

PROCEEDINGS OF SPIE

Seventh International Symposium on Precision Engineering Measurements and Instrumentation

Kuang-Chao Fan

Rong-Sheng Lu

Man Song

Editors

7–11 August 2011

Lijiang, China

Sponsored by

International Committee on Measurements and Instrumentation

National Natural Science Foundation of China (China)

Organized by

Hefei University of Technology (China)

Beijing Information Science and Technology University (China)

National Taiwan University (Taiwan, China)

Harbin Institute of Technology (China)

Published by

SPIE

Volume 8321

Part One of Two Parts

Proceedings of SPIE, 0277-786X, v. 8321

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:

Author(s), "Title of Paper," in *Seventh International Symposium on Precision Engineering Measurements and Instrumentation*, edited by Kuang-Chao Fan, Rong-Sheng Lu, Man Song, Proceedings of SPIE Vol. 8321 (SPIE, Bellingham, WA, 2011) Article CID Number.

ISSN 0277-786X
ISBN 9780819479402

Published by

SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Copyright © 2011, Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at copyright.com. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 0277-786X/11/\$18.00.

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.



SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B ... 0Z, followed by 10-1Z, 20-2Z, etc.

The CID number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages. Numbers in the index correspond to the last two digits of the six-digit CID number.

Contents

Part One

xvii	Conference Committees
xix	<i>Introduction</i>

SEVENTH INTERNATIONAL SYMPOSIUM ON PRECISION ENGINEERING MEASUREMENTS AND INSTRUMENTATION

- 8321 02 **2D temperature field measurement in a direct-injection engine using LIF technology** [8321-04]
Y. Liu, H. Tian, J. Yang, J. Sun, A. Zhu, Beijing Univ. of Civil Engineering and Architecture (China)
- 8321 03 **The measurements of water flow rates in the straight microchannel based on the scanning micro-PIV technique** [8321-07]
H. L. Wang, W. Han, M. Xu, China Jiliang Univ. (China)
- 8321 04 **The modeling of hemispherical resonator gyro and its space applications** [8321-08]
X. Wang, W. Wu, B. Luo, Y. Li, National Univ. of Defense Technology (China)
- 8321 05 **Design of the system of three-point target automatic orientation** [8321-18]
M. Dai, L. Tan, J. Liu, Y. Song, Chang Chun Institute of Optics, Fine Mechanics, and Physics (China)
- 8321 06 **Measurement error analysis of taxi meter** [8321-19]
H. He, D. Li, Tianjin Univ. of Technology (China); H. Li, Dept. Tianjin Cancer Hospital Equipment (China); D.-J. Zhang, M.-F. Hou, Research Institute of Measure Technology (China); S. Zhang, Tianjin Univ. of Technology (China)
- 8321 07 **Research on forecast method of dynamic angle measurement** [8321-21]
Z. Chen, Hefei Univ. of Technology (China); D. Peng, F. Zheng, Y. Zheng, X. Chen, Chongqing Univ. of Technology (China)
- 8321 08 **Compatibility design for time grating interface based on forecasting method** [8321-23]
F. Zheng, Chongqing Univ. of Technology (China); Z. Chen, Hefei Univ. of Technology (China); J. Lu, C. Dong, Chongqing Univ. of Technology (China)
- 8321 09 **Weight function theory of dynamic accuracy loss** [8321-26]
M. Jiang, X. Lu, M. Duan, X. Wang, Zhejiang Normal Univ. (China)
- 8321 0A **Suppression of radiated emission in fiscal taxi meter** [8321-27]
H. He, P. Yang, Tianjin Univ. of Technology (China); X. Su, D. Zhang, K. Wang, M. Hou, Research Institute of Measure Technology (China)

- 8321 0B **Electromagnetic inhibition of high frequency thermal bonding machine** [8321-28]
H. He, Q. Zhang, Tianjin Univ. of Technology (China); H. Li, Dept. Tianjin Cancer Hospital Equipment (China); D. Zhang, M. Hou, Research Institute of Measure Technology (China); X. Zhu, Tianjin Univ. of Technology (China)
- 8321 0C **Research of a novel CMM with 3-PSS parallel mechanism** [8321-30]
P. Hu, L. Yao, S. Li, Hefei Univ. of Technology (China)
- 8321 0D **Error compensation for the linear error of a universal tool microscope's scale system** [8321-33]
X. Wang, Z. Qiu, Tianjin Univ. (China); J. Guo, B. Yang, National Institute of Metrology (China)
- 8321 0E **Image feature extraction method of planar target based on homography** [8321-34]
B. Wu, X. Xiao, T. Xue, X. Yang, Tianjin Univ. (China)
- 8321 0F **The application of micro-stepping for step-motor in the automatic blood viscosity measurement** [8321-37]
W. Qu, L. Zhu, Beijing Information Science and Technology Univ. (China)
- 8321 0G **Design and calibration of a novel piezoelectric six-axis force/torque sensor** [8321-39]
L. Qin, C. Jiang, J. Liu, Y. Duan, Chongqing Univ. (China)
- 8321 0H **Absolute distance measurement applying spectrally-resolved interferometry** [8321-40]
W. Zhou, Academy of Opto-electronics (China); Y. Xu, Jiangxi Univ. of Science and Technology (China) and Huazhong Univ. of Science and Technology (China); L. Ding, Academy of Opto-electronics (China)
- 8321 0I **Micro-vision-based displacement measurement with high accuracy** [8321-41]
Q. Lu, Foshan Univ. (China); X. Zhang, South China Univ. of Technology (China); Y. Fan, Foshan Univ. (China)
- 8321 0J **Localization/mapping motion control system for a mobile robot** [8321-42]
J.-S. Yang, C.-S. Su, Tamkang Univ. (Taiwan, China); C.-Y. Yang, Science Institute of Northern Taiwan (Taiwan, China)
- 8321 0K **Contact-flatted measurement of eye stiffness based on force-displacement relationship** [8321-48]
J. Zhang, J. Ma, Huainan Normal Univ. (China); X. Zhang, Anhui Institute of Architecture and Industry (China)
- 8321 0L **Fast parallel 3D profilometer with DMD technology** [8321-51]
W. Hou, Y. Zhang, Univ. of Shanghai for Science and Technology (China)
- 8321 0M **Low velocity intense rubidium beam source from a 3D magneto-optical trap** [8321-52]
X. Wang, North Univ. of China (China) and Tsinghua Univ. (China); Y. Feng, Tsinghua Univ. (China) and Joint Institute of Measurement Science (China); H. Xue, Z. Zhou, Tsinghua Univ. (China)

