

Society for Experimental Mechanics

SEM Annual Conference and Exposition on Experimental and Applied Mechanics 2006

June 4 – 7, 2006
Saint Louis, Missouri, USA

Volume 1 of 4

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571
www.proceedings.com

ISBN: 978-1-60423-601-9

Some format issues inherent in the e-media version may also appear in this print version.

Proceedings of the 2006 SEM Annual Conference and Exposition on Experimental and Applied Mechanics © 2006

The 2006 SEM Annual Proceedings was produced for the Society for Experimental Mechanics, Inc. by The Printing House, Inc. Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by SEM, provided that the base fee of US \$2.00 per copy, plus US \$.25 per page is paid directly to Copyright Clearance Center, 27 Congress Street, Salem, MA 01970 USA. For those organizations that have been granted a photocopy license by CCC, a separate system of payment has been arranged. The fee code for users of the Transactional reporting Service is: 1046-6770/YR @2.00 + \$25.

For Further information concerning publication policy, contact:

Society for Experimental Mechanics, Inc.
7 School Street
Bethel, Connecticut 06801 USA
Phone: 203-790-6373 Fax: 203-790-4472
e-mail: sem@sem1.com
sem.org

This product contains Adobe Acrobat software. Copying this product's instructions and/or designs for use on future CD-ROMs or digital products is prohibited without written permission from the Printing House and Adobe Systems Incorporated. The Printing House or its suppliers are not liable for any direct, indirect, special, incidental, or consequential damages to your hardware or other software arising out of the use—or the inability to use—the material on this CD-ROM. This includes, but is not limited to, the loss of data or loss of profit. Adobe, Acrobat and the Acrobat logo are trademarks of Adobe Systems Incorporated or its subsidiaries and may be registered in certain jurisdictions.

Society for Experimental Mechanics, Inc.
ISBN: 978-1-60423-601-9

Society for Experimental Mechanics

SEM Annual Conference and Exposition on
Experimental and Applied Mechanics 2006

TABLE OF CONTENTS

VOLUME 1

Structural Connection and Methodologie

Chair: H. Sadid, Idaho State University

Cochair: G. Murasawa, Yamagata University

A New Method of Measuring Young's Modulus Using Postbuckling Behavior	1
<i>A. Ohtsuki</i>	

Mechanical and Physical Characterization of Lightweight Shotcrete Used for Repair	9
<i>P. Ruggiero, A. Shukla, R. Brown</i>	

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Novel Applications

Chair: C.A. Sciammarella, Politecnico di Bari

Keynote Presentation: Advances in Optoelectronic Metrology: from Milliscale to Nanoscale Applications.....	18
<i>R.J. Pryputniewicz</i>	

Student Paper Competition I

Sponsored by: SEM and the SEM Education Foundation

Chair: M.E. Tuttle, University of Washington

2005 1st Place Winner: Microsample Tensile Testing of Platinum Alloys Using ISDG Techniques	35
<i>C. Kovalchick</i>	

Influence of Surface Properties on the Fracture of MEMS Beams	37
<i>T. Alan</i>	

Heterogeneous Nanoscale Strain Fields in Polymer Nanocomposites	39
<i>Q. Chen</i>	

Damage Mechanisms

Chair: M. Keller, University of Illinois at Urbana-Champaign

Identification of Ductile Damage Parameters Using Digital Image Processing	41
<i>M. Rossi, G.B. Broggiato, S. Papalini</i>	

Testing of a Steel-adhesive-repair System for Pipeline.....	49
<i>M.A. Rosas, J.S. Dias, J.C. Grion, L.O. Lima, N.F. Soares, R.D. Vieira, J.L.F. Freire</i>	

Characterization of Composites

Chair: Y.-L. Lo, National Cheng Kung University

Tensile Stress-strain Properties and Fracture Resistance of Paper and Paperboard	60
<i>T. Yokoyama, K.N. Nakai</i>	

Evolution of Strategically Tuned Absolutely Resilient Structures (STARS).....	68
<i>K.R. Biszick, H.A. Toutanji, J.A. Gilbert, S.A. Marotta, T.K. Ooi</i>	
A Dual-actuator Load Frame for Mixed-mode Fracture of Laminated or Adhesively Bonded Specimens.....	75
<i>D.A. Dillard, H.K. Singh, S. Park, D. Ohanehi, M.A. McGaw</i>	
Digital Image Correlation in Material Characterization	
Chair: W.-C. Wang, National Tsing Hua University	
Analysis of Friction Stir Welds Using Image Correlation	85
<i>S. Adapa, T.P. Chu, J. Schneider</i>	
Characterization of Heterogeneous Response of Pipeline Steel Weld Using Digital Image Correlation.....	90
<i>J. Yan, M.A. Sutton, A.P. Reynolds, S. Adeeb, D. Horsley</i>	
Mechanical Response of Nano-composites	
Studies on Flexural and Thermal Response of Hand-layup Carbon/Epoxy Composites.....	97
<i>M.V. Hosur, F.H. Chowdhury, S. Jeelani</i>	
Micromechanical Properties of Polyurethane Foam with SiC Nanoparticles.....	105
<i>F. P. Chiang, Y. Ding</i>	
Core/Skin Debond Fracture Toughness of S2-Glass/Epoxy Sandwich Composites with Nanophased Polyurethane Core	111
<i>M.C. Saha, E. Kabir, S. Jeelani</i>	
Applications of Experimental Mechanics in Deformation Analysis	
Chair: R. Moser, Bridgestone Firestone North America Tire, LLC.	
Experimental Measurements of Strain Changes Around Fastener Holes during Cold Expansion	118
<i>D. Backman, R. Rutledge, M. Yanishevsky</i>	
Measurement of Section Deformation of Circular Tubes under Cyclic Bending	138
<i>K.-H. Chang, W.-F. Pan</i>	
Visualization and Simulation of Flexural Wave Propagation within Fibre-reinforced Polymers	146
<i>D.H. Mueller, Ch. R. Koenig, J. Mueller, M. Calomfirescu</i>	
SYMPOSIUM ON MEMS & NANOTECHNOLOGY:	
Small Force Metrology	
Organized by: G.A. Shaw, National Institute of Standards and Technology, SEM MEMS & Nanotechnology Division	
Chair: P.R. Guduru, Brown University	
Force Calibration via Electrostatics.....	155
<i>J.R. Pratt, G.A. Shaw, J.A. Kramar, L. Kumanchik</i>	
Use of Transfer Artifacts for Small Force Measurement	166
<i>G.A. Shaw, R.S. Gates, J.R. Pratt, M.G. Reitsma</i>	
A Novel Testing Device for Mechanical Characterization of Individual Micro-/Nano- scale Fibers	174
<i>U. Singh, P. Kaul, A.R. Abramson, V. Prakash</i>	

