## **Table of Contents**

**Preface, Committees, Sponsors** 

## **Chapter 1: Optical Measurements**

H.L. Tsay, P.H. Huang, K.H. Wu and T.M. Huang	3
Full-Field Refractive Index Variation Measurement Based on Phase Shift Interferometry and SPR Phase Detection Y.S. Lin and M.H. Chiu	9
Wavelength Modulating Self-Mixing Interferometer D.M. Guo and H.Q. Jiang	15
Scanning Surface Plasmon Microscope for Sensing Lipid Array and Au Film Defect S.C. Wei, P.T. Yang, F.X. Gu, K.B. Sung and C.W. Lin	21
Research on Axial Multi-Focus Scanning in Confocal Microscopy with Liquid Crystal Spatial Light Modulator L.M. Zou, M.J. Zhou, B.K. Wang and X.M. Ding	27
Application of 3D Nanorelief Sharp-Edge Detection Method in the Optical Interference Microscope	
E.V. Sysoev, Y.V. Chugui, R.V. Kulikov, I.A. Vykhristyuk, L.C. Chen, H.H. Hai and K.C. Fan <b>3D Optical Measuring and Laser Technologies for Science and Industry</b>	34
Y.V. Chugui	41
Theory and Experiment Study on Laser Self-Mixing Interference with Multiway Feedback External Cavity	
Y. Zhang, H. Huan, D.D. Xu, L.X. Huang and S. Lu	47
IC Test Probe Measurement System H.W. Liu and C.S. Chen	53
Chapter 2: Sensors and Actuators for Measurement Systems	
Development and Evaluation of a Combined Three-Component Micro Force Sensor with a Lower Uncertainty	<i>(</i> 1
T.H. Qin, X. Jin, Z.J. Zhang and B.Y. Zhang	61
Self-Sensing Giant Magnetostrictive Actuator for Active Vibration Isolation Y.Y. Yang, L. Wang, J.B. Tan, X.Y. Zhu, B. Zhao, G.L. Jin, X.P. Zhao and Y.M. Liu	67
<b>Tip-Tilt Tests by Using Eddy Current Measuring Sensors</b> Y.S. Kim, J.H. Kim, J.H. Song, C.H. Lee, W.G. Lee, H.S. Kim, K.D. Lee, M. Cho, H.S. Ahn, W.H. Park and H.S. Yang	73
Wireless Input Technology Based on MEMS Inertial Measurement Unit - A Survey Z.X. Fu, G.Y. Zhang, Y.R. Lin and Y. Liu	79
A Small-Sized and Battery-Supplied Data Acquisition System for the Electromagnetic Launcher to Measure Pulsed Magnetic Fields	
R.G. Cao and X.C. Xu	85
Chapter 3: Micro- and Nanoscale Measurements	
A Multi-Segments Stitching Method for Profile Measurement of Large Scale Aspheric Surface within Submicrometer Accuracy	
S.W. Ye, P. Yang, Z.Z. Wang, Y.T. Zhang and Y.F. Peng	95
Surface Profile Measurement of Micro-Optics by Using a Long Stroke Atomic Force	
Microscope S. Ito, M.L. Li, Z.G. Jia, Y.L. Chen, Y. Shimizu and W. Gao	102