- 8321 0N **The machining precision analysis of the ion beam figuring system** [8321-53]
T. Xing, Institute of Optics and Electronics (China); Y. Li, X. Jia, J. Xu, Institute of Optics and Electronics (China) and Graduate School of the Chinese Academy of Sciences (China)
- 8321 0O **An improved SIFT descriptor** [8321-55]
L. Zeng, Y. Zhai, The Academy of Equipment Command and Technology (China)
- 8321 0P **A novel linear displacement sensor** [8321-56]
J. Yang, J. Zhang, X. Chen, T. Zhang, Chongqing Univ. of Technology (China)
- 8321 0Q **Semi-automatic inspecting instrument for watch escape wheel based on machine vision** [8321-61]
Z. Wang, Z. Wang, Tianjin Univ. (China); J. Zhang, Hefei Univ. of Technology (China); Z. Cai, X. Liu, Tianjin Univ. (China)
- 8321 0R **Investigation of bromide's spectra by high resolution UV-laser** [8321-65]
J. Zhang, J. Ma, Huainan Normal Univ. (China)
- 8321 0S **On-line detection for LED module based on machine vision** [8321-66]
Y. Yang, W. Pang, Hefei Univ. of Technology (China)
- 8321 0T **Bubbles image processing and parameters measurement based on the high-speed photography** [8321-67]
T. Xue, X. W. Liu, Y. X. Jin, B. Wu, Tianjin Univ. (China)
- 8321 0U **Rigorous electromagnetic analysis of metallic cylindrical focusing micromirrors designed by a modified focal-length function** [8321-70]
G.-A. Mei, J.-S. Ye, Y. Zhang, Capital Normal Univ. (China)
- 8321 0V **The capillary blood rheological measurement system** [8321-72]
M. Zhou, Chongqing Jiao Tong Univ. (China); L. Zhu, M. Dong, Beijing Information Science and Technology Univ. (China)
- 8321 0W **Turbine blade tip clearance measurements using skewed dual optical beams of tip timing** [8321-75]
D. Ye, F. Duan, H. Guo, Y. Li, K. Wang, Tianjin Univ. (China)
- 8321 0X **Real-time specified object tracking system under complex background** [8321-76]
X. Li, W. Wang, Y. Zhang, H. Chen, Tianjin Univ. (China)
- 8321 0Y **Self-calibration method of two-dimensional grid plate** [8321-77]
G. Ding, X. Chen, Shanghai Jiao Tong Univ. (China); L. Wang, L. Lei, Y. Li, Shanghai Institute of Measurement and Testing Technology (China)
- 8321 0Z **Piezoelectric inchworm-type probe-approaching stepper** [8321-78]
X. Fu, W. Xiao, L. Xu, Tianjin Univ. (China)
- 8321 10 **A free-form total internal reflection (TIR) lens for illumination** [8321-79]
G. Yu, S. Ding, J. Jin, T. Guo, China Jiliang Univ. (China)

- 8321 11 **Numerical analyses for thinned fiber Bragg grating under uneven surrounding refractive index environment** [8321-81]
B. Luo, Chongqing Univ. of Technology (China) and Univ. of Electronic Science and Technology of China (China); M. Zhao, Chongqing Univ. of Technology (China); X. Zhou, Univ. of Electronic Science and Technology of China (China); D. Huang, S. Wang, Chongqing Univ. of Technology (China); X. Cao, Univ. of Electronic Science and Technology of China (China)
- 8321 12 **A 3D nano driving system with large-stroke** [8321-82]
S. Wang, Z. Du, Luoyang Institute of Science and Technology (China); T. Xie, Huazhong Univ. of Science and Technology (China)
- 8321 13 **Underwater photogrammetric theoretical equations and technique** [8321-85]
Y. Fan, G. Huang, G. Qin, Z. Chen, Institute of Surveying and Mapping (China)
- 8321 14 **Design of an analogue contact probe for nano-coordinate measurement machines (CMM)** [8321-86]
R.-J. Li, Hefei Univ. of Technology (China) and Anhui Electrical Engineering Professional Technique College (China); K.-C. Fan, Hefei Univ. of Technology (China) and National Taiwan Univ. (Taiwan, China); S. Tao, J.-Z. Qian, Q.-X. Huang, Hefei Univ. of Technology (China); F. Cheng, Nanyang Technological Univ. (Singapore)
- 8321 15 **Repeatability test of in-line gear measuring machine** [8321-87]
J. Tang, Z. Shi, Beijing Univ. of Technology (China)
- 8321 16 **Application of wavelet analysis in laser-generated ultrasonic nondestructive testing** [8321-88]
X. Tan, M. Pan, S. Luo, C. Fan, National Univ. of Defense Technology (China)
- 8321 17 **Design of a cryogenic absolute prism refractometer for infrared optical materials** [8321-92]
S. Liao, Institute of Optics and Electronics (China); L. Ni, Institute of Optics and Electronics (China) and Graduate School of Chinese Academic of Science (China); Q. Ren, Institute of Optics and Electronics (China)
- 8321 18 **Concept of a novel nano displacement magnetostrictive actuator with self-sensing function** [8321-96]
G. Zhang, Z. Pan, National Univ. of Defense Technology (China)
- 8321 19 **High precision measurement system based on coplanar XY-stage** [8321-97]
K.-C. Fan, Hefei Univ. of Technology (China) and National Taiwan Univ. (Taiwan, China); J.-W. Miao, W. Gong, Y.-L. Zhang, F. Cheng, Hefei Univ. of Technology (China)
- 8321 1A **An interference signal processing method for displacement measurement by dual wavelength and single grating** [8321-99]
G. Wang, S. Yan, D. Yang, W. Zhou, X. Xie, National Univ. of Defense Technology (China)
- 8321 1B **Design for H type co-planar precision stage based on closed air bearing guideway with vacuum attraction force** [8321-100]
B. Zhang, Z. Shi, J. Lin, H. Zhang, Beijing Univ. of Technology (China)