Student Paper Competition II

Sponsored by: SEM and the SEM Education Foundation

Chair: M.E. Tuttle, University of Washington

Advanced Warpage Measurement Using Far Infrared TWYMAN-Green Interferometry	187
<i>A. Cox</i>	
Time Dependent Surface Transformations in NiTi Caused by Polishing.....	189
<i>A. Creuziger</i>	
Phase Boundary Propagation and Fracture in Nitinol	191
<i>S. Daly</i>	
Nanoindentation and Finite Element Modeling of Extracellular Matrix Proteins	193
<i>C. Franck</i>	

Damage Mechanics and Injury Mechanisms in Biomechanics

Organized by: D.J. Nuckley, University of Washington, SEM Biological Systems and Materials Division

Chair: D.J. Nuckley, University of Washington

Cochair: T. Juliano, United States Army Research Laboratory

Modeling Damage in Human Vertebral Trabecular Bone under Experimental Loading	195
<i>T.L. Bredbenner, D.P. Nicolella, D.T. Davy</i>	
Dynamic Tensile Deformation of Aluminum Alloy 6061-T6 and 6061-OA.....	205
<i>X. Tang, V. Prakash, J.J. Lewandowski</i>	
The Expansion Behavior of Human Lumbar Pedicle Cortex.....	214
<i>S. Inceoğlu, C. Kiliçer, A. Tami, R.F. McLain</i>	

Novel Optical Methods

Widefield Laser Doppler Vibrometer Using High-speed Cameras.....	220
<i>P.L. Reu, B.D. Hansche</i>	
Using Digital Micromirror Device for Digital Programmable Light Spectrum Synthesis System	229
<i>C.-H. Chuang, Y.-L. Lo</i>	
Novel Polariscope to Extract Multiple-parameter from Twisted Nematic Liquid Crystal	237
<i>T.C. Yu, Y.-L. Lo</i>	
Ultrasonic Stress Analysis of V-Notched Strip by Time-averaged Photoelasticity and FEM	244
<i>W.-C. Wang, Y.-H. Tsai</i>	

Inverse Problems I: Isotropic Materials

Chair: J.F. Cárdenas-García, University of Texas at Brownsville

Cochair: H. Sol, Vrije Universiteit Brussel

Mechanics Properties and Corrosion Resistance Evaluation of Cadmium Replacement Coatings Applied on Bolts.....	255
<i>D.D. de Menezes, L. Sathler, S.J.R. de Oliveira, L.C.V. de Castro</i>	
Determination of Two Independent Elastic Properties by a Simple Tensile Loading Test.....	267
<i>M. Fujikawa, Y. Uchiyama, M. Takashi</i>	

Identification of the Stress-strain Behavior of a Tensile Specimen after Necking	276
<i>D. Debruyne, S. Cooreman, D. Lecompte, H. Sol, D. Van Hemelrijck</i>	
Optical Methods in Micro and Nano Mechanics	
Chair: F.-P. Chiang, State University of New York at Stony Brook	
Advanced Experimental Techniques for Whole-field Nano-mechanics Measurement	283
<i>Z. Wang, Y. Xing</i>	
Effect of Heating on Fiber Shrinkage	290
<i>I. Emri, B.V. Bernstorff, A. Voloshin</i>	
Young's Modulus Measurement Using a Transparent Indenter Measurement Method	297
<i>C. Feng, B.S.-J. Kang</i>	
Dynamic Behavior of Low-impedance Materials I	
Organized by: D.T. Casem, U.S. Army Research Laboratory, SEM Dynamic Behavior of Materials Division	
Chair: D.T. Casem, U.S. Army Research Laboratory	
Cochair: V. Prakash, Case Western Reserve University	
Dynamic Response of an Alternative Tissue Simulant, Physically Associating Gels (PAG)	304
<i>P. Moy, T. Weerasooriya, T.F. Juliano, M.R. VanLandingham, W. Chen</i>	
Experimental Investigation of Radial Inertia Effects in Hopkinson Bar Testing of Extra-soft Materials	311
<i>B. Song, W. Chen, T. Weerasooriya</i>	
High Rate Characterization of Low Impedance Materials Using a Polymeric Split Hopkinson Pressure Bar	314
<i>D.S. Cronin, C.P. Salisbury, C.R. Horst</i>	
Micromechanical Property Quantification Using Scanning Acoustic Microscopy	323
<i>O. Marangos, J.L. Katz, Y. Wang, P. Spencer, A. Misra</i>	
SYMPOSIUM ON MEMS & NANOTECHNOLOGY:	
Computational Methods	
Organized by: A.J. Przekwas, ESI-Group, SEM MEMS & Nanotechnology Division	
Chair: A. Siahmakoun, Rose-Hulman Institute of Technology	
Cochair: A. Haque, Pennsylvania State University	
A New Type Atomic Force Microscope Based on Chaotic Motions	331
<i>M. Liu, D. Chelidze</i>	
Finite Element Modeling of Tensile Test of Thin-film Specimens	339
<i>S. Pradhan, D. Kim, T.C. Chu</i>	
Experiments and Simulation of Laser Micromachining for Microsystem Applications	345
<i>K.A. Nowakowski, R.J. Pryputniewicz</i>	
Student Paper Competition III	
Sponsored by: SEM and the SEM Education Foundation	
Chair: M.E. Tuttle, University of Washington	
Radial Inertia Effects on Dynamic Response of Soft Biological Tissues	369
<i>Y. Ge</i>	

