

# Table of Contents

Sponsors

Reviewers

Preface

## I. Micro/ Nano-Metrology

|                                                                                                                                                                                      |    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| <b>Engineering Nanotechnology: The Top Down Approach</b><br>R.J. Hocken, R. Feserman, J. Overcash, O. Ozturk and C. Stroup                                                           | 3  |
| <b>Dimensional Measurements for Micro- and Nanotechnology</b><br>G.L. Dai, F. Pohlenz, H.U. Danzebrink and L. Koenders                                                               | 7  |
| <b>Recent Advances in our Research on Ultrahigh Resolution Laser Confocal Microscopy</b><br>J.B. Tan and J. Liu                                                                      | 11 |
| <b>Reliable Detection of Periodic Micro Structures on Open Surfaces</b><br>F. Härtig, M.P. Krystek and S. Klein                                                                      | 15 |
| <b>The Assessment of Functional Properties of Surfaces with Morphological Operations</b><br>M. Dietzsch, S. Gröger, M. Gerlach and M.P. Krystek                                      | 19 |
| <b>Tactile and Optical Microsensors - Test Procedures and Standards</b><br>U. Neuschaefer-Rube, M. Neugebauer, W. Ehrig, M. Bartscher and U. Hilpert                                 | 23 |
| <b>Simulation of Light Scattering from Nanostructured Surfaces</b><br>A. Tausendfreund, S. Patzelt, S. Simon and G. Goch                                                             | 27 |
| <b>Characterization and Manipulation of Boron Nanowire inside SEM</b><br>M. Chang, C.H. Lin and J.R. Deka                                                                            | 31 |
| <b>AFM with the Slope Compensation Technique for High-Speed Precision Measurement of Micro-Structured Surfaces</b><br>Y.G. Cui, B.F. Ju, J. Aoki, Y. Arai and W. Gao                 | 35 |
| <b>Compact Displacement Measurement System Based on Microchip Nd:YAG Laser with Birefringence External Cavity</b><br>Y. Tan and S. Zhang                                             | 39 |
| <b>New Synthetic Heterodyne Laser Doppler Vibrometer for Measurement of Mechanical Vibrations with Submicron Amplitude</b><br>S.G. Kang, J.P. La, H.S. Yoon, D.Y. Choi and K.H. Park | 43 |
| <b>Development of the Precision Stage with Nanometer Accuracy and a Millimeter Dynamic Range</b><br>D.H. Jeong, H.K. Kweon and Y.S. Kim                                              | 47 |
| <b>Quasi-Common-Path Laser Feedback Interferometers for Precision Measurement of Non-Cooperative Targets</b><br>X.J. Wan and S.L. Zhang                                              | 49 |
| <b>Self-Mixing Interferometer Based on Four-Bucket Integration Technique for Micro-Displacement Measurement</b><br>D.M. Guo and M. Wang                                              | 53 |
| <b>Micro-Nanometer Positioning Control of Bimodal Ultrasonic Motor Based on Wavelet Differential Actuation Pattern</b><br>C.Y. Xu and X.F. Yu                                        | 57 |
| <b>Adaptive Fiber-Optical Sensor System for Pico-Strain and Nano-Displacement Metrology</b><br>R.V. Romashko, Y.N. Kulchin, S.D. Girolamo, A. Kamshilin and J.C. Launay              | 61 |
| <b>The Development of a Separated Mini-Environment</b><br>H. Zhang, Z. Cai and K.C. Fan                                                                                              | 65 |
| <b>Signal Denoising of MEMS Microstructure Profile</b><br>K. Hu, X.Q. Jiang and X.J. Liu                                                                                             | 69 |
| <b>Measurement and Analysis of Radial Error Motion of a Miniature Ultra-High-Speed Spindle</b><br>K. Fujimaki and K. Mitsui                                                          | 73 |

