanics (ICTAM)*,  
Adelaide (Australia), 24-29 August 2008.

The Proceedings, entitled "Mechanics Down Under" and edited by J. Denier and M. Finn, have been published by Springer, Dordrecht, The Netherlands, 2013, both as an eBook (ISBN 978-94-007-5968-8) and as a Hardcover (ISBN 978-94-007-5967-1).

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**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 Proceedings of IUTAM Symposia published under Procedia IUTAM are open access. The other publications listed above, with the exception of the Annual Reports over the last eight 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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