



Proceedings of the

14th Joint International IMEKO
TC1+TC7+TC13 Symposium

**“Intelligent Quality
Measurements - Theory,
Education and Training”**



in conjunction with the 56th IWK
Ilmenau University of Technology
and the 11th SpectroNet Collaboration Forum

31. August – 2. September 2011 JenTower Jena, Germany



OptoNet e.V.
Competence Network for Optical Technologies



IMPRESSUM

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PREFACE

Ladies and Gentlemen, you are cordially invited to Jena on behalf of the organizers of the 14th Joint International IMEKO TC1+TC7+TC13 Symposium, which will be held from August 31st to September 2nd 2011 in conjunction with the 56th International Scientific Colloquium at Ilmenau University of Technology and the 11th SpectroNet Collaboration Forum.

The title “**Intelligent Quality Measurements – Theory, Education and Training**” is intended to reflect innovative solutions for intelligent quality measurements in both theory and application.

International researchers from 12 countries will present their exciting work in fundamentals of measurement science, mathematical models in measurement, new education and training methods and applications for intelligent quality measurements, for measurements in medicine and measurements in biology.

This years symposium in Jena, the 14th in a successful series, aims to bring researchers and developers from various fields together to share their new thoughts, findings and applications. The response from the academic community has been great, with more than 70 submissions received. The authors have contributed towards new knowledge and understanding, and have provided research results and applications that will be of important value to researchers, students and industry alike.

The competence network SpectroNet Green Vision connects specialists for visual quality control with digital image processing and spectral imaging in research and industry, nutrition and health, transportation, environment, security and administration (www.spectronet.de).

Additionally the 56th International Scientific Colloquium, which will be held at the Ilmenau University of Technology from 12th to 16th September 2011 has had an unbroken tradition of more than 50 years and is the "flagship" event of the university, having an excellent reputation. In 2011 the International Scientific Colloquium is again organised by the Faculty of Mechanical Engineering. The title of the conference is "Innovation in Mechanical Engineering – Shaping the Future" (www.iwk.tu-ilmenau.de).

Jena is the town of Carl Zeiss, Ernst Abbe and Otto Schott, a modern industrial center of scientific instrumentation with the Friedrich-Schiller-University Jena, the University of Applied Sciences Jena, the Fraunhofer Institute for Applied Optics and Precision Engineering, the Institute for Photonic Technologies, the home of the ZEISS Planetarium, Optical Museum and the leading factories CARL ZEISS and JENOPTIK (www.jena.de).

We are grateful to all the contributors who will present their valuable work to the research community. We sincerely wish you a very pleasant stay during the symposium and a nice trip home with plenty of pleasant memories of this event in Jena. We give our best regards to the participants of the Joint International Symposium. Welcome to Germany! Welcome to Jena!



Prof. Dr. Gerhard Linß
Chairman



Prof. Dr. Dietrich Hofmann
Honorary Chairman



Dr. Karina Weißensee
Co-Chairman

INTERNATIONAL PROGRAMME COMMITTEE

All submitted and published contributions have been peer reviewed by the International Programme Committee.

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Prof. H. Weiss, *Austria*

Prof. Eugen-Georg Woschni, *Germany*

Prof. Sarwat Zahwi, *Egypt*

Prof. Giuseppe Zingales, *Italy*

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PROGRAMME

Plenary lectures

From Verbal Models to Mathematical Models – A Didactical Concept not just in Metrology

Karl H. Ruhm

URN: [urn:nbn:de:gbv:ilm1-2011imeko-002:3](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-002:3)

The Role of Mathematical Models in Measurement outside the Laboratory

Marcel Boumans

The Role of Mathematical Models in Measurement: A Perspective from Psychometrics

Mark Wilson

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Multichannel-EEG Measurements with Dry Electrodes

Jens Haueisen

Progress on Measurement in Medicine and Biology: A Multiscale Systems Engineering Approach

Ronald Summers

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Fundamentals of Measurement Science