Nanomechanical Behavior of Individual Polymer Micro/nano-structures Using a Novel Characterization Device	371
<i>P. Kaul</i>	
Dynamic Failure of Microelectromechanical Systems	373
<i>J. Kimberley</i>	
Removal of Halation Effects in Shape Measurement Using Phase Reliability Evaluation Value	375
<i>S. Ri</i>	
Optimization Studies of Composite Materials with Integrated Embedded Sensor Networks	377
<i>K. Schaaf</i>	
Biologically Inspired Materials	
An Elastomeric Self-healing Material	379
<i>M.W. Keller, S.R. White, N.R. Sottos</i>	
Compression and Instrumented Indentation Measurements on Biomimetic Polymers	383
<i>T.F. Juliano, P. Moy, T. Weerasooriya, M.R. VanLandingham, A.M. Forster</i>	
Nanocapsules for Self-healing Composites	391
<i>B.J. Blaiszik, S.R. White, N.R. Sottos</i>	
Self-healing Composites	397
<i>T. Plaisted, S. Nemat-Nasser</i>	
Model Validation of a Jointed/Foamed System	
Organized by: A. Urbina, Sandia National Laboratories, SEM Model Validation & Uncertainty Quantification Division Chair: T.W. Simmermacher, Sandia National Laboratories	
Comparison Measures and Metrics for Validation of Mathematical Models	400
<i>T.L. Paez, A. Urbina</i>	
Experimental Model Validation of Foam Encapsulated Components	410
<i>C.C. O'Gorman, P.S. Hunter, T.D. Hinnerichs, T.L. Paez, A. Urbina</i>	
Development and Validation of a Viscoelastic Foam Model for Encapsulated Components	422
<i>T.D. Hinnerichs, A. Urbina, T.L. Paez, C. O'Gorman</i>	
Validation of a Combined Non-linear Joint and Viscoelastic Encapsulating Foam Model	439
<i>A. Urbina, T.L. Paez, D.L. Gregory, B.R. Resor, T.D. Hinnerichs, C. O'Gorman</i>	
Modelling Pneumatic Circuits with Variable-geometry Nozzles: A Hybrid Approach	447
<i>G. Olmi, G. Vassura</i>	
Inverse Problems II: Residual Stresses	
Organized by: Optical Methods and Residual Stress Divisions Chair: M.B. Prime, Los Alamos National Laboratory Co-chair: G. Horn, University of Illinois, Urbina-Champaign	
Method for Mapping Multi-axial Residual Stresses in Continuously-processed Bodies	458
<i>A.T. DeWald, M.R. Hill</i>	

Solution to the Residual Stress Problem in Orthotropic Materials Using Genetic Algorithms	466
<i>J.F. Cárdenas-García, Y. Zhou, A. Zapata</i>	
Effect of Tool Parameters on Temperature Fields in High-speed Machining	471
<i>J.J. Mason, Zimmer Inc.; R.V. Kazban, K.M. Vernaza-Peña</i>	
Uncertainty, Model Error, and Improving the Accuracy of Residual Stress Inverse Solutions	479
<i>M.B. Prime, P. Pagliaro</i>	
Noise Sensitivity of Optical Techniques Using the Hole Drilling Approach for Residual Stress Measurement	489
<i>A. Baldi, F. Bertolino</i>	
Time-Dependent Constitutive Behavior I	
Organized by: H. Lu, Oklahoma State University and Y. Miyano, Kanazawa Institute of Technology, SEM Time Dependent Materials Division	
Chair: V.B. Chalivendra, University of Massachusetts, Dartmouth	
Evaluation of Geometrical Effects to Viscoelastic Waves in PMMA Bars	496
<i>T. Tamaogi, Y. Sogabe, Y. Arimitsu, Z. Wu</i>	
Temperature and Humidity Effect on Creep Behavior of Polybutylene Succinate	504
<i>S. Somiya, T.S. Sakai</i>	
Viscoelastic Analysis of Drive Belts	510
<i>I. Emri, J. Kramar, A. Nikonov, R. Cvelbar, U. Florjančič</i>	
Dynamic Compressive Behavior of Crosslinked Silica Aerogels	522
<i>H. Lu, H. Luo, G. Churu, N. Leventis</i>	
Impact, Explosions, and High Rate Phenomena I	
Organized by: T. Vogler, Sandia National Laboratories, SEM Dynamic Behavior of Materials Division	
Chair: D. Dolan, Sandia National Laboratories	
The Mechanical Response of Tantalum Loaded Dynamically in Shear	528
<i>E. Cerreta, G.T. Gray III, C.P. Trujillo, C.M. Cady</i>	
Multiscale Finite-element Modeling of a Tantalum Impact Experiment	534
<i>S.N. Kuchnicki, R.A. Radovitzky, T.J. Vogler, A.M. Cuitiño</i>	
Dynamic Compression of Amorphous and Annealed Bulk Metallic Glass	542
<i>G. Sunny, J.J. Lewandowski, V. Prakash</i>	
Dynamic Damage Nucleation and Growth in Boron Carbide	550
<i>B. Paliwal, K.T. Ramesh</i>	
Real-time Observations of Dynamic Necking and Fragmentation in an Expanding Ring Experiment	554
<i>H. Zhang, K. Ravi-Chandar</i>	
SYMPOSIUM ON MEMS & NANOTECHNOLOGY:	
Fabrication of MEMS/NEMS	
Organized by: W.C. Crone, University of Wisconsin, Madison, SEM MEMS & Nanotechnology Division	
Chair: G.A. Shaw, National Institute of Standards and Technology	
Cochair: W. Han, Worcester Polytechnic Institute	
Developing Advanced Polymer Nanocomposites via a New Combinatorial Approach based on Twin Screw Extrusion	558
<i>A.K. Kota, F. Choudhary, H.A. Bruck, D.I. Bigio, S. Raghavan, M. Duesterberg, D. Powell</i>	