## II. Precision Measurement

|                                                                                                                                                                                                                                             |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Development of Measurement System for Accuracy Control in Subsection Manufacture</b><br>F. Zhang, X.H. Qu, J.F. Dai and S. Ye                                                                                                            | 79  |
| <b>Study on the Composite Measuring Method for Small Module Gears</b><br>J.J. Ding, Z.D. Jiang, B. Li and J.J. Guo                                                                                                                          | 83  |
| <b>Collinear Constraint Based Mobile Vision Coordinate Measurement System</b><br>Z.J. Yu, X. Li, X. Si, J. Zhu, D. He and Q. Gao                                                                                                            | 87  |
| <b>Designing a System of Interferometry Based on DSP</b><br>X. Ding, Z.M. Zhao, Y. Chen and Y. Hou                                                                                                                                          | 91  |
| <b>Multiple Measurement Techniques for Coordinate Metrology</b><br>S. Osawa, O. Sato and T. Takatsuji                                                                                                                                       | 93  |
| <b>Novel High-Precision Pitch Artifact Using Balls</b><br>M. Komori, S. Osawa, O. Sato, T. Kiten, D. Shirasaki and T. Takatsuji                                                                                                             | 95  |
| <b>Refractive Index and Thickness Determinations Using a Dual-Path Mach-Zehnder Interferometer</b><br>S.T. Lin and T.L. Lin                                                                                                                 | 97  |
| <b>Measuring and Machining of Ripples on Silicon Surface with Femtosecond Pulse Laser</b><br>X. Fu, L. Li, Y. Wu and N. Geng                                                                                                                | 101 |
| <b>Straightness Error Compensation for Ultra-Precision Machining Based on a Straightness Gauge</b><br>G.H. Cao and Y. Namba                                                                                                                 | 105 |
| <b>R&amp;D of Ray Tracing Simulation Software and Fabrication Technologies Based on VCAD (Volume-CAD) Concept for GRIN Lens</b><br>N. Itani, Y. Watanabe, W. Lin, Y. Uehara, S. MORITA, T. Mishima, H. Ohmori and A. Makinouchi             | 109 |
| <b>Surface Topography of Chromium Coatings after Pneumatic Ball Peening</b><br>A. Dzierwa, P. Pawlus and R. Reizer                                                                                                                          | 113 |
| <b>A Calculating Method in Design Flat Air Bearing with Central Feedhole and Pocket</b><br>V.T. Thang and L.C. Du                                                                                                                           | 117 |
| <b>Research on a Novel Vibration System for Dynamic Balancing Measurement Based on Flexure Hinge Mechanism</b><br>D. Zhao, P. Qin and P. Cai                                                                                                | 121 |
| <b>Hydraulic Pressure Wave Generator for Performing the Calibration of Hydraulic Components</b><br>S.H. Wang, L.L. Han and T.T. Tsung                                                                                                       | 125 |
| <b>The Research of Data Acquisition and Control Method about On-Line Measurement System on High Precision of Large Diameter</b><br>B. Wang, X.F. Yu and H. Zeng                                                                             | 129 |
| <b>Online Measurement for Dimensions of Thermal Train Wheel</b><br>Y. Yang, S. Deng and Z. Hong                                                                                                                                             | 133 |
| <b>Stability Derivatives Estimation of Unmanned Aerial Vehicle</b><br>Y.P. Sun, L.T. Wu and Y.C. Liang                                                                                                                                      | 137 |
| <b>Design of a Compliant Micromechanism for Optical-Fiber Alignment</b><br>Y.H. Hu, K.H. Lin, S.C. Chang and M. Chang                                                                                                                       | 141 |
| <b>Measurement Method for Measuring Circular Motion Error of CNC Machine Tools</b><br>K.H. Lin, Y.H. Hu, C.A. Chan and M. Chang                                                                                                             | 145 |
| <b>Optical-Electronic System for Remote Measurements of Shifts and Deformations in Huge Mechanical and Engineering Constructions</b><br>Y.V. Chuguy, A.G. Verkhogliad, V.S. Bazin, V.E. Kalikin, S.V. Kalichkin, S. Makarov and S.G. Savkov | 149 |
| <b>Incompressible and Analytical Study on a Basic Model of Out-Pump Type Complex Journal Gas Bearings</b><br>S. Yao, S.M. Barrans and L. Blunt                                                                                              | 153 |
| <b>Capacitance Automatic Measurement Method of the Thickness of Liquid Film on Plat Form</b><br>S.X. Xu, B. Wang and Y.Z. Zheng                                                                                                             | 157 |

|                                                                                                                                |     |
|--------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Calibration Technology of the Articulated Arm Flexible CMM</b><br>X.Y. Wang, S.G. Liu, G.X. Zhang, B. Wang and L.F. Guo     | 161 |
| <b>Theory and Application Research of Dynamic Measuring Accuracy</b><br>Y.T. Fei and M. Jiang                                  | 165 |
| <b>Research on the Application Technology of Linear CCD in Dynamic Measuring Molten Tin Glass Surface</b><br>Y. Yu and S.X. Xu | 169 |