- 8321 1C **Suppression research of arrival angle for free space optical communication** [8321-103]
Y. Cao, M. Zhao, Chongqing Univ. of Technology (China)
- 8321 1D **A tunable external cavity laser using a micromachined silicon flexure for atomic spectroscopy** [8321-104]
H.-C. Chuang, K.-Y. Huang, National Taipei Univ. of Technology (Taiwan, China)
- 8321 1E **Effect of plane height and incident angle of structure laser on measurement of step-style work piece based on computer-vision** [8321-106]
B. Yan, L. Liu, W. Deng, N. Lü, M. Zong, Beijing Information Science and Technology Univ. (China)
- 8321 1F **Study on the properties of the normalized reflectivity of fiber Bragg grating based on evanescent wave** [8321-109]
M. Zhao, X. Cao, B. Luo, J. Hu, J. Liu, Chongqing Univ. of Technology (China)
- 8321 1G **Displacement measurements of highway bridges using digital image correlation methods** [8321-111]
C.-H. Chiang, Chaoyang Univ. of Technology (Taiwan, China); M.-H. Shih, National Chi Nan Univ. (Taiwan, China); W. Chen, C.-P. Yu, Chaoyang Univ. of Technology (Taiwan, China)
- 8321 1H **Singular spectrum and singular entropy used in signal processing of NC table** [8321-112]
L. Wang, Y. He, Nanyang Institute of Technology (China)
- 8321 1I **The Rockwell hardness primary national machine according to the new international definition** [8321-114]
L. He, F. Zhang, National Institute of Metrology (China)
- 8321 1J **DSP based lunar sampling control system for the coiling-type sampler** [8321-116]
Y. Ling, A. Song, W. Lu, Southeast Univ. (China)
- 8321 1K **Air compressor multi-pattern smart monitor** [8321-121]
Q. Zhao, Y. Qin, J. Dai, Hunan Univ. of Science and Technology (China); G. Huang, Yingdesi Electronic Ltd. (China)
- 8321 1L **Research on full closed loop NC system of linear cutting machine for high accuracy internal gear machining** [8321-122]
Y. Zheng, Chongqing Univ. of Technology (China); D. Peng, Z. Chen, Chongqing Univ. of Technology (China) and Hefei Univ. of Technology (China); T. Zhang, X. Chen, F. Zheng, Chongqing Univ. of Technology (China)
- 8321 1M **Estimation of the convergence order of rigorous coupled-wave analysis for OCD metrology** [8321-123]
Y. Ma, S. Liu, X. Chen, C. Zhang, Huazhong Univ. of Science and Technology (China)
- 8321 1N **3D fiber probe for multi sensor coordinate measurement** [8321-124]
A. Ettemeyer, NTB Interstate Univ. of Applied Science of Technology Buchs (Switzerland)