VOLUME 2

SYMPOSIUM ON MEMS & NANOTECHNOLOGY: Fabrication of MEMS/NEMS (Continued from Volume 1)

Synthesis and Dimension Control of Ultrafine γ -Aluminum Oxide by Detonation 567
R.Y. Li, X.J. Li, H.H. Yan, X.H. Xie, Y.D. Qu, Z.R. Yang

Pre-sliding Friction Dynamics in High Precision Machine Slides 573
S. Chattopadhyay

Student Paper Competition IV

Sponsored by: SEM and the SEM Education Foundation

Chair: M.E. Tuttle, University of Washington

Failure Analysis of Composite Asphalt Concrete Pavement Systems 582
V.K.S. Subramaniam

Dynamic Tensile Behavior of Aluminum Alloys 6061-T6 and -OA 584
X. Tang

Blast Resistance of Woven and Layered Composite Materials 586
S.A. Tekalur

High Speed Imaging Systems: Mechanics Perspective 588
V. Tiwari

In-situ Temperature and Stress Measurements Using Neutron Diffraction 590
W. Woo

Damage Mechanics and Injury Mechanisms

Chair: E.N. Brown, Los Alamos National Laboratory

Cochair: B. Blaiszik, University of Illinois

Dynamic Response of Dental Structures 592
N.G. Ohlson

Characterization of Fracture Properties of Very Soft Tissue 600
D.-L. Guo, B.-S. Chen, N.-S. Liou

Effect of Strain Rate on Compression Behavior of Syntactic Foams 604
M.C. Saha, S. Nilufar, S. Jeelani

Damage Quantification in Electrically Conductive Composite Laminates 612
A.S. Liberson, B.R. Walsh, M.J. Roemer, G.P. Tandon, R.Y. Kim

Identifying Fatigue Damage Under Varying Environmental Conditions 620
M. Liu, D. Chelidze

3D Contouring and Strain Determination: The State of the Art

Organized by: C.A. Sciammarella, Politecnico di Bari, SEM Optical Methods Division

Chair: C.A. Sciammarella, Politecnico di Bari

Cochair: L. Lamberti, Politecnico di Bari

Techniques to Analyze Displacements and Contouring of Surfaces 627
C.A. Sciammarella, L. Lamberti, D. Posa

Development of Scalable Optoelectronic Methodologies for Characterization of Surface Shape and Deformation 639
C. Furlong, I.M. Gouverneur, M.T. Rodgers

Performance Comparison of White Light – Optical Profilometers	649
<i>A. Baldi, F. Ginesu, P. Pedone, D. Romano</i>	
Contour Measurement Using Radial Metrology.....	657
<i>J.A. Gilbert, D.R. Matthys, K.R. Biszick</i>	
Coupled Strain and Fresnel Response of Photoelastic Coatings at Oblique Incidence.....	668
<i>J. Hubner, L. Chen</i>	
Inverse Problems III: Orthotropic Materials	
Chair: A. Giraudeau, Ecole Nationale Supérieure d'Arts et Métiers	
Cochair: S. Ekwaro-Osire, Texas Tech University	
Comparison Between the Finite Element Model Updating Methods and the Virtual Fields Method	681
<i>S. Avril, F. Pierron</i>	
Identification of Material Properties of Composite Beams: Inverse Method Approach	690
<i>E. Euler, H. Sol, E. Dascotte</i>	
Determining Material Properties of Orthotropic Bimaterials.....	699
<i>S. Ekwaro-Osire, J.F. Cárdenas-García, G.G. Weber</i>	
On the Identification of Mechanical Properties Using Structural Tests and Optical Methods	705
<i>L. Crouzeix, H.H. Moreno, J.-N. Perié, B. Douchin, L. Robert, F. Collombet</i>	
Thermal Methods	
Chair: E.A. Patterson, Michigan State University	
Localized Stress Analysis of Robotic Welds	715
<i>R.J. Greene, G. Calvert</i>	
Thermoelastic Stress Measurement on Epoxy and on Fiber of CFRP	721
<i>J. Pirisinu, R. Marsili, M. Moretti, G.L. Rossi</i>	
Comparison of Local Strain Measurements done by Strain Gage and Differential Thermographic Technique.....	730
<i>C. Casavola, U. Galietti, D. Modugno, C. Pappalettere, Politecnico di Bari</i>	
Rail Crack Detection: An Infrared Approach to In-service Track Monitoring.....	741
<i>R.J. Greene, J.R. Yates, E.A. Patterson</i>	
Residual Stress	
Chair: M.A.M. Cavaco, Federal University of Santa Catarina	
Cochair: E. Cerreta, Los Alamos National Laboratory	
Residual Stresses from Interface Defects in Wafer Bonded Silicon	749
<i>G.P. Horn, T.J. Mackin, J.R. Lesniak</i>	
Comparison and Evaluation of Residual Stress Measurement Techniques, A Technical and Economical Study.....	756
<i>M. Belassel, J. Pineault, M.E. Brauss</i>	
Residual Stress and Damage Initiation in Small Stainless Steel Pipework.....	763
<i>S. Quinn, P.J. Tatum, J.M. Dulieu-Barton, J. Eaton-Evans</i>	

