

INTERNATIONAL MEASUREMENT CONFEDERATION IMEKO BULLETIN

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Nyomás:

- IMEKO XIX -



September 6-11, 2009 – Lisbon, Portugal

580 participants from 47 countries, 375 presented papers and 150 posters, 4 round tables - prosaic statistical data, but behind them a very friendly atmosphere in amicable surroundings, the FIL Meeting Centre (the site of World Expo '98) right by the river Tagus. Each day began with an invited plenary speech of a highly recognized expert:

1. Terahertz based imaging for inspection and spectroscopic analysis
Prof. Tilo Pfeifer, Rheinisch-Westfälische Technische Universität, Aachen, Germany;
long-standing member of the IMEKO General Council
2. World metrology - the next ten years
Dr. Andrew Wallard, UK, Director of the Bureau International de Poids et Mesures
in Sèvres, France
3. Metrology challenges for biofuels
Prof. João A.H. da Jornada, President of INMETRO, the Brazilian National
Metrology Institute in Rio de Janeiro
4. Challenges in medical measurements
Dr. John G. Webster, Professor Emeritus of Biomedical Engineering at the University
of Wisconsin-Madison, USA

5. Space metrology - a cosmic vision

Dr. André T.N. Tavares, Portugal, currently working for the Testing Division of the European Space Research and Technology Centre in the Netherlands

In addition to the 76 oral and 4 poster sessions four Workshops took place:

- on new definition of the kilogram
- on the Vocabulary in Metrology
- on ADC testing and
- on measuring the impossible: measurement of characteristics related to human perception and interpretation

One of the round table discussions also dealt with questions in connection with the VIM, the others were

on continuous and dynamic calibration in force and torque
on traceability in chemistry, health, food and nutrition and
on higher education in the 21st century

Ten exhibitors rounded up the overall picture.

As always, the entire scientific program was primarily based on the contribution of the 24 Technical Committees; most of them held meetings as well to determine forthcoming activities.

The *György Striker Junior Paper Award* (donation of the founding Secretary General of the International Measurement Confederation and his wife, Barbara) was given to a young scientist from The University of Tokyo, Japan, Mr. **Ryota Kudo** for his paper “Fundamental verification for 2-dimensional super-resolution optical inspection for semiconductor defects by using standing wave illumination shift”

Two technical visits were organized and – inevitably – two social events.

This report would not be complete without mentioning the excellent work and hospitality of the Portuguese Member Organization of IMEKO, RELACRE (Associação de Laboratórios Acreditados de Portugal), its delegate to the General Council, Prof. Pedro Silva Girão, General Chairman of the World Congress and his Vice Chairman, Dr. Pedro Miguel Ramos (both from the Instituto Superior Técnico / Instituto de Telecomunicações in Lisbon) and of course, the President of IMEKO, Prof. António Manuel da Cruz Serra.

52nd IMEKO General Council Session and related meetings

Members of the **Advisory Board** met in the morning of September 5 under the chairmanship of Prof. Leo Van Biesen, Past President of IMEKO (Belgium). The meeting of the **Technical Board** chaired by incoming President Dr. Dae-Im Kang (South Korea) followed in the afternoon. The day was closed with the meeting of the **MEASUREMENT Editorial Board** under the chairmanship of the Editor-in-Chief, Prof. Ken T.V. Grattan (UK) in the presence and contribution of the Publisher, Mr. Christopher Greenwell on behalf of Elsevier Ltd. (UK).

Main agenda items were the proposals for the election of Officers, Board and Standing Committee members for the period 2009-2012, amendments to the Constitution and By-Laws to include the rules for the organization of joint events as suggested by the Italian Member Organization and the possibility of counting on the assistance of Distinguished Service Award Holders, to profit from their experience also further on in the work of the Credentials and Membership Committee, the Drafting Committee and other projects. One of the important plans is the creation of an e-journal under the title ACTA IMEKO to contain papers presented at World Congresses and TC events. The office of Vice President for Scientific Publications was set up to serve the purpose, as all relevant aspects have to be carefully investigated. The issue of soliciting new Member Organizations especially in the Americas is still considered of primary significance to increase activities on high level and under financially safe circumstances.