- 8321 1O **A 3D numerical study of pinhole diffraction in visible-light point diffraction interferometry** [8321-125]
T. Xing, Institute of Optics and Electronics (China); J. Xu, F. Xu, Institute of Optics and Electronics (China) and Graduate School of the Chinese Academy of Sciences (China)
- 8321 1P **The design and comparison of transmission turbidity detection and scattering turbidimetry detection** [8321-131]
D. He, L. Zhu, Beijing Information Science and Technology Univ. (China)
- 8321 1Q **In-line monitoring of thermal deformation and surface topography of flip chip substrates** [8321-133]
M. Chang, W.-E. Tsai, Chung Yuan Christian Univ. (Taiwan, China); J.-Y. Lin, K.-Y. Jiang, Hua Qiao Univ. (China)
- 8321 1R **The simulation and experimental analysis of the MFL for cracks inspection in pipelines under mechanics-magnetic coupling** [8321-136]
X. Song, Hubei Univ. of Technology (China) and Key Lab. of Nondestructive Testing (China); L. Xue, Z. Xu, Hubei Univ. of Technology (China)
- 8321 1S **Design and realization of measuring system for pneumatic solenoid valve based on high speed data acquisition** [8321-137]
Y. Lu, W. Fan, Z. Luo, B. Guo, China Jiliang Univ. (China)
- 8321 1T **Hardware-software partitioning for the design of system on chip by neural network optimization method** [8321-138]
Z. Pan, W. Li, Q. Shao, L. Chen, South China Normal Univ. (China)
- 8321 1U **Use evolutionary strategies to design the structure of network-on-chip** [8321-139]
Z. Pan, Q. Shao, L. Chen, South China Normal Univ. (China)
- 8321 1V **Precise thermal control of CCD assembly of space optical remote sensor** [8321-140]
W. Yang, Xi'an Institute of Optics and Precision Mechanics (China); Y. Li, The No.5 Academy of Aerospace Science and Technology Group of China (China); T. He, Z. Bai, X. Zhang, Y. Wang, Xi'an Institute of Optics and Precision Mechanics (China); L. Yu, W. Fu, The No. 5 Academy of Aerospace Science and Technology Group of China (China); Y. Li, Xi'an Institute of Optics and Precision Mechanics (China)
- 8321 1W **Optical visualization of acoustic wave propagating along the wedge tip** [8321-141]
C.-H. Yang, I.-H. Liu, National Taipei Univ. of Technology (Taiwan, China)
- 8321 1X **Research on the automatic laser navigation system of the tunnel boring machine** [8321-144]
Y. Liu, Y. Li, Beijing Information Science and Technology Univ. (China)
- 8321 1Y **Measurement and investigation into air source heat pump exergy** [8321-145]
H.-P. Cho, National Taiwan Univ. (Taiwan); C.-W. Hsu, C.-S. Jwo, M.-Y. Tsai, National Taipei Univ. of Technology (Taiwan, China); S.-L. Chen, National Taiwan Univ. (Taiwan, China)
- 8321 1Z **A glass tube micro-stylus probe for surface form metrology** [8321-150]
B. Xu, Y. Shimizu, W. Gao, Tohoku Univ. (Japan)

- 8321 20 **Full-field chromatic confocal surface profilometry employing DMD correspondence for minimizing lateral cross talks** [8321-151]
L.-C. Chen, H.-W. Li, Y.-W. Chang, National Tipei Univ. of Technology (Taiwan, China)
- 8321 21 **Design of a linear-rotary micro-stage** [8321-153]
Y. Peng, Y. Sakurai, Y. Arai, Y. Shimizu, W. Gao, Tohoku Univ. (Japan)
- 8321 22 **Separation and reconstruction of high pressure water-jet reflective sound signal based on ICA** [8321-157]
H. Yang, Y. Sun, M. Li, D. Zhang, T. Wu, Anhui Univ. of Science and Technology (China)
- 8321 23 **Research on a novel method of real-time detection and dynamic calibration for angular displacement sensor** [8321-159]
Z. Gao, Hefei Univ. of Technology (China) and Chongqing Univ. of Technology (China); D. Peng, X. Chen, Chongqing Univ. of Technology (China); Z. Chen, Hefei Univ. of Technology (China)
- 8321 24 **A new measuring method for motion accuracy of 3-axis NC equipments based on composite trajectory of circle and non-circle** [8321-162]
F. Yang, Z. Du, J. Yang, M. Hong, Shanghai Jiaotong Univ. (China)
- 8321 25 **Dynamic force calibration by laser interferometer** [8321-163]
F. Meng, Z. Zhang, Y. Zhang, W. Zhang, National Institute of Metrology (China)
- 8321 26 **Imaging spectrograph for fast LED optical properties measurement** [8321-164]
K.-P. Chuang, F.-C. Yang, Y.-S. Chang, M.-S. Huang, Industrial Technology Research Institute (Taiwan, China)
- 8321 27 **Research on dynamic error correction method for NC rotary table based on time grating sensor** [8321-167]
Z. Chen, Hefei Univ. of Technology (China); D. Peng, Y. Zheng, F. Zheng, Chongqing Univ. of Technology (China); Z. Gao, Hefei Univ. of Technology (China) and Chongqing Univ. of Technology (China)
- 8321 28 **Analysis of microfluidic flow driven by electrokinetic and pressure forces** [8321-168]
C.-H. Chen, National Formosa Univ. (Taiwan, China)

Part Two

- 8321 29 **Calibration of the constants of high precision range-finder using unequal weight separation method** [8321-171]
H. Bao, D. Zhao, Z. Fu, J. Zhu, Zhengzhou Institute of Surveying and Mapping (China); Z. Gao, Henan Institute of Engineering (China)
- 8321 2A **Gravity anomaly interpolation based on genetic algorithm improved back-propagation neural network** [8321-172]
D. Zhao, H. Bao, Q. Wang, Zhengzhou Surveying and Mapping Institute (China); Z. Gao, Henan Institute of Engineering (China)