Experiments in Deformation and Fracture

Chair: S. Nemat-Nasser, University of California, San Diego

Cochair: K.T. Ramesh, The Johns Hopkins University

Interfacial Adhesion in Multi-stage Injection Molded Components..... 773

A. Ananthanarayanan, H.A. Bruck, S.K. Gupta

Prediction of Austenite-martensite Interfaces in CuAlNi Around a Notch Tip 784

A. Creuziger, T.W. Shield, W.C. Crone

Modal Parameter Estimation

Chair: A.K. Maji, University of New Mexico

Cochair: E. Euler, Vrije Universiteit Brussel

SOD Based Modal Parameters Extraction for Distributed-parameter Vibration Systems 794

W. Zhou, D. Chelidze

Particle Velocity Sensors for Modal Testing on Lightweight Structures 804

L. Valent, A. Vecchio, L. Bregant

Thermal Methods and Thermal Methods Roundtable

Organized by: R.J. Greene, University of Sheffield, SEM Thermal Methods Division

Chair: R.J. Greene, University of Sheffield

Heat Generation Assessment of The Phase Transformation in an SMA Ribbon 812

F. Maquin, F. Pierron, S. Avril, F. Scarpa

In-plane Thermal Diffusivity Measurements of C/C Brakes Using Thermography 818

Y. Zhang, T. Chu

Impact, Explosions and High Rate Phenomena II

Organized by: T. Vogler, Sandia National Laboratories, SEM Dynamic Behavior of Materials Division

Chair: E. Cerreta, Los Alamos National Laboratory

Cochair: C. Tsembeles, Cambridge University

Evolution of Microstructure and Plastic Dissipation in Zirconium During High Rate Deformation 824

H.A. Padilla, C.D. Smith, A.J. Beaudoin, J. Lambros, I.M. Robertson

Experimentally-based Viscoelastic Model for Polyurea, Including Pressure and Temperature Effects 829

A.V. Amirkhizi, J. Isaacs, S. Nemat-Nasser

The Behaviour of Water Saturated Sand Under Shock-loading..... 834

D.J. Chapman, K. Tsembeles, W.G. Proud

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Optical Methods for MEMS/NEMS

Organized by: C. Furlong, Worcester Polytechnic Institute, SEM MEMS & Nanotechnology &

Optical Methods Divisions

Chair: D.S. Epp, Sandia National Laboratories

MEMS Mirrors Array for Variable Optical Path Delay..... 841

R. Snyder, B. Broschat, S.R. Kirkpatrick, A.Z. Siahmakoun

Studies of Dynamic Properties of MEMS and NEMS Using a Three Dimensional Nano-imager 851

J. Bai, S. Liu, R.F. Gibson, T. Shi

Optical Coherence Tomography with an Auto-Focus Device for the Refractive Index and Thickness Measurements	859
<i>Y.-L. Lo, C.-C. Yen, C.-C. Liao, S.-J. Chen</i>	
Nano-pattern Recognition and Correlation Technique for Deformation Measurements of Nano-structures	867
<i>H. Bi, C.M. Hartsough, B. Han</i>	
Structural Connections & Methodologies	
Organized by: J.D. Helm, Lafayette College, SEM Structural Testing Division	
Chair: J.D. Helm, Lafayette College	
Cochair: A.T. Andonian, Goodyear Tire & Rubber Company	
Through-the-Thickness Strain Analysis of Single-lap Thick Composite Joints	869
<i>G.A. Isaicu, G. Restivo, G.L. Cloud, B.B. Raju</i>	
Optimization of Clamp-up Procedure for Thick Composite Joints	878
<i>G.A. Isaicu, G.L. Cloud, B.B. Raju</i>	
Laboratory Evaluation of Weathering and Freeze-thaw Effects on Silicone Foam Bridge Joint Sealant	885
<i>M.R. Shrestha, R.B. Malla, S. Boob, M.T. Shaw</i>	
A DIC Based Testing System for Fiber Reinforced Polymer (FRP) Strengthened Concrete Plates	893
<i>J.D. Helm, S.J. Kurtz</i>	
Impact and Vibration Monitoring	
Chair: V. Kulkarni, Intel	
Cochair: G. Restivo, Michigan State University	
A Force Transducer for Reinforced Concrete Columns	899
<i>E. Canbay</i>	
Long Duration Shock Pulse Shaping Using Nylon Webbing	909
<i>N.T. Davie</i>	
SPIRE – Spectrometer Mirror Mechanism – Thermo-mechanical Qualification	919
<i>G.T. Turzo, D.P. Pouliquen, K.M. Mercier, J.P.B. Baluteau</i>	
Static Qualification Logic for Ariane 5 Structures	934
<i>G.T. Turzo, M.J. Jacquesson</i>	
Time-Dependent Constitutive Behavior II	
Organized by: H. Lu, Oklahoma State University and Y. Miyano, Kanazawa Institute of Technology, SEM Time Dependent Materials Division	
Chair: Y. Miyano, Kanazawa Institute of Technology	
Measurements of Relaxation Modulus Using Nanoindentation	947
<i>H. Lu, G. Huang</i>	
Identifying Polymer Aging Through Indentation Testing: Experimental and Modeling Results	955
<i>K.B. Nagendran, R.D. Bradshaw</i>	
Estimation of Creep Deformation Applying Phased Stress on GFRPC	964
<i>T.S. Sakai, S.S. Somiya</i>	