As the Agreement between Elsevier Ltd. and IMEKO concerning the production of the official IMEKO journal MEASUREMENT was due to expire with the last issue in 2009, a new Journal Sponsoring Agreement was negotiated, drafted and signed. The initial term of validity will begin with the first issue of 2010 and shall conclude with the last issue of 2012.

The GC accepted the invitation of the Slovenian MO, so the 53rd Session will be in Portorož, by the Adriatic Sea on May 30, 2010 with related meetings on the previous day – all preceding TEMPMEKO, the 11th TC12 Symposium on Temperature and Thermal Measurements in Industry and Science which will be organized this time jointly with the International Symposium on Humidity and Moisture of the CIPM CCT/WG6.

Bids are still welcome to host the GC-Session in 2011 and the World Congresses in 2015 and onwards.

IMEKO Officers and Standing Committee members 2009-2012

President: Dr. Dae-Im Kang, South Korea

Past President and Chair of the Advisory Board: Prof. Antonio M. Da Cruz Serra, Portugal

President Elect and Chair of the Technical Board: Prof. Pasquale Daponte, Italy

Secretary General: Prof. Mladen Borsic, Croatia

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Vice President for IMEKO XX: Dr. Sam Yong Woo, South Korea

Vice President for External Relations: Dr. Hidetaka Imai, Japan

Vice President for Scientific Publications: Prof. L. Van Biesen, Belgium

Information Officer: Dr. Dirk Röske, Germany

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Credentials and Membership Committee – Prof. R. Collay, France (Chair)

Prof. H.S. Brandi, Brazil

Mr. Z. Zelenka, Hungary

Drafting Committee – Mr. M. Yates, UK (Chair)

Prof. T. Pfeifer, Germany

Prof. Ch. Eugene, Belgium

Advisory Board Prof. A.M. Da Cruz Serra, Portugal (Chair)

Prof. F. Righini, Italy

Prof. R.Z. Morawski, Poland

Prof. T. Ono, Japan

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Prof. L. Van Biesen, Belgium HONORARY MEMBER

Dr. K. Iizuka, Japan HONORARY MEMBER

Dr. T. Kemény, Hungary HONORARY MEMBER

Prof. M. Peters, Germany HONORARY MEMBER

Technical Board Prof. P. Daponte, Italy (Chair)
Ms. K. Havrilla, Hungary (Secretary)
Dr. D. Röske, Germany (Information Officer)
Dr. J. Holub, Czech Republic
Ms. M. Chambon, France
All TC Chairs ex officio
Editor-in-chief of MEASUREMENT ex officio

Chair of the MEASUREMENT Editorial Board: Prof. K.T.V. Grattan, UK
Editor-in-chief

As a tradition, upon the proposal of the Member Organizations, **IMEKO Distinguished Service Awards** were bestowed upon the following persons at the Closing Session of the World Congress for their continuous outstanding support and devoted service to accomplishing the objectives of the Confederation in relation to measurement science and technology, as Officers, MO delegates and/or TC members, as well as participants and authors at different events:

Prof. Leo van Biesen, Belgium
Prof. Roland Collay, France
Prof. Francesco Righini, Italy
Prof. Bernard P.Th. Veltman, The Netherlands and
Prof. Eugen-Georg Woschni, Germany

Metrology for Green Growth *– IMEKO XX*

The 20th IMEKO World Congress will take place in Busan, Republic of Korea, from 9 to 14 September, 2012 under the auspices of the Korea Research Institute of Standards and Science, our South Korean Member Organization.

<http://imeko2012.kriss.kr>

Please contact the Website (or the IMEKO Website www.imeko.org) for detailed information – we are looking forward to greeting you also on this occasion.