### III. Online and In-Process Measurement

|                                                                                                                                                                                                           |     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Online Measurement of Micro-Aspheric Surface Profile with Compensation of Scanning Error</b><br>Y. Arai, A. Shibuya, Y. Yoshikawa and W. Gao                                                           | 175 |
| <b>Development of Ultra Precision Gear Measuring Instrument/UPGMI</b><br>H. Ogasawara, N. Maeda and T. Hayashi                                                                                            | 179 |
| <b>Use of Air Beam for In-Process Optical Measurement in Precision Machining</b><br>Y. Gao, K. Xiao, Y. Zhang and Y.S. Chan                                                                               | 183 |
| <b>Development and Evaluation of a Non-Contact On-Machine Profile Measurement System Using a Compact Laser Probe</b><br>R. Kobayashi, S. MORITA, Y. Watanabe, Y. Uehara, W. Lin, T. Mishima and H. Ohmori | 187 |
| <b>Measurement Method for Micro-Cavity Based on Improved MAP Algorithm</b><br>J.W. Cui, J.B. Tan and Q. Shi                                                                                               | 191 |
| <b>A Novel Control Method Using Nonlinear Observer for a <math>XY\theta_z</math> Planar Actuator</b><br>Y. Arai, S.Y. Dian and W. Gao                                                                     | 195 |
| <b>Machining Accuracy Improvement by Automatic Tool Setting and On Machine Verification</b><br>E.S. Lee, C.H. Lee and S.C. Kim                                                                            | 199 |
| <b>Study on the Multifunctional Bearing Test-Bed for Testing the Limit PV Performance</b><br>J.W. Yu, T. You and X.F. Yu                                                                                  | 203 |
| <b>Online Stereo Vision Coordinate Measurement System Using on Aircraft Assembly</b><br>Z.J. Yu, X.X. Li, D.R. He, J.G. Zhu, X.Y. Si and L. Zhang                                                         | 207 |
| <b>Laser Remote Inspection of Live Contact Wire for Railways</b><br>Y.V. Chuguy, A.G. Verkhogliad, V.S. Bazin, V.E. Kalikin, S.V. Kalichkin, S. Makarov and I.A. Vykhristyuk                              | 211 |

### IV. Surface Metrology

|                                                                                                                                                                                                                     |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Analysis of Digitizing and Traditional Measuring System at Surface Measurement of Lids</b><br>B. Barisic, M. Rucki and Z. Car                                                                                    | 217 |
| <b>High Precision Measurement and Evaluation of the Fine Mould Surface Structures</b><br>M.N. Durakbasa, P.H. Osanna, M.E. Yurci and A. Nomak-Akdogan                                                               | 221 |
| <b>3D Topography for Drilled Surfaces</b><br>G. Varga and I. Dudas                                                                                                                                                  | 225 |
| <b>Study on the Key Technology of Airport Runway Frictional Coefficient Measurement</b><br>L.W. Wang, Z.J. Yu, L. Zhang, J. Gao and J. Song                                                                         | 229 |
| <b>Simultaneous Flatness and Surface Roughness Measurement of a Plastic Sheet Using a Fan-Shaped Laser Beam Scanning System</b><br>F.J. Shiou and Y.W. Deng                                                         | 233 |
| <b>A Surface Texture Information System Integrated with AutoCAD for Next Generation GPS</b><br>Q. Qi, X. Liu and X.Q. Jiang                                                                                         | 237 |
| <b>A Study on Surface Material Measures for Areal Surface Texture Measuring Instruments: Measuring Conditions for the Areal Profiling</b><br>K. Nemoto, K. Yanagi, M. Aketagawa, D. Kanda, I. Yoshida and M. Uchida | 241 |