Inverse Problems IV: Nonlinear Problems

Chair: M.B. Prime, Los Alamos National Laboratory

Cochair: S. Avril, Ecole Nationale Supérieure des Mines de Saint-Etienne

Identification of an Elasto-plastic Constitutive Equation Using the Virtual Fields

Method 971

Y. Pannier, S. Avril, R. Rotinat, F. Pierron

Identification of Hardening Behavior Using Inverse Modeling and Image

Correlation 979

D. Lecompte, S. Cooreman, H. Sol, J. Vantomme, A.M. Habraken

Elasto-plastic Material Parameter Identification by Inverse Methods: Sensitivity

Matrix Calculation 987

S. Cooreman, C. Bouffieux, D. Lecompte, D. Debruyne, H. Sol, J. Vantomme

Measurement and Modeling of Thermoelastic Transformations in Nitinol 1001

K.E. Perry, P.E. Labossiere, E. Steffler, N. Stevens, W.R. Lloyd

3-D Shape Measurement & Thermal Analysis

Chair: D.R. Matthys, Marquette University

Cochair: M. Sasso, Università Politecnica delle Marche

Optical Methods for Monitoring the Infusion Process in Vacuum Assisted Resin

Transfer Molding (VARTM) 1007

J.M. Bayldon, J.-J. Luo, I.M. Daniel

Optimization of a Fringe Projection Shape Measurement System 1017

I.M. Gouverneur, C. Furlong

High Sensitivity Shadow Moiré Using Nonzeroth-Order Talbot Distances 1019

A. Cox, B. Han, C.-W. Han

Analysis of Vibration Characteristics for Drillstrings Using Active Circuits 1021

M.A. Elsayed, C. Aissi, C. Kancharla

Research on Method of Fracture Toughness of Undisturbed Frozen Soils 1031

X. Liu, H. Li, Y. Wang

Dynamic Behavior of Low-impedance Materials II

Organized by: D.T. Casem, U.S. Army Research Laboratory, SEM Dynamic Behavior of Materials Division

Chair: M.J. Forrestal, Consultant, Sandia National Laboratories

Cochair: P. Moy, U.S. Army Research Laboratory

A Comparative Study of Hopkinson Bar Techniques for Soft Materials 1042

D. Casem

Fracture Toughness of PMMA as a Function of Loading Rate 1048

T. Weerasooriya, P. Moy, D. Casem, M. Cheng, W. Chen

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Characterization of Materials for MEMS

Organized by: R.J. Pryputniewicz, Worcester Polytechnic Institute, SEM MEMS & Nanotechnology Division

Chair: I. Chasiotis, University of Illinois at Urbana-Champaign

Cochair: B.C. Larson, Oak Ridge National Laboratory

Strain Measurements of Silicon Dioxide Microspecimens by Digital Imaging

Processing 1056

W.N. Sharpe, J. Pulskamp, D. Gianola, C. Eberl, R. Polcawich, R. Thompson

Tensile Testing of Thin-film Specimens on Polyamide Substrates Using SPDIC	1062
<i>S. Pradhan, T.C. Chu, S.M. Aouadi</i>	
Analysis of Modified Nucleosides Using Glass Microfluidic Devices	1068
<i>D.L. Morris Jr., C.P. Thiede, A.M. Huehls, C.F. Sweeny, A.Z. Siahmakoun</i>	
Optical Methods	
Chair: H.V. Tippur, Auburn University	
Cochair: P.K. Datta, I.I.T. Kharagpur	
NDE of RCC Using Digitome Volumetric X-ray Image System	1073
<i>T.P. Chu</i>	
Phase Unwrapping of Electronic Speckle Pattern Interferometry Maps	1077
<i>M.J. Huang, K.M. Kuo</i>	
Shearing Interferometer Using Achromatic Light Source	1083
<i>S.-T. Lin, H.-Y. Cheng</i>	
Speckle Pattern Interferometry	
Chair: A. Voloshin, Lehigh University	
Cochair: P.L. Reu, Sandia National Laboratories	
Low-cost Non-destructive Inspection of Thinning Defects by Simplified Speckle Interferometry	1089
<i>G. Restivo, G.A. Isaicu, G.L. Cloud</i>	
Reliability and Precision of Embedded DSPI for the Measurement of Interior Strain Fields	1099
<i>G. Restivo, G.L. Cloud, B.B. Raju</i>	
Time-Dependent Constitutive Behavior III	
Organized by: H. Lu, Oklahoma State University and Y. Miyano, Kanazawa Institute of Technology, SEM Time Dependent Materials Division	
Chair: I. Miskioglu, Michigan Technological University	
Effect of Water Absorption on Fracture Toughness for GFRPES	1110
<i>T. Maruyama, S. Somiya</i>	
Mechanical Characterization of the Compression Behavior of Heterogeneous Polypropylene Compounds	1116
<i>M. Jerabek, R. Steinberger, Z. Major, K. Ravi-Chandar</i>	
Inverse Problems V: Novel Experimental Techniques	
Chair: R. Tomlinson, University of Sheffield	
Cochair: F. Pierron, Ecole Nationale Supérieure d'Arts et Métiers	
Using Genetic Algorithm for Parameter Reconstruction of a Chirped Fiber Bragg Grating	1123
<i>H.-C. Cheng, Y.-L. Lo</i>	
Full-field Measurements for Permeability Identification by Inverse Methods	1131
<i>G. Morren, J. Gu, H. Sol, B. Verleye, S. Lomov</i>	

VOLUME 3

Inverse Problems V: Novel Experimental Techniques (Continued from Volume 2)

The Design and Commissioning of a Novel Tomographic Polariscope	1141
<i>R.A. Tomlinson, H. Yang, D. Szotten</i>	