EVENT CALENDAR

2010

TC2 – Photonic Measurements

19th Symposium on Photonic Measurements
Hangzhou, China
September 11-13

Contact: Prof. Lin Jianzhong
President, China Jiliang University
258 Xueyuan St., Xiasha Higher Education Zone
Hangzhou 310018, CHINA
Phone: +86 571 86836009
Fax: +86 571 86836028
E-mail: linjz@cjlu.edu.cn

TC3 – Measurement of Force, Mass and Torque

TC5 – Hardness Measurement

TC22 – Vibration Measurement

21st Conference on Measurement of Force, Mass and Torque / HARDMEKO 2010 /
2nd Meeting on Vibration Measurement
Pattaya, Thailand
November 21-25

Contact: Dr. Pian Totarong, Director
National Institute of Metrology
3/4 -5, Moo 3, Klong 5
Klong Luang, Pathumthani 12120, THAILAND
Phone: +662 577 5100
Fax: +662 577 2823
E-mail: iro@nimt.or.th
<http://www.imeko2010.nimt.or.th>

TC4 – Measurement of Electrical Quantities

TC19 – Environmental Measurements

17th Symposium & 15th IWADC Workshop “Instrumentation in the era of information and communication technologies”

Kosice, Slovakia

September 8-10

Contact: Prof. L. Michaeli

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Fax: +421 55 6022853

E-mail: Linus.Michaeli@tuke.sk

<http://www.imeko.tuke.sk>

TC7 – Measurement Science

13th TC1/TC7 Symposium “Without measurement no science, without science no measurement”

London, UK

September 1-3

Contact: Prof. S.H. Khan

The City University

School of Engineering and Mathematical Sciences

Northampton Square

London EC1V OHB, UK

Phone: +44 20 70408183

Fax: +44 20 70408568

E-mail: s.h.khan@city.ac.uk

TC9 – Flow Measurement

FLOMEKO 2010 – the 15th Conference on Flow Measurement

Taipei, Taiwan

October 12-14

Contact: Dr. M. Reader-Harris

TUB NEL Ltd.

East Kilbride, Glasgow G75 0QF, UNITED KINGDOM

Phone: +44 1355 593825

Fax: +44 1355 593875

E-mail: mreader@tuvnel.com

<http://www.flomeko2010.itri.org.tw/>

TC10 – Technical Diagnostics

11th Workshop on Smart Diagnostics of Structures

Krakow, Poland

October 18-20

Contact: Prof. T. Uhl

University of Science and Technology AGH

Al. Mickiewicza 30

30-059 Krakow, POLAND

Phone: +48 12 617 3116

Fax: +48 12 6343505

E-mail: tuhl@agh.ed.pl

TC12 – Thermal and Temperature Measurement

Joint International Symposium on Temperature, Humidity, Moisture and Thermal Measurements in Industry and Science – TEMPMEKO & ISHM 2010

Portorose, Slovenia

May 31 – June 4

Contact: Dr. J. Bojkovski

University of Ljubljana

Faculty of Electrical Engineering

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Fax: +386 1 4264 633

E-mail: jovan.bojkovski@fe.uni-lj.si

TC14 – Measurement of Geometrical Quantities

10th Symposium on Measurement and Quality Control – ISMQC2010

Osaka, Japan

September 5-9

Contact: Prof. Y. Takaya

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Graduate School of Engineering

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Phone: +81 6 6879 7320

Fax: +81 6 6879 7320

E-mail: takaya@mech.eng.osaka-u.ac.jp

<http://www.ismqc2010.mech.eng.osaka-u.ac.jp/>

TC18 – Measurement of Human Functions

4th Symposium on Measurement, Analysis and Modeling of Human Functions –
ISHF2010

Prague, Czech Republic

June 14-16

Contact: Dr. S. Papezova

Czech Technical University

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16607 Prague, CZECH Republic

Phone: +420 224 352 401

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E-mail: stanislava.papezova@fs.cvut.cz

TC21 – Mathematical Tools for Measurement

Workshop on Measurement Systems and Process Improvement (MSPI 2010)

Teddington, UK

April 19-20

Contact: Prof. A. Forbes

National Physical Laboratory

Teddington, Middlesex TW11 0LW, UK

Phone: +44 20 8943 6348

Fax: +44 20 8614 0446

E-mail: Alistair.Forbes@npl.co.uk

<http://conferences.npl.co.uk/mspi/>

Co-sponsorships:

9th International Scientific Conference on Coordinate Measuring Technique (TC14)
Bielsko-Biała, Poland
April 14-16