### V. Optical Metrology and Image Processing

|                                                                                                                                                               |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Laser Diode Self-Mixing Interference Based on Phase Measurement Method</b><br>M. Wang and D.M. Guo                                                         | 247 |
| <b>A Novel Laser Feedback Interferometer for Metrology of Large Range Displacement</b><br>W. Mao and S.I. Zhang                                               | 251 |
| <b>Eliminate of the Nonlinearity in Heterodyne Interferometer</b><br>W.M. Hou, L.Y. Shen and X. Ren                                                           | 255 |
| <b>Characterizing the Thermal Properties of Solid Materials with Weakly Absorption by the Transient Thermal Grating Method</b><br>X.D. Xu and X.J. Liu        | 259 |
| <b>Aspheric Surface Testing Using a Partial Compensation Lens</b><br>Q. Hao and Q.D. Zhu                                                                      | 263 |
| <b>New Approach to Fringe Pattern Analysis Obtained by Scanning Polished Metal Cylinders with Gaussian Beam</b><br>R. Jabłoński and J. Mąkowski               | 267 |
| <b>Theoretical Study on Self-Calibration for the Wide-Range Laser Auto-Collimation Method</b><br>H. Shimizu and O. Hayashi                                    | 271 |
| <b>Study on the Phase Unwrapping Method with Colored Encoded Grating Pattern in 3-Dimension Profile Measurement</b><br>B. Li, Z.D. Jiang and X.Q. Wang        | 275 |
| <b>A Study of the Surface Profile Measurement Using a Reference Error Free Interferometer</b><br>E. Okuyama and T. Yamasuge                                   | 279 |
| <b>3D Displacement Measurement with Pico-Meter Resolution Using Single Heterodyne Grating Interferometry</b><br>C.C. Hsu, J.Y. Lee, C.C. Wu and H.C. Shih     | 283 |
| <b>Merging Phase Shifting Interferometry with Confocal Chromatic Microscopy</b><br>J. Cohen-Sabban                                                            | 287 |
| <b>Positional Detection in Grating Mosaic Based on Image Processing of Far-Field Diffraction Intensity Patterns in Two Wavelengths</b><br>Y. Hu and L.J. Zeng | 291 |
| <b>A Comparison of Image Registration Methods Used for Printed Circuit Board Inspection</b><br>S.C. Lin, C.T. Chen and C.H. Chou                              | 295 |
| <b>Analyzing the Grating Profile Parameters Based on Scanning-Electron Microscope Images</b><br>Y. Li and L.J. Zeng                                           | 299 |
| <b>Machine Vision Based Tracking Control of a Ball-Beam System</b><br>C.C. Ho and C.L. Shih                                                                   | 301 |
| <b>A Point Matching Method for Stereovision Measurement</b><br>N.G. Lu, M.L. Dong, P. Sun and J.W. Guo                                                        | 305 |
| <b>Photogrammetric Measurement of Deformation of Large Deployable Mesh Microwave Antenna</b><br>M.L. Dong, W.Y. Deng, Y.N. Sun and Y.Q. Wang                  | 309 |
| <b>Photogrammetric Method with Distance Constraint for Profile of Inflatable Space Antenna</b><br>W.Y. Deng, M.L. Dong, N.G. Lu and Y.Q. Wang                 | 313 |
| <b>A Research on the Colorimetric Characterization of Digital Camera</b><br>G.X. Jia, X.H. Qu, H. Gong and S.H. Ye                                            | 317 |
| <b>Autofocusing System for Optical Microscope Based on DVD Pick-Up Head</b><br>C.L. Chu, C.Y. Chung, C.M. Tseng, Y.C. Lin, C.F. Li and K.M. Yeh               | 321 |
| <b>Automatic Inspection System for Grain Size Distribution Using a Commercial Grind Gauge</b><br>M. Yoshida, K. Yanagi, M.H. Hafiz and M. Hara                | 323 |
| <b>Optical Detection Using Multi-Wavelength Modulation</b><br>B.P. Ng, S.H. Luen, Y. Zhang and Y.C. Soh                                                       | 325 |
| <b>An Improved Active Homodyne Detector</b><br>H.L. Seck, Y. Zhang and Y.C. Soh                                                                               | 329 |
| <b>Improved Accuracy of 2-D Non-Contact Range Sensors Using 2-D Lateral Effect Position Sensitive Detector</b><br>S. Cui, Y. Zhang, S.Y. Lim and Y.C. Soh     | 333 |
| <b>A Dynamic Model of Two-Beam Tuning Fork</b><br>Z.G. Dong, Y. Zhang and Y.C. Soh                                                                            | 337 |