- 8321 2B **The study of double flank micro gear roll testing** [8321-173]
 Y.-C. Liu, N.-C. An, S.-H. Yang, S.-Z. Yan, S.-L. Chen, Metal Industries Research and Development Ctr. (Taiwan, China)
- 8321 2C **Automatic railway wheelset inspection system by using ultrasonic technique** [8321-174]
 C. Peng, X. Gao, L. Wang, Z. Wang, Q. Zhao, Y. Zhang, J. Peng, K. Yang, Southwest Jiaotong Univ. (China)
- 8321 2D **Measurement of microchannels inside transparent substrate based on confocal microscopy** [8321-175]
 F. Cheng, D. L. Butler, Nanyang Technological Univ. (Singapore); K.-C. Fan, Nanyang Technological Univ. (Taiwan, China) and National Taiwan Univ. (Taiwan, China)
- 8321 2E **A controlled-force laser interference profilometer** [8321-178]
 B. Yang, S. Chang, T. Xie, W. Pan, Huazhong Univ. of Science and Technology (China)
- 8321 2F **Non-uniform interpolation and re-sampling for tactile scanning measurement** [8321-179]
 X. Liu, Y. Hei, J. Wang, S. Chang, Huazhong Univ. of Science and Technology (China)
- 8321 2G **Development and assessment of a fiber-optic liquid level sensor with long-period fiber grating and Shewhart control charts** [8321-182]
 J.-N. Wang, National Yunlin Univ. of Science and Technology (Taiwan, China); C.-H. Jan, National Taiwan Univ. (Taiwan, China); J.-L. Tang, National Chung Cheng Univ. (Taiwan, China); W.-T. Wu, National Pingtung Univ. of Science and Technology (Taiwan); D.-C. Chen, Ching Yun Univ. (Taiwan, China); C.-H. Chen, National Chung Cheng Univ. (Taiwan, China); J.-Y. Syu, C.-Y. Luo, National Yunlin Univ. of Science and Technology (Taiwan, China)
- 8321 2H **An embedded image processing and feedback compensation for the vibration-resistance system using white light interferometer** [8321-184]
 S. P. Tseng, L.-C. Chen, C. Ho, C.-Y. Sheng, National Taipei Univ. of Technology (Taiwan, China)
- 8321 2I **A component based software framework for vision measurement** [8321-186]
 L. He, L. Bei, Huazhong Univ. of Science and Technology (China)
- 8321 2J **A new and effective 3D measurement system for micro solder bump** [8321-187]
 H. J. Pahk, Z. C. Li, J.-I. Mun, Seoul National Univ. (Korea, Republic of)
- 8321 2K **A novel implementation of homodyne time interval analysis method for primary vibration calibration** [8321-190]
 Q. Sun, National Institute of Metrology (China); L. Zhou, FOTON Environmental Engine Co. Ltd. (China); C. Cai, H. Hu, National Institute of Metrology (China)
- 8321 2L **Fractal analysis of motor imagery recognition in the BCI research** [8321-191]
 C.-T. Chang, H.-P. Huang, T.-H. Huang, National Taiwan Univ. (Taiwan, China)
- 8321 2M **Vibration errors in phase-shifting interferometer with absolute testing** [8321-194]
 X. Jia, Institute of Optics and Electronics (China) and Graduate School of the Chinese Academy of Sciences (China); T. Xing, Institute of Optics and Electronics (China)

- 8321 2N **Frictional properties of lubrication greases with the addition of nickel nanoparticles in pneumatic cylinder** [8321-200]
H. Chang, C.-W. Lan, J.-B. Guo, National Taipei Univ. of Technology (Taiwan, China)
- 8321 2O **A new model and improvement on test methods of the readout noise in the CCD camera** [8321-202]
Z. Yang, Xi'an Institute of Optics and Precision Mechanics (China) and Graduate Univ. of Chinese Academy of Sciences (China); P. Ruan, W. Ge, H. Wang, Xi'an Institute of Optics and Precision Mechanics (China)
- 8321 2P **Design and characterization of a chip defect inspection system during bonding process based on linear CCD imager** [8321-203]
M.-F. Chen, P.-H. Huang, Y.-H. Chen, T.-M. Huang, Instrument Technology Research Ctr. (Taiwan, China); M. Chang, Chung Yuan Christian Univ. (Taiwan, China)
- 8321 2Q **Algorithm of white-light interferometry for reconstruction of profile** [8321-207]
C.-Y. Pai, J.-W. Liaw, Chang Gung Univ. (Taiwan, China); M. Chang, Chung Yuan Christian Univ. (Taiwan, China)
- 8321 2R **Deployment precision measurement modeling of a deployable space telescope based on tape springs** [8321-208]
C. Li, Xi'an Institute of Optics and Precision Mechanics (China); X. Feng, Xi'an Institute of Optics and Precision Mechanics (China) and Graduate Univ. of Chinese Academy of Sciences (China)
- 8321 2S **Dynamic characteristic analysis of the constrained beams** [8321-209]
Y.-L. Hwang, National Formosa Univ. (Taiwan, China); W.-H. Gau, Huafan Univ. (Taiwan, China)
- 8321 2T **Parameters measurement of wheel set using three-dimensional profile reconstruction** [8321-220]
L. Wang, L. Jiang, J. Li, L. Luo, Southwest Jiaotong Univ. (China)
- 8321 2U **Wedge angle measurement of transparent objects by adopting transmitted differential interference contrast technique** [8321-223]
S.-K. Yu, W.-L. Chen, National Tsing Hua Univ. (Taiwan); T.-K. Liu, Industrial Technology Research Institute (Taiwan, China); S.-C. Lin, National Tsing Hua Univ. (Taiwan, China)
- 8321 2V **Measuring technology for runout of high-precision master gear** [8321-229]
Y. Ma, Z. Lou, J. Jin, K. Li, L. Wang, Dalian Univ. of Technology (China)
- 8321 2W **Research on the pattern evaluation in the digital speckle pattern interferometry** [8321-231]
Y. Wang, N. Li, H. Zhou, J. Sun, Hefei Univ. of Technology (China); L. Yang, Hefei Univ. of Technology (China) and Oakland Univ. (United States)
- 8321 2X **Research on automatic defect localization for ultrasonic normal probe detection on railway wheel** [8321-234]
X. Gao, Z. Wang, C. Peng, Y. Zhang, Southwest Jiaotong Univ. (China)
- 8321 2Y **Nonlinearity error correction of constant voltage power supply** [8321-235]
Y. B. Zhang, G. M. Liu, F. Ji, Z. Q. Wu, J. G. He, CAEP (China)