Precise Diameter Measurement of a Microsphere Based on Polarization Analysis of Whispering Gallery Mode Resonance	
M. Michihata, A. Kawasaki and Y. Takaya	108
Nanosteps Preparation Based on Focused Ion Beam Technique C.Y. Wang, W.X. Jing, Y.J. Zhang, M. Liu, Q.J. Lin and Z.D. Jiang	114
Improvement of Lateral Resolution of 3D-Relief Interferometric Measurement by Deconvolution	
E.V. Sysoev, I.A. Vykhristyuk, V.V. Shirokov and R.V. Kulikov	120
Development of a 3D Tunneling Current Probing System for Micro- and Nano-Coordinate Metrology	
Z.Y. Sun, A. Schuler and T. Hausotte	126
Chapter 4: Measurements and Calibration of Multi DOF and Robotics Systems	
Self-Calibration of Coupling Error for 3-DOF Displacement Measurement of Planar Working Stage Based on Two Planar Gratings Y.M. Liu, Z.L. Li, D.H. Du, M.Q. Yuan, J.Z. Huang and J.B. Tan	135
A Three-Axis Angle Sensor with a Linear Encoder Scale Reflector Y. Shimizu, T. Maruyama, S. Ito and W. Gao	133
Design and Calibration of Real-Time 3D Coordinate Measurement System Based on Multi- Angle Intersection and Cylindrical Imaging L.H. Yang, L.J. Wang, H.Q. Liu, Y.J. Ren, J.R. Lin and Y. Guo	147
Metrology Performance of Laser Line Scanning of Additive Manufacturing Fixtures Based on Geometrical Product Specification (GPS)  M. Zhang, B. Boeckmans, J.P. Kruth, W. Dewulf and Z.Y. Shi	153
Using XXY Table to Construct a Verticality Calibrator and its Error Analysis J.C. Lin and C.J. Lin	159
Investigation of Delta Robot 3D Printer for a Good Quality of Printing C.T. Hsieh	164
Chapter 5: Measurements and Monitoring of Mechanical Parameters of Machines and Equipment	
Study on the Frequency Compensation of the Dynamic Unbalance Signal Extraction for General Hard Bearing Dynamic Balancing Machine R. Qin, P. Cai, D.D. Zhao and Y. Gao	173
A System for Clearance Measurement of Bearings before and after Assembling N. Meier and A. Georgiadis	179
Evaluation of Handle Rotational Feeling in Fishing Reel by Coordinate Measurement and Gear Transmission Error Measurement	1,7
T. Inoue and S. Kurokawa	185
Principle and Practice of the Measurement for Hourglass Worms and Hobs B. Yu, Z.Y. Shi, Y. Ye, L. Yan, Y. Fu, L.T. Zhang and J. Tang	191
Combination of Double Scale Measurements for Large Scale Surface Profile Measurement E. Okuyama and M. Ito	197
Dynamic Calibration for Measurement System of Form Measuring Instruments Based on Elliptical Standard J.Z. Huang, T.H. Guo, J.B. Tan and T. Sun	203
Problems of Signal Processing in Ultrasonic Gas Flow Measurement V. Hans	209
Evaluation of Measurement Uncertainty for Torque Standard Machine Using Air Rotary Bearing	21.5
V.V. Duy, V.T. Thang and P.V. Hung  Evaluation of Volumetric Data for Dimensional X-Ray Computed Tomography	215
H. Fujimoto, M. Abe, K. Matsuzaki, O. Sato and T. Takatsuji	223

## **Chapter 6: In-Process and Inline Metrology**

A Case Study of Developing SEMI PV Standards in Taiwan (2009~2014) S.T. Hsu, Y.S. Long and T.C. Wu	231
A Novel MEMS Device for Scanning Profile Measurement with Three Cantilever Displacement Sensors	
H. Šhimizu, T. Akiyoshi, S. Yanagihara, Y. Tamaru and A. Baba	237
Challenge for the Traceable Dimensional Measurement Using CMM in Factory Floor O. Sato, K. Matsuzaki, H. Fujimoto, S. Osawa, M. Abe and T. Takatsuji	243
<b>High-Resolution Real-Time Visual Inspection System for Micro Assembly</b> B.Y. Zhang, M.Z. Xiao, Z.J. Zhang and T.H. Qin	249
<b>Standardize Test Method of Reliability Evaluation for c-Si Photovoltaic Product</b> S.T. Hsu, Y.S. Long and T.C. Wu	257
<b>Standardization of Current-Voltage Test Method for DSSC Products</b> S.T. Hsu, Y.S. Long and T.C. Wu	263
Chapter 7: Machine Vision and Image Processing	
Error Analysis and System Optimization of Pose Measurement with Monocular Vision Based on Point Feature Model	
Z.Y. Wang, Z.J. Yao and Q.Y. Wang	271
Calibration of Measuring Systems for the Expert Evaluation of Color Characteristics I.G. Palchikova, E.S. Smirnov, A.F. Aleynikov and Y.V. Chugui	277
Implementation of an Embedded Facial Recognition System C.M. Lee and Y.M. Li	283
Using 3D Matching for Picking and Placing on UR Robot H.Z. Zhao, G.L. Yang and C.Y. Chen	289
Accurate 3-D Surface Profilometry Using Novel Boundary Edge Detection on Digital Image Correlation	205
L.C. Chen, C.W. Liang, H.Y. Tseng and S.T. Lin	295
Design of a Novel Compound Eye System L.H. Li, C.Y. Chan and W.B. Lee	303
Relationship between Coordinate Transformation Uncertainty and Arrangement of	
Common Reference Points in Large-Scale Metrology J.R. Lin, Y. Ren, Y. Guo, Y.J. Ren, L.H. Yang and J.G. Zhu	309
Chapter 8: Measurements and Monitoring in Power Engineering, Electrical Machines and Apparatus	
A Mahalanobis Distance Measurement Method to Analyze Current Waveform for Determining the Motor's Quality Types Y.C. Yeh, T.F. Chien, C.Y. Chang and T.S. Chu	317
Digital Measurement and Control Technology of Grey Predictor-Based Inverse Hyperbolic Sliding Function for Solar PV Inverters E.C. Chang, R.C. Wu, G.Y. Chen, P.S. Wang and K.Y. Liao	323
Power Quality Measurements of a Horizontal Axial Small Wind Turbine Y.J. Liu, Y.C. Chen, P.H. Lan and T.P. Chang	329
Design and Implementation of Closed-Loop Controller with Current Sensors for Brushless DC Motor Drives	
M.H. Chen	335
Study on Measuring Method and Experiment of Arc Fault Detection Device J.H. Yang, R.C. Zhang and L. Huang	342