Stress Analysis of Pinned Aluminum Joint by Reflective Photoelasticity	1148
<i>B.E. Foust, J.A. Lesniak, R.E. Rowlands</i>	

3-D Shape Measurement II

Chair: I. Emri, University of Ljubljana

Cochair: J. Gu, Vrije Univeriteit Brussel

Shape Measurement Method Using DMD Camera for Wide-reflectance Objects	1154
<i>S. Ri, M. Fujigaki, T. Matui, Y. Morimoto</i>	

Development of a Biaxial Stretching Machine for Rubbers by Optical Methods	1161
<i>M. Sasso, D. Amodio</i>	

360-deg Measurement on Tubular Samples with Axial Stereogrammetry	1172
<i>K. Genovese, E. Cosola, C. Pappalettere</i>	

Calibration of 3D Computer Vision Using Circular Dots.....	1182
<i>P.-F. Lu, C.-Y. Hsu</i>	

Dynamic Behavior of Materials I

Organized by: D. Frew, Sandia National Laboratories, SEM Dynamic Behavior of Materials Division

Chair: P. Moy, U.S. Army Research Laboratory

Cochair: B. Song, Purdue University

High Rate Tensile Strength Measurements of Frangible Bullets Using a Kolsky Bar	1190
<i>S.P. Mates, R. Rhorer, S. Banovic, E. Whitenton, R. Fields</i>	

Experimental Validation of Nanoparticle-based Damping	1199
<i>M.V. Kireitseu</i>	

Full Field Strain Measurement During a Tensile Split Hopkinson Bar Experiment	1205
<i>A. Gilat, T. Schmidt, J. Tyson</i>	

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

MEMS Materials and Structures Exposed to Dynamic Loading

Organized by: W.-Y. Lu, Sandia National Laboratories, SEM Dynamic Behavior of Materials and MEMS & Nanotechnology Divisions

Chair: W.-Y. Lu, Sandia National Laboratories

Cochair: H. Jin, Sandia National Laboratories

MEMS Dynamics: Measurements and Modeling	1210
<i>R.J. Pryputniewicz, R.T. Marinis, A.R. Klempner, P. Hefti</i>	

Mechanical Shock Testing for LIGA Materials Characterization	1225
<i>V.I. Bateman, A.M. Morales</i>	

Dynamic Loading of LIGA Structures	1232
<i>W.-Y. Lu, H. Jin, S. Lee, K. Gwinn, W. Chen, B. Song</i>	

Structural Material Testing

Chair: A.T. Andonian, Goodyear Tire & Rubber Company

Cochair: D. Siegert, Laboratoire Central des Ponts et Chaussées

Material Characterization of Coal Gasification Byproducts	1240
<i>S. Mohanty, Y.P. Chugh</i>	

Parametric Simple and Combination Resonance Characteristics of Plates Under

Tensile Loading: An Experimental Study	1252
<i>P.K. Datta, R.S. Udar</i>	

Monitoring of Stress Corrosion Cracking in Stainless Steel Weldments by Acoustic and Electrochemical Measurement	1261
<i>A. Yonezu, H. Cho, T. Ogawa, M. Takemoto</i>	
Digital Image Correlation for Model Validation	
Chair: M.A. Sutton, University of South Carolina	
Cochair: S.B. Park, State University of New York at Binghamton	
High-speed Multi-camera DIC for Finite Element Model Validation, Part 1.....	1269
<i>P.L. Reu, T.J. Miller</i>	
High-speed Multi-camera DIC for Finite Element Model Validation, Part 2.....	1276
<i>T.J. Miller, P.L. Reu, T.D. Hinnerichs, C.S. Lo</i>	
Inverse Problems VI: Miscellaneous	
Chair: H. Sol, Vrije Universiteit Brussel	
Cochair: J.F. Cárdenas-García, University of Texas at Brownsville	
Spatial Resolution, Noise, and Information Delocalization of Input Data for Inverse Methods.....	1283
<i>S. Bossuyt, D. Lecompte, H. Sol</i>	
Full-field Optical Measurement for Material Parameter Identification with Inverse Methods	1289
<i>J. Gu, S. Cooreman, A. Smits, S. Bossuyt, H. Sol, D. Lecompte, J. Vantomme</i>	
Inverse Calculation of Vehicle Excitations from Road Test Measurements.....	1300
<i>C.W. Engelhardt, W. Gordon</i>	
Mechanics of Materials: Introduction to Strain Gage Tutorial I	
Sponsored by: Technical Committee on Strain Gages Division	
Chair: R.B. Watson, Vishay Micro-Measurements	
Experimental Stress/Strain Analysis of an Aircraft Platform Using Experimental Data.....	1308
<i>Z.S. Wowczuk, S. Lucey, J.E. Smith</i>	
Dynamic Behavior of Materials II	
Organized by: D. Frew, Sandia National Laboratories, SEM Dynamic Behavior of Materials Division	
Chair: T. Mason, Los Alamos National Laboratories	
Investigations of High-speed Friction at Metal-on-metal Interfaces.....	1314
<i>F. Yuan, V. Prakash</i>	
Effect of Polyurea on the Dynamic Response of Steel Plates.....	1323
<i>M.R. Amini, J.B. Isaacs, S. Nemat-Nasser</i>	
Dynamic Material Characterization by SHPB Tests and FE Optimization	1327
<i>M. Sasso, D. Amodio, G. Newaz</i>	
Determination of Early Flow Stress in Ductile Specimens Using SHPB.....	1336
<i>B. Song, W. Chen, B.R. Antoun, D.J. Frew</i>	
Development of DEM Validation Tools with 3D X-ray Particle Tracking System	1339
<i>I. Govender, A.T. McBride, M.S. Powell</i>	