Contact: Dr W. Jakubiec
University of Bielsko-Biała
Department of Manufacturing Technology and Automation
Willowa 2
43-309 Bielsko-Biała, POLAND
Phone: +48 33 82 79 321
Fax: +48 33 82 79 300
E-mail: wjakubiec@ath.bielsko.pl
<http://www.wtp.pl/conf/9/index.html>

Sensor&Test 2010 – The Measurement Fair
Nürnberg, Germany
May 18-20

Contact: AMA Service GmbH
Ms. Christiane Schild
Von-Münchhausen-Str. 49
31515 Wunstorf, GERMANY
Phone: +49 5033 9639-0
Fax: +49 5033 1056
E-mail: info@sensorfairs.de
www.sensorfairs.de

2011

TC2 – Photonic Measurements

20th Symposium on Photonic Measurements
Linz, Austria

Contact: Prof. B. Zagar

Johannes Kepler Universität
Institute for Measurement Technology
Altenbergerstr. 69
4040 Linz, AUSTRIA
Phone: +43 732 2468 9209
Fax: +43 732 2468 9233
E-mail: bernhard.zagar@jku.at
www.emt.uni-linz.ac.at

TC4 – Measurement of Electrical Quantities

18th Symposium
Brasil
September 14-16
16th Workshop on ADC Modeling and Testing
Orvieto, Italy

NEWS in brief

New Spanish delegate to the IMEKO General Council: **Prof. José A. Robles** representing CEM, the Spanish Centre of Metrology.

As Prof. Pasquale Daponte (Italy) became President Elect of IMEKO, he transferred chairmanship of TC4 – Measurement of Electrical Quantities to **Prof. Linus Michaeli**, (Slovakia). His Deputy is **Prof. Janusz Mindykowski**, (Poland).

TC18 – the Technical Committee on Measurement of Human Functions will be chaired in the future by **Prof. Yasuharu Koike** from the Tokyo Institute of Technology, succeeding Prof. K. Ito, founding Chairman (since 1998). Vice Chairman: **Prof. Vittorio Sanguineti**, (Italy); Scientific Secretary: **Prof. Etienne Burdet**, (UK).

Prof. Rainer Tutsch, (Technical University of Braunschweig, Germany) was elected Vice Chairman of TC14 – Measurement of Geometrical Quantities.

Prof. G.V. Iyengar, (USA) has resigned from the chair of TC23 – Metrology in Food and Nutrition. His successor will be appointed next year.

There will be a celebration for **Prof. Ludwik Finkelstein** on December 7 at the City University in London with a Bursary Fund named and launched in his honour. **Prof. Pasquale Daponte**, President Elect of IMEKO was requested to say a few words about Prof. Finkelstein's involvement with the Confederation. The list is long, as Professor Finkelstein started his highly valuable contribution to the cause in 1973 when he was asked to present a survey paper entitled "Fundamental Concepts of Measurement" at the 6th IMEKO Congress held in Dresden (then East Germany). He continued as one of the organizers of the 7th IMEKO Congress in 1976 in London. He was delegate of the UK Member Organization to the General Council from 1982 to 2000, chairing also the Drafting Committee. As chair of TC1 – at that time called Higher Education, he staged a colloquium on The Nature and Scope of Measurement Science in 1975 in London. He participated in several events of TC7 – then Measurement Theory and authored several lectures e.g. at IMEKO World Congresses. For many years he has been Editor-in-chief of the IMEKO Journal MEASUREMENT and he is now one of the Associate Editors.

The IMEKO community greatly appreciates Professor Finkelstein's actively supporting the aims and objectives of the International Measurement Confederation.

IMEKO will endorse also **CAFMET 2010**, the Third International Metrology Conference of the African Committee of Metrology to be held in Cairo, Egypt, April 19-23

<http://www.ac-metrology.com>

CAFMET staged a Metrology Forum in Benin, from 26 to 30 October, 2009

The General Council welcomed in Lisbon Dr. Malcolm Smith, President of the National Conference of Standardisation Laboratories International (**NCSLI**, USA); there is a continued interest in possible association between the two organizations. This would be facilitated by IMEKO participation in their major event in Providence, Rhode Island, USA

www.ncsli.org

As IMEKO maintains a long-standing mutual information relationship with the Society for Experimental Mechanics, Inc. (**SEM**) in Connecticut, USA, as well, let us mention here two of their next Conferences:

IMAC-XXVIII – Structural Dynamics and Renewable Energy

Jacksonville, Florida

February 1-4

SEM 2010 Annual Conference & Exposition “Experimental Mechanics of High Performance Systems”

June 7-9

Indianapolis, Indiana

<http://sem.org>

The British Society for Strain Measurement, as a rule, called our attention to the 7th **BSSM** International Conference on Advances in Experimental Mechanics which will be in Liverpool, UK; September 7-9, 2010

www.bssm.org

Our Brazilian Member Organization, the Brazilian Society of Metrology (**SBM**) had its 5th Congress – METROLOGIA 2009 – between 9 and 13 November
www.metrologia2009.org.br

The **World Standards Day** message on October 14, 2009 bore the title Tackling Climate Change Through Standards – authored by the Presidents of IEC and ISO and the Secretary General of ITU (International Electrotechnical Commission, International Organization for Standardisation, International Telecommunication Union).

What is metrology?

Survey by the delegate of the Swiss Member Organization to the IMEKO General Council, Mr. Karl H. Ruhm (Technical University, Zurich) on the basis of opinions assessed from the members of the Technical Committees on Education and Training in Measurement and Instrumentation (TC1) and Measurement Science (TC7)

Introduction

Without metrology, in short “measurement-based informatics”, today’s life is hardly conceivable. The field of applications is almost infinite, the technical tools keep developing rapidly and the theoretical base is still improving too. The following overview assigns the generic term «Metrology» to the well-known environment of daily measurement activities.

1 The Term «Metrology»

The term «Metrology» is not very common in practice and is frequently mistaken for the better-known term «Meteorology». Even among experts the term «Metrology» is understood too narrowly if just associated with activities of legislative state organs.

We recognise the Greek roots. A very free interpretation is «Art of Measurement». The art of every discipline implies creativity of the human mind on the one hand and skill for the transformation of *intellectual concepts* and for the solution of *practical tasks* on the other hand. In this respect metrology describes an area of human *thinking* and *acting* of enormous importance. The field includes acquisition, processing, representation and deliverance of information from arbitrary processes. Not only the instrumentation-, organisation- and application-specific topics are important but also the conceptual, structural and scientific ways of thinking, which always form the basis of technological activities and realizations.

According to these considerations the term «Metrology» is a synonym for «Measurement Science and Technology».

The accompanying adjective is «metrological». Amazingly, there is no derived verb for the main activity in metrology. We just have «to measure» as the very familiar verb. However, the term «Metrologist» exists.

Inconsistent perceptions concerning the term «Metrology» have arisen in the course of history. The innumerable fields of measurement have developed independently for centuries. We keep waiting for the convergence to, the consensus about and the recognition of a common language in the field under consideration. Language remains a dynamic process, which even normative committees have to obey.

It must not disturb that science and technology are not as easily separable as the above definition suggests: The one cannot exist without the other; metrology is an entity. Metaphorically speaking: metrology bridges measurement science and measurement technology, connects theory and practice, covers theoretical aspects and technological aspects. Or: there is a basic theoretical orientation on the one hand as well as an instrumental, computational, applicational and organisational orientation on the other hand. That there has always been a “gap” between them, implies an inherent, tiresome and undeniable fact. Thus, the term «Metrology» reveals even a programmatic and compulsory character.

2 Sub-Topics of Metrology

Considering the different possibilities of measurement procedures and the innumerable versions and applications of technology, we use arbitrary sub-terms; their number is nearly unlimited. And here again, we have to speak about «Science» and «Technology». Example: Geodetic Metrology (Geomatics).

An important sub-term is Legal Metrology. Although verification, quality and reliability of measurement results play a mayor role in metrology anyway, the state legislator asks for additional consideration. He issues internationally harmonized, normative regulations concerning physical quantities and their definitions, compliance and supervision in areas of public interest and protection requirement. Moreover, he defines the corresponding infrastructure. For example this concerns sensitive areas like health service, environment, trade, traffic, security, jurisdiction, and so on. Even political issues are often involved.