## **Chapter 9: Measurements in Biology and Biomedicine**

Brain Activity Monitoring System Based on EEG-NIRS Measurement System Y.W. Tang and Y.D. Lin	351
Specular Highlight Detection from Endoscopic Images for Shape Reconstruction C.H. Wu and M.Y. Su	357
Surface Deformation Measurement Using Point Set Registration C.H. Wu and S.W. Jheng	363
Analyses of DNA Image Cytometry Uncertainty Caused by Diffractive Blurring I.G. Palchikova, E.S. Smirnov and A.A. Konev	369
Efficient Evaluation Method of Cell's Viability Using Dielectrophoresis R. Komai, K. Aritoshi and K. Taguchi	375
Chapter 10: Applied Materials	
Investigate the Humping Ferro-Damp Induced under Non-Uniform Magnetic Field Density J.E. Ho and L.T. Lien	383
Enhancement-Mode GaN MOS-HEMT with Quaternary InAlGaN-Barrier P.G. Chen, H.H. Chen, M. Tang and M.H. Lee	389
Experimental Study on Formation of the Microstructure on Copper Film Using Ultraviolet Nanosecond Laser	20.7
X. Fu, H. Qi, Y.W. Zhao and D. Xu  Drain Side N <sup>+</sup> Layout Manners ("npnpn" Arranged-Type) on ESD Robustness in the 60-V	395
pLDMOS-SCR S.L. Chen, Y.T. Huang, C.H. Yang, C.Y. Yen, K.J. Chen, Y.C. Wu and J.M. Lin A Study of Making Dye Sensitized Solar Cell Using MK-II Dye by Electrophoretic	401
Deposition Method  K. Sugii, K. Tamiya and K. Taguchi	407
Efficient Selective Dismantlement of Protoplast Cell with Femtosecond Laser T. Tamura and K. Taguchi	412
Photocatalytic Activity and Visible-Light Response of TiO <sub>2</sub> Thin Film Doped with Nitrogen by Using Urea C. Ogawa and K. Taguchi	418
Chapter 11: Engineering Technologies and Applications	
Study on Temperature Rise Modeling of Main Motor of Hot Rolling Mill Based on Support Vector Machines	
Y. Gao, P. Cai, F. Chen and R. Qin  Designing, Modelling, Geometric and Noise- and Vibration Analysis of New Type Spiroid	427
Worm Gear Drive I. Dudás and S. Bodzás Parameter Design and Performance Optimization of the Two-Phase Mixture Pressure	432
Ulcer-Preventing Cushion D. Wang, Z.Y. Mao and P. Cai	439
Investigation of the Effect of Ultrasound on Cell Growth Y. Tamai and K. Taguchi	447
New Performance Method of Capacity Effect from High to Low Level Lighting for DSC Device	
Y.S. Long, S.T. Hsu and T.C. Wu Improvement of Variation Propagation Control in Mechanical Assembly Using Adjustment	453
Assembly Technique C.Z. Sun, L. Wang, J.B. Tan, B. Zhao, G.L. Jin and X.P. Zhao	459
Preparation of CNT Counter Electrode by Electrophoresis for Dye-Sensitized Solar Cell K. Tamiya, K. Sugii and K. Taguchi	465
A Computational Method for Contact Deformation of Arbitrary Logarithmic Crowned Roller-Raceway Contact Z.Z. He, Y.X. Chen and M.H. Shao	470