## VI. Biomeasurement

|                                                                                                                                                                                                  |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Direct Measurement of NO in Biological Samples</b><br>S. Mochizuki, M. Goto, Y. Ogasawara and F. Kajiya                                                                                       | 343 |
| <b>On the Measurement of the Effective Refractive Index of Biological Colloids</b><br>A. García-Valenzuela, C. Sánchez Pérez, A. Reyes-Coronado and R.G. Barrera                                 | 345 |
| <b>Surface Plasmon Resonance Bio-Sensor with Full Field Phase Detection</b><br>J.Y. Lee, T.K. Chou, H.C. Shih and C.C. Hsu                                                                       | 349 |
| <b>Study on the Intravenous Lung Assist Device (ILAD) Using PZT Actuators and PVDF Sensors</b><br>G.B. Kim, S.J. Kim, Y.C. Lee, C.U. Hong, H.S. Kang, J.S. Kim, S.Z. Kim, S.J. Yoon and M.H. Kim | 353 |
| <b>Study on the Immobilization of Ni-NTA and NTA on PMMA Substrate Base</b><br>W.S. Chong, G.B. Kim and C.U. Hong                                                                                | 357 |
| <b>A Basic Study of the CNT-Biomolecule Conjugation by Molecular Dynamics Analysis</b><br>S.M. Kim and H.K. Kweon                                                                                | 361 |
| <b>Lie Detection Experiment Methodology: Infrared Image and Spectrum Analysis</b><br>W.S. Li, H. Li, S. Lu and Q. Hu                                                                             | 365 |
| <b>Study of Equilibrium Sense Improvement Displaying Visual Information</b><br>G.B. Kim, S.H. Jeong, W.S. Chong, H.S. Kang, S.J. Kim, M.H. Kim, J.W. Hwang and C.U. Hong                         | 369 |

## VII. Sensor Technology

|                                                                                                                                                                                      |     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>A Robotic Facial Expression Recognition System Using Real-Time Vision System</b><br>K.T. Song, M.J. Han, F.Y. Chang and S.H. Chang                                                | 375 |
| <b>Freeform Surface Measurement from a Single Encoded Image Captured by a Camera with Varying Parameters</b><br>R.S. Lu, Z.J. Liu, X.M. Dang and P.H. Hu                             | 379 |
| <b>Development of a Flexible Temperature Sensor Array System</b><br>Y.J. Yang, B.T. Chia, D.R. Chang, H.H. Liao, W.P. Shih, F.Y. Chang and K.C. Fan                                  | 383 |
| <b>Signal Detection and Control of an Intelligent Robot</b><br>F.C. Wang, H.M. Lin, P.K. Chen, F.Y. Chang and K.C. Fan                                                               | 387 |
| <b>Fabrication and Characterization of Electro-Active Polymer for Flexible Tactile Sensing Array</b><br>L.C. Tsao, D.R. Chang, W.P. Shih and K.C. Fan                                | 391 |
| <b>Advanced Measurement Methods of Geometric Object Properties Using Airborne Ultrasound</b><br>H.F. Schweinzer, G. Kaniak and J. Kellner                                            | 395 |
| <b>Measurement of Acoustic Emission Wave by Using Optical Fiber Sensor during Microsecond Discharge</b><br>Y. Akematsu, A. Hirao, H. Takezawa, K. Kageyama, N. Mohri and H. Murayama | 399 |
| <b>Predictive Measurement Method for Time Grating Displacement Sensor</b><br>X.K. Liu, Y.T. Fei, D. Peng and X. Wang                                                                 | 403 |
| <b>Intelligent Profile Measurement for Wide-Area Resist Surface Using Multi-Sensor AFM System</b><br>S.J. Liu, K. Watanabe, S. Takahashi and K. Takamasu                             | 407 |
| <b>Increasing the Metrological Reliability of Sensors. New Problems and Ways of Solution</b><br>K. Sapozhnikova and R.E. Taymanov                                                    | 411 |
| <b>Consistency Checking and Combining Measurement Results for a Wireless Sensor Network</b><br>M.D. Duta and M.P. Henry                                                              | 415 |
| <b>Validated Uncertainty Evaluation for Self-Validating Sensor</b><br>Z.G. Feng, Q. Wang and K. Shida                                                                                | 419 |
| <b>Ultrareliable Measuring Complex for Nuclear Reactor of New Generation</b><br>R.E. Taymanov, I. Druzhinin and K. Sapozhnikova                                                      | 423 |
| <b>Key Technique of Tip Clearance Measurement for Rotational Blades</b><br>Y.Z. Ma, F.J. Duan, Y.Z. Zheng, C.S. Ai and S.H. Ye                                                       | 427 |