- 8321 27 **Rapid measurement of micro discharging gap** [8321-236]
Y. Zhang, F. Ji, G. Liu, L. Zhang, J. He, Institute of Machinery Manufacturing Technology (China)
- 8321 30 **Influence of the concentration measurement of carbon monoxide with temperature** [8321-237]
J. Guo, X. Gao, L. Wang, Z. Wang, J. Hou, Southwest Jiaotong Univ. (China)
- 8321 31 **Applying Kalman filter on optical measurement of atmospheric compositions** [8321-238]
W. Li, Imperial College London (United Kingdom)
- 8321 32 **Zernike moments features for shape-based gait recognition** [8321-240]
H. Qin, L. Qin, J. Liu, J. Chao, Chongqing Univ. (China)
- 8321 33 **The non-contact precision measurement and noise reduction method for liquid volume metrology** [8321-242]
J. Wang, Z. Liu, L. Tong, L. Zhang, L. Guo, X. Bao, National Institute of Metrology (China)
- 8321 34 **The investigation of mold life for glass thermal imprint** [8321-245]
L. K. Chen, Y. M. Hung, C. K. Sung, National Tsing Hua Univ. (Taiwan, China)
- 8321 35 **Investigation of the thermally structural denaturation of bovine serum albumin by a home-made optical heterodyne polarimeter** [8321-251]
C. Wu, National Tsing Hua Univ. (Taiwan, China)
- 8321 36 **Evaluation method for one-dimensional assembly yield based on Taguchi orthogonal experiment** [8321-260]
Z. Wen, Z. Zhu, Z. Zhou, S. Yang, Hunan Univ. of Science and Technology (China)
- 8321 37 **Study on the dynamic performance of a novel buck-boost matrix converter based on double-loop control strategy** [8321-261]
Q. Li, X. Zhang, Q. Chen, Hunan Univ. of Science and Technology (China)
- 8321 38 **Improved wavelet de-noising method of rail vibration signal for wheel tread detection** [8321-263]
Q. Zhao, C. Liu, X. Gao, L. Luo, Southwest Jiaotong Univ. (China)
- 8321 39 **ESPI solution for defect detection in crystalline photovoltaic cells** [8321-264]
C.-C. Yin, T.-K. Wen, National Chiao Tung Univ. (Taiwan, China)
- 8321 3A **Development of a 3D touch trigger probe using micro spherical stylus machining by micro-EDM for micro-CMM** [8321-266]
C.-L. Chu, Y.-L. Chen, T.-Y. Tai, Y.-H. Liu, C.-H. Chuang, C.-T. Lu, Southern Taiwan Univ. (Taiwan, China)
- 8321 3B **Design of life testboard of manual slack adjuster** [8321-268]
Z. Luo, G. Qiu, M. Lin, B. Guo, China Jiliang Univ. (China)

- 8321 3C **Development of a lightweight portable optical measurement system for the print-through phenomenon of fiber-reinforced plastics** [8321-270]
 F.-J. Shiou, Y.-Z. Lai, National Taiwan Univ. of Science and Technology (Taiwan, China); M.-L. Tsai, United Ship Design and Development Ctr. (Taiwan, China)
- 8321 3D **Measurement and deposition of nanometer-scale Cu dot using an atomic force microscope with a nanopipette probe in liquid condition** [8321-273]
 S. Ito, K. Yamazaki, F. Iwata, Shizuoka Univ. (Japan)
- 8321 3E **A system for the measurement of thermal deformation of mechanical parts** [8321-274]
 Z. Luo, N. Liu, Q. Luo, L. Jin, China Jiliang Univ. (China)
- 8321 3F **Non-invasive measurement of micro-area skin impedance in vivo** [8321-281]
 D. Li, W. Liang, T. Liu, H. Yu, K. Xu, Tianjin Univ. (China)
- 8321 3G **Development and calibration of a compact self-sensing atomic force microscope head for micro-nano characterization** [8321-289]
 T. Guo, S. Wang, J. Zhao, J. Chen, X. Fu, X. Hu, Tianjin Univ. (China)
- 8321 3H **Development of a dual-axis optoelectronic precision level** [8321-290]
 K.-C. Fan, T.-H. Wang, S.-Y. Lin, National Taiwan Univ. (Taiwan, China); Y.-C. Liu, Metal Industries Research and Development Ctr. (Taiwan, China)
- 8321 3I **Contouring error compensation on a micro coordinate measuring machine** [8321-291]
 K.-C. Fan, H.-Y. Wang, J.-K. Ye, National Taiwan Univ. (Taiwan, China)
- 8321 3J **Integrated gray-level gradient method for 3D velocity fields extraction of sprays in in-line digital holography** [8321-297]
 Y. Yang, G. Li, L. Tang, L. Huang, Chongqing Univ. of Technology (China)
- 8321 3K **Reconstruction of the hologram generated by spherical wave** [8321-298]
 Y. Yang, L. Tang, G. Li, L. Huang, Chongqing Univ. of Technology (China)
- 8321 3L **Measurement and research on the appearance of tongue board based on modification to discuss centrifugal fan air performance** [8321-300]
 C.-S. Jwo, T.-T. Cheng, National Taipei Univ. of Technology (Taiwan, China); H.-P. Cho, National Taiwan Univ. (Taiwan, China); W.-T. Chiang, ASLI Mechanical Co., Ltd. (Taiwan, China); S.-L. Chen, National Taiwan Univ. (Taiwan, China); C.-W. Chen, L.-Y. Jian, National Taipei Univ. of Technology (Taiwan, China)
- 8321 3M **Accurate and efficient identification of cable natural frequencies for cable tension monitoring by vibration frequency method** [8321-301]
 L. Liu, W. Chen, P. Zhang, S. Hu, W. Luo, Chongqing Univ. (China)
- 8321 3N **PZT local linearity and image sampling strategy for white-light vertical scanning measurement** [8321-302]
 X. Liu, J. Li, W. Lu, Huazhong Univ. of Science and Technology (China)
- 8321 3O **Strain measurement aided assembly for a CFRP hexapod** [8321-305]
 G. Ren, C. Li, W. Wang, X. Fan, Xi'an Institute of Optics and Precision Mechanics (China)