We are familiar with other sub-terms, «Analytical Metrology» with additional subgroups like «Chemical Metrology» (Chemometrics), «Clinical Metrology» for example. Recently also terms like «Economic Metrology» (Econometrics) and «Financial Metrology» have appeared. The definitions of the measurands of interest (soft quantities) and of the accompanying concepts and tools are still under discussion.

3 Main Metrological Aspects

In fact, that’s all about the term «Metrology». Further important terms, definitions and interpretations are located in the two sub-divisions «Measurement Science» and «Measurement Technology».

3.1 Measurement Procedure

In science and technology a measurement procedure means acquisition, processing, assignment, representation, transfer, storage and presentation of defined, selected and limited *information* concerning arbitrary time- and space-dependent processes. In particular we speak about *properties* and *behaviour* of the processes. We perceive the term «process» in an extremely wide sense. Properties and behaviour of interest of a process may, but don't have to be represented by significant quantities, which are either accessible by sensors and / or observable by other means. These are the quantities intended to be measured and / or to be observed. The results of a measurement or observation procedure *describe* the process to a selected, limited and constrained extent, always defined and modelled before the procedure as a priori knowledge. As a consequence, metrology is nothing else than a sub-division of «Informatics» («Information Science» and «Information Technology»).

Thus a measurement procedure may consist of a selection of virtual and real sub-procedures (acquisition, operation, mapping, transformation, stimulation, impact, observation, identification, estimation, description, representation etc.). Based on causal relations (logical and mathematical models) we get the desired and defined information from processes of interest and map it accordingly. We call this procedure *model based measurement*. In many cases, we even activate (stimulate) a process intentionally to launch a measurement procedure. Either individual, trained staff performs the procedures by means of specific instrumentation, or an automatism – hopefully supervised competently and consistently by experts – takes over independently. In innumerable areas, measurement processes are integrated in open and closed loops (control, automation), even in nature, as we all realise. Thereby metrology does networking of information (sensor fusion and data fusion) and betakes itself under the authority of «Systems Science» and «Systems Technology», where terms like structure, modelling, feedback, optimisation, estimation, error, probability, uncertainty, stability and robustness stand in the spotlight. Who among the metrologists is fully aware of this obvious fact?

Sensor processes and observer processes deliver data. Data reconstruction, data fusion and data mining tie them in model-based measurement results.

Mandatory demands and verifying checks guarantee a specified measurement quality, represented by measurement errors and uncertainties, to be communicated unambiguously and quantitatively.

3.2 Measurement Science

The human mind develops fundamental task-, technology- and application-independent concepts, strategies, structures and methods regarding the general demand for informa-

tion acquisition at processes, the information processing in instrumentation and the information transfer to customers.

The general propaedeutic fields of natural sciences and technology (mathematics, signal and system theory, stochastics and statistics, modelling and identification, control theory and optimization) form the base. On this foundation the following objectives of measurement science are essential:

- basic principles and structures of measurement (concept)
- topics, demands, constraints and limitations (task)
- relations between the properties and the behaviour of interest of the dynamical process on one hand and the time- and space-dependent quantities to be acquired on the other hand (process and measurement process models)
- definition of the quantities of interest and their relation to the standards (representativity, measurability, traceability)
- measurement effects of the accessible quantities to be acquired (information extraction)
- causality, determinism and chance
- principles of forward and backward analysis (mapping and reconstruction)
- data processing (reconstruction, data-fusion, data-mining)
- model of the non-ideal behaviour of the measurement process
- performance, verification and quality assurance

Initially, this happens without consideration of practicability and availability concerning any possible hardware and software tools (measurement process). The main advantage is that we are able to use those concepts, principles and methods without exception in any field of application. The horizon is very broad; and yet it is a matter of a few common basic objectives only.

That most points concern the propaedeutic fields mentioned above, applied logic and mathematics in fact, leaves open the question about the amount of remaining generic topics of measurement science. Of course, the profound reason is that logic and mathematical structures represent scientific relations more exactly and less arbitrarily than the insufficient verbal descriptions and definitions of our everyday language.