|                                                                                                                                                                  |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Optimal Design of Microaccelerometer</b><br>Y.C. Liang and Y.P. Sun                                                                                           | 431 |
| <b>Measurement of Strain Induced by Impact with Fiber Bragg Grating</b><br>P.Y. Zhu, D. Liu and Y. Lin                                                           | 435 |
| <b>Sensor Dynamic Modeling Based on LS-SVM and NGA</b><br>Q. Wang, Z.G. Feng and K. Shida                                                                        | 439 |
| <b>Application of Particle Swarm Optimization-Based Digital Beamforming Technique to the Identification of Multiple SAW Tags</b><br>H. Zhu, Q. Li and W. Shi     | 443 |
| <b>Study on Oil and Gas Pipeline Leakage Real-Time Inspection System Based on Distributed Optical Fiber</b><br>Y. Zhou, S.J. Jin, H. Feng, Z.M. Zeng and Z.G. Qu | 447 |
| <b>Effect of Arc Discharge Pressure on Discharge Current in EDM</b><br>A. Hirao, S. Tai, H. Takezawa, N. Mohri, K. Kageyama, H. Murayama and Y. Akematsu         | 451 |

## VIII. Intelligent Measurement and Instrumentation

|                                                                                                                                                                                           |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Material Tester Using a Controlled Oscillator and an Inertial Mass</b><br>S. Hashimoto and Y. Fujii                                                                                    | 457 |
| <b>Reconsideration of Body Mass Measurement on the International Space Station and Beyond</b><br>K. Shimada and Y. Fujii                                                                  | 461 |
| <b>Flatness-Based Control of a Coriolis Mass Flowmeter</b><br>H. Röck, T. Schröder, K. Kolahi and F. Koschmieder                                                                          | 465 |
| <b>Fabrication of Micro Tetrahedron Patterns Using Ultra-Precision Shaping System</b><br>J.W. Park, S.C. Choi, H.S. Oh, Y.W. Kim, S.W. Kim, C.M. Lee and D.W. Lee                         | 469 |
| <b>Load and Damage Monitoring of Intelligent Structures Based on Optical Fibers</b><br>Z.M. Zhao, L. Guo, W. Li, X. Hong and C. Ma                                                        | 473 |
| <b>Development of a High-Precision Temperature Measurement Instrument Based on Quartz Tuning-Fork Temperature Sensor</b><br>J. Xu, B. You and X. Li                                       | 477 |
| <b>A New Method and Characterization for Pollution Preventing of Camera Window</b><br>D.H. Kim, J.Y. Song and M.R. Lee                                                                    | 481 |
| <b>Measurement Method for Four Degrees of Freedom Using Reflective Diffraction Grating</b><br>T.H. Ha, C.W. Lee and J.W. Song                                                             | 485 |
| <b>Development of Durability Test Bench and Experimental Evaluation for Refrigerant Compressor of Automotive Air Conditioning System</b><br>J.N. Lee, C.B. Huang, K.J. Jang and C.W. Tsai | 489 |
| <b>A Study on Dynamic Performance of Precise XY Stages Using Real-Time Input Shaping</b><br>S.W. Park, S.W. Hong, H.S. Choi and W.E. Singhose                                             | 493 |
| <b>Performance Evaluation of Ultra-Precision Motion Controlled Positioning Stage</b><br>E.S. Buice, S.T. Smith, R.J. Hocken, D.L. Trumper and D. Otten                                    | 497 |
| <b>Theory Study of Nanometer Metrological Grating Based Two Times Moiré Fringe</b><br>X.S. Ma, Y.T. Fei, G.H. Li, Z.Y. Ying and S.Y. Li                                                   | 501 |
| <b>Lag Time and Working Frequency of FBG Strain Sensor</b><br>L. Sun, H.N. Li, D.Z. Liang and J. Fang                                                                                     | 505 |
| <b>A Planar Capacitive Sensor for Large Scale Measurement</b><br>W. Wang, X.X. Li and Z.C. Chen                                                                                           | 509 |
| <b>Temperature Characterization for Nano-Polishing of PCD Composites</b><br>Y. Chen, L.C. Zhang and J.A. Arsecularatne                                                                    | 513 |
| <b>Measurement and Characterization of Surface Quality in Fast Tool Servo Machining of Optical Microstructures</b><br>C.F. Cheung, T.C. Kwok, S. To, W.B. Lee, X.Q. Jiang and H.F. Li     | 517 |
| <b>Abrasive Dispersing in Ultra-Fine Diamond Tools</b><br>J. Liu, H. Huang and X.P. Xu                                                                                                    | 521 |
| <b>Nanomechanical Properties and Nanostructure of CMG and CMP Machined Si Substrates</b><br>B.L. Wang, H. Huang, J. Zou and L.B. Zhou                                                     | 525 |