- 8321 3P **Intensity error correction for 3D shape measurement based on phase-shifting method** [8321-306]
T.-T. Chung, M.-H. Shih, National Taiwan Univ. (Taiwan, China)
- 8321 3Q **Design and implementation of an early warning system in vehicle for road speed control hump based on DSP and CCD** [8321-307]
S. Yang, P. Zhu, Y. He, L. Wang, Hunan Univ. of Science and Technology (China)
- 8321 3R **Surface warpage measurement of diamond grid disk by shadow Moiré method** [8321-308]
T. Y.-F. Chen, J.-S. Chen, National Cheng Kung Univ. (Taiwan, China)
- 8321 3S **Application of autoregressive distributed lag model to thermal error compensation of machine tools** [8321-309]
E. Miao, P. Niu, Y. Fei, Y. Yan, Hefei Univ. of Technology (China)
- 8321 3T **In-process and post-process measurements of drill wear for control of the drilling process** [8321-310]
T.-I. Liu, California State Univ., Sacramento (United States); G. Liu, California State Univ., Long Beach (United States); Z. Gao, California State Univ., Sacramento (United States)
- 8321 3U **Nonlinear analysis and dynamic compensation of stylus scanning measurement with wide range** [8321-311]
H. Hui, X. Liu, W. Lu, Huazhong Univ. of Science and Technology (China)
- 8321 3V **CAIP system for vision-based on-machine measurement** [8321-313]
R. Xia, R. Lu, Y. Shi, Q. Li, J. Dong, N. Liu, Hefei Univ. of Technology (China)
- 8321 3W **A study of the tool change timing in turning micro V-grooves roller** [8321-314]
Y.-S. Liao, Z.-Z. Lin, Y.-A. Hung, National Taiwan Univ. (Taiwan, China)
- 8321 3X **Vibro-acoustic modulation technique for micro-crack detection in pipeline** [8321-317]
J. Jiao, L. Zhang, G. Song, C. He, B. Wu, Beijing Univ. of Technology (China)
- 8321 3Y **A comparison of noise removal by the Fourier and the Haar transformations** [8321-318]
C.-H. Kuo, National Chung-Hsing Univ. (Taiwan, China) and Hiwin Technologies Co., Ltd. (Taiwan);
J.-C. Tsai, Y.-J. Chen, National Chung-Hsing Univ. (Taiwan, China)
- 8321 3Z **Optimization of parameters of photonic nanojet generated by dielectric microsphere for laser nanojet SNOM** [8321-320]
J. J. Wang, D. McCloskey, J. F. Donegan, Trinity College Dublin (Ireland)
- 8321 40 **Polarized multi-color in-line digital holographic microscope for high-speed 3D surface profiling** [8321-321]
J.-S. Chen, National Chung Hsing Univ. (Taiwan, China); Z. S. Lin, National Chung Cheng Univ. (Taiwan, China)

- 8321 41 **Autonomous navigation vehicle system based on robot vision and multi-sensor fusion** [8321-322]
L. Wu, Chengdu Electromechanical College (China); Y. Chen, Chengdu Electromechanical College (China) and Southwest Jiaotong Univ. (China); Z. Cui, Chengdu Electromechanical College (China)
- 8321 42 **A refraction Doppler measurement method** [8321-323]
T. Wang, Jiangsu Maritime Institute (China); J. Hu, J. Chen, S. Zhuang, Univ. of Shanghai for Science and Technology (China)
- 8321 43 **Pulsed eddy current systems for defect and geometrical profile measurement** [8321-324]
G. Y. Tian, Y. He, A. Simm, Univ. of Newcastle (United Kingdom)
- 8321 44 **Human tracking with thermal omnidirectional vision** [8321-325]
Y. Tang, Y. F. Li, H. Chen, City Univ. of Hong Kong (Hong Kong, China)
- 8321 45 **Review of the state of the art of whole field optical measurement techniques for strain analysis** [8321-326]
T. Walz, Dantec Dynamics GmbH (Germany)
- 8321 46 **High-numerical-aperture focused field measurement system based on a confocal microscopy** [8321-327]
Z. Zhou, Beijing Information Science and Technology Univ. (China) and Tsinghua Univ. (China); Q. Tan, Tsinghua Univ. (China)
- 8321 47 **Design of 3D translational motion measurement system based on twin area array CCDs** [8321-328]
K. Wang, Y. Lv, Q. Yi, Beijing Information Science and Technology Univ. (China)
- 8321 48 **Displacement measurement based on the Moiré fringe** [8321-329]
X. Li, Beijing Information Science and Technology Univ. (China)
- 8321 49 **Measurement system of tiny angle based on LED** [8321-330]
X. Lang, Y. Lv, L. Liu, Y. Niu, Beijing Information Science and Technology Univ. (China)
- 8321 4A **Research on space-borne optical collimation system** [8321-331]
L. Liu, Y. Lv, X. Lang, K. Wang, Q. Yi, W. He, Beijing Information Science and Technology Univ. (China)
- 8321 4B **Future of phased array radar systems** [8321-334]
A. Bassouni, US-Radars Consulting (United States)