Measurement Science is independent from political, social, economic, environmental and technological requirements and evolutions. *Methods in measurement science develop slowly and steadily.*

3.3 Measurement Technology

The implementation of scientific concepts as well as the use of technological and organisational tools (acquisition and observing tools, sensorics, actuation, measurement processes, instrumentation, computer, software, premises, auxiliaries, personal,

institutions) are objective- and application-oriented: The term «Measurement Technology» is seen in an extremely wide sense. Normally these tools reflect the present state-of-the-art of technology. Of course, they too presuppose superior and application-independent concepts, strategies and structures, which we learn from and apply by the help of «Measurement Science». «Measurement Technology» does not just mean «Instrumentation».

Measurement procedures at space- and time-dependent processes should take place «on line» and «in real time». If not, corresponding means help to avoid errors and incorrect interpretations. The fact that both, instrumentation and observer, may influence the process under observation undesirably, has to be emphasized again and again. Methods in measurement technology develop rapidly and unsteadily.

3.4 Causality and Chance in Metrology

A measurement process is also an identifying process concerning relations. Whether a relation complies with the conditions of causality is one of the most important questions in certain border fields of application. In addition, this includes the question about the definition and the representativeness of a chosen and acquired quantity. Fortunately causality is assured in most cases. Only Quantum Mechanics has shown a lack of an accepted agreement about the character of measurement in this field until now.

Many influences impact measurement results in an unwanted, yet causal and deterministic way indeed (forward impact, forward mapping). If the mechanism of the effects (structure) and the amount (parameter) of the *deterministic* influences are unknown, which is usually the case for different reasons, we perceive them contradictorily as *random* events in the measurement result and interpret them accordingly. Thus, an inference (backward reasoning, reconstruction) on the measurand of interest is *not* possible in a straightforward and deterministic way. A measurement uncertainty will remain within the result, which must be evaluated, quantified and reported properly.

3.5 Quality in Metrology

The requirements and statements concerning the quality of measurement results are extremely different in practice. Since there is no ideal measurement at all, measurement results must be accompanied by estimated or calculated errors and uncertainties. There are two serious reasons for the usual and understandable uneasiness about such a procedure:

- An error and uncertainty analysis requires deep, model based knowledge about both, the process and the measurement process as well, which cannot be taken as granted.
- Effort and cost of measurement procedures grow excessively with increasing quality demands.

In order to meet advanced demands a measurement process must always incorporate a qualification process of its own.

3.6 Importance of Metrology

The significance of measurement is based

- on the scientific investigation of our dynamic world
- on the desire for assured information in connection with the political, economic, ecological, physical and security relevant needs of human society.

Metrology constitutes an astonishingly high percentage of the gross national product in industrialised countries, a fact that is usually unknown.

3.7 Education in Metrology

Measurement Science

Despite the enormous scientific, technical, economic and social relevance of metrology, educational activities concerning «Measurement Science» are rudimentary and even keep declining. Well structured curricula about Measurement Science as well as systematic and consistent textbooks for education purposes are missing in general. The common saying “everybody is able to measure” and the promises of euphoric sensor advertisements like “plug and play” suggest a “simplicity of use”, which is seldom true in practise. Experts know: “The only certainty in measurement is its uncertainty” and concerning sensors the slogan “plug and pray” fits much better. But obviously, measurement on the limits requires diving into ambitious structural and theoretical fields in the «Measurement Science» area, supported by the current possibilities of powerful and high-speed computational tools.

Measurement Technology

On the other hand we admit that education concerning «Measurement Technology» enjoys sufficient attention on different education levels with different institutions and companies as a challenge for practical technological applications.

3.8 Future of Metrology

Obviously, the acquisition of information, including measurement, has always been an important field of activity in society. The demands regarding performance, quality, reliability and optimal effort will keep increasing. This is true for the rapidly developing instrumental tools as well as for the scientific strategies and methods still evolving (model-based measurement).

Conclusion

Metrology is a hidden art of enormous relevance, astonishing omnipresence and downright serving character. Metrology is extremely universal, supportive, effective and useful. Measurement Science is related largely to applied mathematics and applied informatics. Indeed, it is applied mathematics and informatics, intentionally disregarding the strong technological background at the border of the process of interest. The field of metrology keeps expanding. It is shaped by short-term possibilities of technological realisations rather than by long-term theoretical and algorithmic tools.