|                                                                                                                                                                                                   |     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Development of Nanometrology for Nanoelectronics: Growth and Characterization of Transition Metal Monolayer Films on Silicon</b><br>N.I. Plusnin, W.M. Il'yashenko, S.A. Kitan and S.V. Krylov | 529 |
| <b>On the Measurement of Dielectric Constant of Coatings with Capacitance Sensors</b><br>A. Guadarrama-Santana and A. García-Valenzuela                                                           | 533 |
| <b>Broadband Dielectric Properties of the Ba<sub>3</sub>MnTa<sub>2</sub>O<sub>9</sub> Complex Perovskites</b><br>J.W. Chen, B.K. Wang, J.C. Hsu and G.N. Rao                                      | 537 |

## **IX. Uncertainty, Traceability and Calibration**

|                                                                                                                                                                                                                                              |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>ESAD Shearing Deflectometry: A Primary Flatness Standard with Sub-Nanometer Uncertainty</b><br>R.D. Geckeler                                                                                                                              | 543 |
| <b>Achieving Nanorad Level Stability of Beam Deflection with Scanning Pentaprisms</b><br>R.D. Geckeler                                                                                                                                       | 547 |
| <b>Traceable Dimension Metrology by AFM for Nanoscale Process Control</b><br>T. Bao                                                                                                                                                          | 549 |
| <b>Test Artefacts for the Verification of Optical Digitizers</b><br>O. Sato, S. Osawa, T. Takatsuji, M. Murakami and R. Harada                                                                                                               | 553 |
| <b>Kalman Filter for Estimation of a Linear Regression Model with Account of the Regression Vector Error and its Application to Calibration of Measuring Instruments</b><br>C. Hajiyev                                                       | 557 |
| <b>Research on Specification Uncertainty in the Next Generation GPS</b><br>W. Lu, X. Liu, X. Jiang and Z. Xu                                                                                                                                 | 561 |
| <b>Traceable Nanometrology Realized by Means of Nanopositioning and Nanomeasuring Machine</b><br>G. Jäger, E. Manske, T. Hausotte, R. Mastlylo, N. Dorozhovets and N. Hofmann                                                                | 565 |
| <b>Study on Scanning Squareness Measurement Method and Uncertainty Estimation</b><br>X. Chen and K. Takamasu                                                                                                                                 | 569 |
| <b>Improved Abbe Vertical Metroscope for the Calibration of Gauge Blocks</b><br>S.Z.A. Zahwi, M. Bahrawy, M. Amer and N. Farid                                                                                                               | 573 |
| <b>Analysis of Gear Measurement Using Virtual Gear Checker (VGC)</b><br>F. Takeoka, M. Komori, M. Takahashi, A. Kubo, T. Takatsuji, S. Osawa and O. Sato                                                                                     | 577 |
| <b>Industrial Robot Error Compensation Using Laser Tracker System</b><br>J.F. Ouyang, W. Liu, X.H. Qu and Y. Yan                                                                                                                             | 579 |