Author Index

Conference Committees

Conference Chairs

- K. C. Fan**, National Taiwan University/Hefei University of Technology (China)
Wei Gao, Tohoku University (Japan)
Jiubin Tan, Harbin Institute of Technology (China)

Honorary Committee

- Y. T. Fei**, Hefei University of Technology (China)
G. F. Jin, Member of CAE/Tsinghua University (China)
Z. H. Zhang, Member of CAE/National Institute of Metrology (China)
S. H. Ye, Member of CAE/Tianjin University (China)
Z. Li, Huazhong University of Science and Technology (China)
Q. S. Han, Beijing Information Science and Technology University (China)
C. K. Chen, National Cheng Kung University (Taiwan, China)
Y. Chugui, Russian Academy of Sciences (Russia)
G. B. Wang, National Natural Science Foundation (China)
Z. D. Jiang, Xi'an Jiaotong University (China)

Program Committee

- W. H. Huang**, University of Science and Technology of China (China)
Y. S. Gao, Hong Kong University of Science & Technology (China)
D. Butler, Nanyang Technological University (Singapore)
M. Chang, Chung Yuan Christian University (Taiwan, China)
L. C. Chen, National Taipei University of Technology (Taiwan, China)
S. T. Gao, National Institute of Metrology (China)
Q. X. Huang, Hefei University of Technology (China)
M. Krystek, PTB (Germany)
S. Kurokawa, Kyushu University (Japan)
S. J. Lee, Yuan-Ze University (Taiwan, China)
S. Y. Lee, National Chen Kung University (Taiwan, China)
Y. F. Li, City University of Hong Kong (China)
S. C. Lin, National Tsing Hua University (Taiwan, China)
H. J. Pahk, Seoul National University (Korea, Republic of)
Y. Shimizu, Tohoku University (Japan)
G. Y. Tian, University of Newcastle upon Tyne (United Kingdom)
Z. G. Xu, Huazhong University of Science and Technology (China)
L. X. Yang, Oakland University (United States)
W. M. Hou, University of Shanghai for Science & Technology (China)

J. X. Yang, Zhejiang University (China)
J. Y. Yen, National Taiwan University (Taiwan, China)
H. T. Young, National Taiwan University (Taiwan, China)
W. H. Zhou, Chinese Academy of Science (China)

Session Chairs

- 1 Precision Theory and Uncertainty Evaluation
T. I. Liu, California State University at Sacramento (United States)
- 2 Micro/Nano Coordinate Measurement
L. C. Chen, National Taipei University of Technology (Taiwan, China)
- 3 Surface Measurement and Characterization
J. B. Tan, Harbin Institute of Technology (China)
- 4 Pre-, In-, and Post-Process Measurement
M. Krystek, PTB (Germany)
- 5 Optical Precision Measurement
A Ettemeyer, NTB Interstate University of Applied Science of Technology Buchs (Switzerland)
- 6 Measurement Theory and Methodology
D. Butler, Nanyang Technological University (Singapore)
- 7 NDT and Instrumentation I
G. Y. Tian, University of Newcastle upon Tyne (United Kingdom)
- 8 Machine Vision and Applications
T. Siebert, Dantec Company (Germany)
- 9 Laser and Optical Measurement
Y. Shimizu, Tohoku University (Japan)
- 10 NDT and Instrumentation II
L. X. Yang, Oakland University (United States)
- 11 Semiconductor and Optoelectronic Process Inspection Technology I
M. Chang, Chung Yuan Christian University (Taiwan, China)
- 12 Sensors and Measurement
H. P. Huang, National Taiwan University (Taiwan, China)
- 13 Optoelectronic System and Instruments
K. S. Woo, KAIST (Korea, Republic of)
- 14 Semiconductor and Optoelectronic Process Inspection Technology II
H. Danzebrink, PTB (Germany)

Introduction

The International Symposium on Precision Engineering Measurement and Instrumentation (ISPEMI) 2011 took place in Lijiang, China on 7–11 August 2011. Its approximately 230 attendees from 18 countries were treated to five days of talks, posters, technical exhibits, and special events, with ample opportunities for discussing measurement science and technology in precision engineering, making personal and scientific connections, and finding out the latest trends in our rapidly evolving interdisciplinary field. The ISPEMI program was organized into thirteen thematic sessions, and the chairs of each solicited manuscripts from their respective oral and poster presenters. These were compiled into the 7th ISPEMI proceedings volume.

The ISPEMI 2011 presentations were thematically diverse, as indicated by the session titles: Precision Theory and Uncertainty Evaluation, Micro/Nano Coordinate Measurement, Surface Measurement and Characterization, Optical Precision Measurement, etc. As you read this volume, you will encounter interesting studies for advanced dimensional, geometrical, micro structures, and material properties measurements using different methods, such as optical, tactile, electrical, NDT, etc. Such breadth and variety nicely illustrates the diversity of research in this exciting field. We hope that as you read this, you will be inspired to (and continue to) actively contribute to measurement and instrumentation research!

**Kuang-Chao Fan
Rong-Sheng Lu
Man Song**