Quantity and Quantity Value

Alessandro Giordani, Luca Mari

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Does Measurement Need its Own System Theory - An Appraisal

Klaus-Dieter Sommer

Uncertainty in Fuzzy Scales Based Measurements

Eric Benoit

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How to Model and Test for the Mechanisms that Make Measurement Systems Tick

A. Jackson Stenner, Mark Stone, Donald Burdick

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The Quantification of Latent Variables in the Social Sciences: Requirements for Scientific Measurement and Shortcomings of Current Procedures

Thomas Salzberger

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Mathematical Models in Measurement

Foundational Imperatives for Measurement with Mathematical Models

Nikolaus Bezruczko

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Aspects of Measurement Strategy with Dynamic Programming

Kimmo Konkarikoski

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Lifetime Prediction of Smart Meter

Tino Almeroth, Olaf Kühn, Gerhard Linß, Andreas Lemke, Jürgen Kramny

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Uncertainty Analysis of Image Features for Vision Applications in Space

Marco Pertile, Stefano Debei, Alessio Aboudan

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Largest Consistent Subsets in Interlaboratory Comparisons: Preference Aggregation Approach

Sergey V. Muravyov, Irina A. Marinushkina

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Mathematical Models of Gear Tooth Speed Sensors with Dual Outputs

Ji-Gou Liu, Zhe Zheng

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Modeling of 3D-Measurement Chains in Nanopositioning and Nanomeasuring Machines

Roland Füßl, Eberhard Manske, Philipp Kreuzer

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From BREAST-Q © to Q-Score ©: Using Rasch Measurement to Better Capture Breast Surgery Outcomes

Stefan J. Cano, Anne F. Klassen, Andrea L. Pusic

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Applications for Intelligent Quality Measurements

Mathematical Methods for Imaging Mass Spectrometry

Dennis Trede, Jan Hendrik Kobarg, Klaus Steinhorst, Theodore Alexandrov

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Application of Advanced Production Metrology for Quality Improvements in Biomedical Engineering - Analysis and Evaluation of Surface Structures of Dental Implants

M.N. Durakbasa, W. Pirker, P.H. Osanna, P. Demircioglu, Gökçen Bas, B. Gültekin

URN: [urn:nbn:de:gbv:ilm1-2011imeko-085:3](https://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-085:3)

Lensless Microscopic Imaging

Rainer Riesenberger

Optimisation of the Format Factor for Spectrometers

Robert Wipf

Application of JENCOLOR Multispectral Sensors in Dermatology

Fredrik Hailer, Frank Krumbein

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Optical Detection of Geometrical and Wear Features of Cutting Tools

Heinz-Wolfgang Lahmann, Jan Klemm

URN: [urn:nbn:de:gbv:ilm1-2011imeko-086:1](https://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-086:1)

Ultra Compact OEM Spectrometer for Multiple Applications - STM

Dieter Steck, Marko Snickers

Worker Assistance and Quality Inspection – Application of Optical 3D Metrology and Augmented Reality Technologies

Steffen Sauer, Dirk Berndt, Jost Schnee, Christian Teutsch

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Diagnostic Concepts for Automated Assembly and Workpiece Inspection Systems (AAWIS)

Stephan Sommer

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Concept of a Measuring System for Large Diameters of Ball Bearings

André Göpfert, Matthias Rückwardt, Maik Rosenberger, Gerhard Linß

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Compact Roughness Sensor Using Light Scattering Techniques

Tobias Herffurth, Gunther Notni, Angela Duparré

Optical Identification of Construction and Demolition Waste by Using Image Processing and Machine Learning Methods

Katharina Anding, Elske Linß, Hannes Träger, Matthias Rückwardt, André Göpfert

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Characteristics of a Monolithically Integrated Micro-Displacement Sensor

Toshihiro Takeshita, Yao Peng, Nobutomo Morita, Hideyuki Ando, Eiji Higurashi, Renshi Sawada

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Upgrade of Optical Microscopes for 3D- Surface Measurements