| <b>Research on Measurement Uncertainty Evaluation Methods Based on Bayesian Principle</b><br>X.H. Chen, Z.Y. Cheng and Y.T. Fei                                                                                                              | 583 |
| <b>Uncertainty Estimation Using Monte-Carlo Method Constrained by Correlations of the Data</b><br>M. Nara, M. Abbe and K. Takamasu                                                                                                           | 587 |
| <b>Analysis of Deformation and Stress Distribution of the Poly-Axial Pedicle Screw</b><br>S.M. Kim, I.C. Yang, D.K. Kim and H.S. Bae                                                                                                         | 591 |
| <b>Tooth Form Evaluation Using Ball Artifact Development of a Measuring Instrument of a Ball Center Distance Traceable to National Standard of Length</b><br>Y. Kondo, K. Sasajima, S. Noguchi, K. Kondo, S. Osawa, K. Naoi and T. Takatsuji | 595 |
| <b>Using of Validated Software for Uncertainty Analyses Tools in Accredited Laboratories</b><br>O. Velychko                                                                                                                                  | 599 |

## **X. Signal Processing and Algorithm**

|                                                                                                                                                                   |     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Universal Designed Structures for Strict Pitch Measurements Using Scanning Probe Microscopes</b><br>K. Sugawara, O. Sato, K. Yoshizaki, I. Misumi and S. Gonda | 605 |
| <b>An Intelligent Design for Foot Orthoses</b><br>S.E. Hussein                                                                                                    | 607 |

|                                                                                                                                                                              |     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>Study on In-Process Detection and Diagnosis of Faults Arc Based on Early Sounds Signature and Intermittent Chaos</b><br>R.C. Zhang, J.H. Yang and J.H. Du                 | 611 |
| <b>Processing of Complex Modulated Ultrasonic Signals in Gas Flow Metering</b><br>O. Ricken and V. Hans                                                                      | 615 |
| <b>Investigation on the Noise Separation in Watt Balance Experiments</b><br>W. Zeng, X.Q. Jiang, P. Scott and L. Blunt                                                       | 619 |
| <b>Advanced Analog-to-Digital Conversion Using Voltage-to-Frequency Converters for Remote Sensors</b><br>S.Y. Yurish                                                         | 623 |
| <b>Correlation Processing of the Signals of the Single-Fiber Intermode Interferometer with a Small Number of Excited Modes</b><br>Y.N. Kulchin, O.B. Vitrik and A.D. Lantsov | 627 |
| <b>Research on Automatic Flaw Classification and Feature Extraction of Ultrasonic Testing</b><br>J. Li, X. Zhan, J. Zhuge, Z. Zeng and S.J. Jin                              | 631 |
| <b>Simulation of Profiles of Normal Ordinate Distribution</b><br>P. Pawlus, R. Reizer and A. Dzierwa                                                                         | 635 |
| <b>Processing Speed Acceleration of an Intelligent Communication Instrument</b><br>H. Kikuchi, H. Shen and S. Iwasaki                                                        | 639 |
| <b>The Design and Use of F1 Softgauges for Validating Surface Metrology Software</b><br>T. Li, X.Q. Jiang, L. Blunt, P. Scott and S. Xiao                                    | 643 |
| <b>Instruction Scheduling on a Pipelined Processor for Mechanical Measurements</b><br>H. Shen and N. Numata                                                                  | 647 |
| <b>The Influence of Form Deviations and Surface Topography of Micro-Components on the Uncertainty of their Geometrical Parameters</b><br>M. Neugebauer and M.P. Krystek      | 649 |