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The author is looking forward to receiving comments, remarks, opinions to the subject.

Dear Readers:

We were proud to inform you about pleasing facts and events on the previous pages. However, as we all know, life is not just full of sunshine. The year 2009 brought also losses and sadness. We had to say good-bye forever to two highly esteemed members of the IMEKO community. Right at the beginning the news came from the UK MO about the passing away of Mr. Sam S. Carlisle, one of the unforgettable pioneers of the Confederation, who signed the first Constitution and By-Laws in 1965. He attended General Council Sessions as UK delegate until the mid 80s.

S. S. Carlisle – First President of IMEKO

Samuel Carlisle the distinguished British engineer, who was the first President of IMEKO died on 16 January 2009.

He was born in Londonderry in 1919 and educated at the Royal Belfast Academical Institution and then at Queen's University, Belfast. He graduated as an electrical engineer. On graduation he worked for the Royal Naval Scientific Service and then for the research organisation of British iron and steel industry.

In 1963 Sam Carlisle was appointed to be Director of SIRA, the cooperative research laboratories of the British scientific instrument industry and a recognised centre of scientific excellence. He took over at a time when the government of his country made great efforts to transform Britain through technology. Sam Carlisle was an effective and forceful advocate of the application of science to industrial problems. He mobilised state support, expanded SIRA and directed it towards the application of measurement, instrumentation and automation to industrial manufacture. As a Director of SIRA he was a key figure in Britain, bridging the gap between science and application. He was widely respected in his country as a leader of his profession and was entrusted with a number of distinguished offices.

He was, on behalf of the UK Institute of Measurement and Control, one of the founders of IMEKO. When the Confederation organised itself in a new way, Sam Carlisle became its first President in 1973 and presided over the World Congress in London in 1976. He brought to his office as President of IMEKO an impressive and forceful personality, management and leadership skills and the high regard in which he was held by his colleagues.

It is important for IMEKO to remember the men who founded and shaped it. Not only is it a debt we owe them, but the history of an organisation is a guide to the planning of its future.

We should remember that the founders of IMEKO face great difficulties in a world divided by ideological differences and diverse cultures. While much of the credit for creating IMEKO as a harmonious family is due to the diplomatic skills and cultural polish of the Secretariat, Sam Carlisle made his contribution with firm leadership combined with an ability to work within the framework of the organisation.

It is important to remember too his technical contribution to the field. At the time of the foundation of IMEKO the scientific world was excited by the spectacular developments of the theory of control and dynamic systems. Sam Carlisle directed attention to the equipment by which control was implemented and stressed the significance of practical problems. His was an important and influential voice.

IMEKO has grown in size and strength since its foundation. In remembering its founders it should strengthen itself to continue their work.

by Ludwik Finkelstein

Professor Ludwik Finkelstein OBE DSc FREng was a member of the General Council of IMEKO and Vice-President 1994-1997

Dr. Richard Lewisch

Austrian delegate to the General Council from 1985 to 1990 died at the age of 85 years on March 2. Earlier, in his capacity as Vice President of BEV – Bundesamt für Eich und Vermessungswesen, Dr. Lewisch was actively involved in the preparations and organization of the extremely successful Interregional Training Course on Theoretical and Practical Aspects of Assuring Measurement Accuracy under the guidance of IMEKO TC8 – (then) Technical Committee on Metrology held at the Austrian Research Center, Seibersdorf mainly for participants from developing countries, in cooperation with UNIDO and the International Atomic Energy Agency. Holder of several honours for his merits by the Austrian Republic he was also Honorary Professor at the Vienna Technical University. We will never forget his friendly manners and well-meaning approach towards the various complicated and less complicated matters on the actual agenda.

R i P

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Contents

The 19th IMEKOWorld Congress	3
The 52nd General Council Session and related meetings	5
IMEKO Officers and Standing Committee members to serve from 2009 to 2012	6
IMEKO Distinguished Service Award holders 2009	7
IMEKO XX	7
Event Calendar	8
NEWS in brief	15
What is metrology?	18
Obituaries	25
Member Organizations, Delegates, Officers	27

Remark:

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