Torsten Machleidt, Dietmar Kollhoff

Special Session on the Role of Mathematical Models in Measurement

Application of Mathematical Models in Optical Coordinate Metrology

Susanne C.N. Töpfer

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Measurement Modelling: Foundations and Probabilistic Approach

Giovanni Battista Rossi

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The Role of Mathematical Modelling in the Analysis and Design of Measurement Systems

Sanowar H. Khan, Ludwik Finkelstein

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Application-Oriented Approach to Mathematical Modelling of Measurement Processes

Roman Z. Morawski

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New Education and Training Methods

New Education Strategy in Quality Measurement Technique with Image Processing Technologies

Gerhard Linß, Maik Rosenberger, Mathias Schellhorn, Patrick Werner, Steffen Lübbecke

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Unified Education and Training at the European Imaging Academy

Peter Keppler, Mark Williamson

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Machine Vision Experts Programme for Image Processing in Industry, Medicine and Environment

Karl-Heinz Franke

Smartphone Measurement Engineering and Quality Assurance – The Breakthrough of Green Game Changers

Dietrich Hofmann, Gerhard Linß, Randolph Margull, Paul-Gerald Dittrich, Eric Düntsch, Michael Rockstroh, Gulfikar Siltama Ultri Rinjani

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Measurement, Metrology and the Coordination of Sociotechnical Networks

William P. Fisher (Jr.)

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An Opinion to Construct Framework of Measurement Science on Education Knowledge System

Komyo Kariya, Sigeru Takayama

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OptoNet MASTER+ - A Model Program for the Promotion of Young Talents

Peggy Lerner, Klaus Schindler

From Paper Books to Smart Books – A Breakthrough of Green Game Changers

Dietrich Hofmann, Gerhard Linß, Randolph Margull, Paul-Gerald Dittrich, Eric Düntsch, Michael Rockstroh

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Measurements in Biology

Segmented Flow Technique in Life Sciences – Applications of the Technological Platform „Pipe Based Bioreactors“

Gunter Gastrock, Andreas Grodrian, Karen Lemke, Jörg Schemberg, Stefan Wiedemeier, Josef Metze

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Potential of Microfluidics in Bioanalytical Applications

Jörg Weber

Design of a Cell-Based Lab-on-a-Chip with Integrated Electrochemical and Optical Detection
Michael Schimmelpfennig, Ute Neubert, Anja Bogen, Stefanie Michaelis, Joachim Wegener, Karl-Heinz Feller

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Mesoscale Sensor/System-Integration based on Multilayer Ceramics

Michael Stelter, Uwe Partsch

Fully Automized System for Pollen Concentration Measurement in Ambient Air

Eberhard Schultheiss, Ulrich Heimann, R. Möller, D. Zühlke

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An Innovative Laser-Based Sensing Platform for Realtime Optical Monitoring of Oxygen

Dörte Steinbrück, Elmar Schmälzlin, Frank Peinemann, Michael U. Kumke

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Multimodal Simulation of the Phage- λ Decision Cycle

Ryan Imms, Colin Warburton, Ron Summers

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Measurements in Medicine

Non-Invasive Spectral Domain Optical Coherence Tomography Combined with Innovative Software Solutions or Better Eye Diagnoses

Tobias Winkler

Measuring Retinal Vessel Diameters in the Rat in Vivo

Dietmar Link, Clemens Strohmaier, Bernd-Ulrich Seifert, Herbert A. Reitsamer, Walthard Vilser, Jens Hauelsen

The Necessity for Measuring a Spectacle Frame by Image Processing

Matthias Rückwardt, André Göpfert, Katharina Anding, Mathias Schellhorn, Gerhard Linß

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The Quality Control Parameters of the Medical Radiological Equipment

Sorin Bercea, Constantin Cenusă, Aurelia Celarel

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Dynamic Measurement of Body Swing in Walking and Jogging by Wearable Sensing System

Shigeru Takayama, Yuuki Matsuda and Komyo Kariya

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Session for Young Scientists

Online Correction of Aberrations to Reduce the Measuring Uncertainty for the Optical High-Speed Measurement of High-Precision Cutting Tools Using Coordinate Measuring Machines

Marco Büchner, Silvio Holder, Frank Richter, Uwe Nehse

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An Approach for Efficient Implementation of Uncertainty Analysis in Production-Related Measurement Processes

Martin Timmermann, Teresa Werner, Albert Weckenmann

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Internet Traffic Clustering Using Packet Header Information

Pekka Kumpulainen, Kimmo Hätönen, Olli Knuuti, Teemu Alapaholuoma

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Knowledge-Based Inspection Planning for Multi-Scaled Quality Testing

Karina Weißensee

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POSTER PRESENTATIONS

Applications for Intelligent Quality Measurements

Loudness Measurement by Robust Magnitude Estimation

Francesco Crenna, Giovanni B. Rossi, Luca Bovio

URN: [urn:nbn:de:gbv:ilm1-2011imeko-074:6](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-074:6)

Improvement of the Fast Impedance Spectroscopy Method Using Square Pulse Excitation

Grzegorz Lentka, Michael Kowalewski

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Analysis and Correction of Errors of Optical Measuring Systems Based on CCD-Sensors

Galina Polte, Alexey Saenko, Victor Musalimov, Gerhard Linß

URN: [urn:nbn:de:gbv:ilm1-2011imeko-079:8](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-079:8)

**Quality Assurance for Measurements of the Radioactivity in the Area of the „Horia Hulubei“
National Institute for Physics and Nuclear Engineering, IFIN-HH**

Ana Stochioiu, Aurelian Luca, Maria Sahagia, Romul Mircea Margineanu, Ion Tudor

URN: [urn:nbn:de:gbv:ilm1-2011imeko-080:1](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-080:1)

A Compact Smart Resistive Sensor Based on a Microcontroller

Zbigniew Czaja

URN: [urn:nbn:de:gbv:ilm1-2011imeko-075:5](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-075:5)

**An Experimental Study of Motion Blur in Optical Coordinate Metrology for Dynamic
Measurements of Geometrical Features**

*Ke Xie, Silvio Holder, André Göpfert, Matthias Rückwardt, Sebastian Krepler, Marco Büchner,
Gerhard Linß*

URN: [urn:nbn:de:gbv:ilm1-2011imeko-081:0](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-081:0)

**The Assessment of the Measuring Performances of a Standard Instrument for Absorbed
Doserate in the Medical Applications of the Ionizing Radiation**

Sorin Bercea, Constantin Cenusă, Ioan Cenusă, Aurelia Celarel, Stela Patrascu

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Measurements in Medicine

**A Clinical Scale for Measuring Functional Caregiving of Children Assisted with Medical
Technologies**

Nikolaus Bezruczko, Shu-Pi C. Chen, Connie Hill, Joyce M. Chesniak

URN: [urn:nbn:de:gbv:ilm1-2011imeko-032:7](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-032:7)

**Information Function of the Heart. Biophysical Substantiation of Technical Requirements for
Electrocardioblock Registration and Measurement of Electrocardiosignals' Parameters
Acceptable for Information Analysis to Diagnose Internal Diseases**

Viacheslav Uspenskiy

URN: [urn:nbn:de:gbv:ilm1-2011imeko-024:6](http://nbn-resolving.org/urn:nbn:de:gbv:ilm1-2011imeko-024:6)

Body, Mind, and Spirit are Instrumental to Functional Health: A Case Study

Carl V. Granger, Nikolaus Bezruczko

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The Fundamentals of the Measurement of the Dosimetric Quantities in Hadrontherapy

Sorin Bercea, Aleksandra Nikolic, Angelica Prioteasa, Aurelia Celarel, Constantin Cenusu

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Fundamentals of Measurement Science

Continious Quantity and Unit; Their Centrality to Measurement

Gordon A Cooper, William P. Fisher (Jr.)

URN: urn:nbn:de:gbv:ilm1-2011imeko-019:9

A Technology Roadmap for Intangible Assets Metrology

William .P Fisher (Jr.), A. Jackson Stenner

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