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Testing of MEMS/Packages

Sponsored by: SEM MEMS & Nanotechnology, Fracture and Fatigue and Electronic Packaging Divisions

Chair: J.C. Suhling, Auburn University

Dynamic Failure of Microelectromechanical Systems..... 1350

J. Kimberley, I. Chasiotis, J. Lambros

Mixed-Mode I/II Fracture of Amorphous Diamond-like Carbon Films 1353

K.N. Jonnalagadda, I. Chasiotis

Structural Health Monitoring Techniques

Organized by: A.K. Ghosh, New Mexico Tech

Chair: G. Isaicu, Michigan State University

Cochair: A. Yonezu, Aoyama Gakuin University

Vibration Based Structural Health Monitoring of Prebended Steel – VHPC Beams 1358

D. Siegert, S. Staquet, G. Cumunel, M. Goursat, F. Toutlemonde

Self-sensing Composites 1368

P. Rye, K. Schaaf, A. Starr, S. Nemat-Nasser

Fatigue and Stress Monitoring with Magnetic Sensor Arrays..... 1373

N. Goldfine, D. Grundy, A. Washabaugh, C. Craven, V. Weiss, V. Zilberstein

Digital Image Correlation for the Micro and Nanoscale Characterization

Organized by: H. Jin, Sandia National Laboratories, SEM Optical Methods Division

Chair: H. Jin, Sandia National Laboratories

Cochair: W.-Y. Lu, Sandia National Laboratories

3-D Shape Measurement Using a Micro/Nano Speckle Method 1385

F.-P. Chiang, G. Uzer

Microscopic Material Characterization Using SEM Topography Images

Correlation 1389

J. Kang, T. Schmidt, M. Jain, D.S. Wilkinson

Digital Image Correlation Combined with Electronic Speckle Pattern

Interferometry for 3D Deformation Measurement in Small Samples 1396

P.L. Reu, B.D. Hansche

Microscale Characterization of LIGA Microsystems Using Digital Image

Correlation 1403

H. Jin, W.-Y. Lu, J. Korellis, J. Chames, N. Yang

Inverse Problems VII: Dynamic Measurements

Chair: F. Pierron, Ecole Nationale Supérieure d'Arts et Métiers

Cochair: A. Zapata, University of Texas, Brownsville

Identification of Joint Properties from Wave Amplitude Measurements 1409

B. Zhang, T.P. Waters, B.R. Mace

Damage Identification by Inverse Methods Using a Laser Velocity Scanner 1417

A. Petreli, H. Sol, P. Guillaume

Identification of Material Properties Using Full Field Measurement on Vibrating

Plate..... 1427

A. Giraudeau, B. Guo, F. Pierron

Thermomechanical Experimental Study with 2-D Dissipative Source Reconstruction	1435
<i>N. Renault, S. André, V. Mollimard, C. Cunat</i>	
Experimental Techniques to Numerical Analyses: The Missing Link in Inverse Modelling	1443
<i>S.S. Lakshmi, C.R. Siviour, N. Petrinic, B.C.F. Elliott</i>	
Dynamic Analysis I	
Chair: P.G. Ifju, University of Florida	
Steady State, Dynamic and Stability Analysis of a Loading ARC (worn) Journal Bearing Used in Turbo-generator	1454
<i>K. Dargaiah, P. Kamalam</i>	
A Generalized Approach for Computing Eigenvector Design Sensitivities	1467
<i>D.E. Smith, V. Siddhi</i>	
Frequency Response Function as Machinability Indicator	1475
<i>A. Giraudeau, M. El Mansori</i>	
Standardization Roundtable	
Organized by: E.A. Patterson, Michigan State University; R. Burguete, Airbus UK	
Chair: E.A. Patterson, Michigan State University	
Standards Project for Optical Techniques of Strain Measurement: Final Report	1486
<i>R. Burguete, E. Hack, M. Kujawska, E.A. Patterson, Q. Saleem, T. Siebert, M. Whelan</i>	
Experiments and Modeling in Fracture	
Experimental Evaluation of the Microplasticity Threshold in Metals Using Dissipation Measurements	1493
<i>F. Maquin, F. Pierron</i>	
Experimental Investigations of Spontaneous Bimaterial Interfacial Fractures	1501
<i>K. Xia, C.E. Rousseau, A.J. Rosakis</i>	
Residual Stress	
Chair: M.L. Steinzig, Los Alamos National Laboratories	
Study of Strengthening of an Austenitic Stainless Steel by Cold Rolling	1510
<i>A. Benamar, G. Inglebert, J. Lu, J.F. Flavenot, P. Barbarin</i>	
SYMPOSIUM ON MEMS & NANOTECHNOLOGY:	
Nanotechnology Science and Education	
Chair: R.J. Pryputniewicz, Worcester Polytechnic Institute	
Public Understanding of Nanotechnology: Effective Communication of Nanoscale Concepts	1518
<i>W.C. Crone, O.M. Castellini, G.K. Walejko, C.E. Holladay, T.J. Theim, G.M. Zenner</i>	
Fiber Optic Sensors	
Chair: C. Furlong, Worcester Polytechnic Institute	
Cochair: S. Yoneyama, Osaka Prefecture University	
Smart Composite Patches for Repairing Aircraft Structural Components	1523
<i>E.E. Gdoutos, Z. Marioli-Riga</i>	
Opto-mechanical Modeling of Embedded Fiber Optic Sensors	1529
<i>K.J. Peters, M. Prabhugoud</i>	

Optical Fiber AE System for Damage Monitoring of CFRP Plate.....	1539
<i>T. Matsuo, H. Cho, M. Takemoto</i>	

Numerical & Finite Element Solutions

Chair: K. Genovese, DIFA-Università della Basilicata

Connection Hub Optimization Using Theoretical and Simulated Analysis Results	1546
<i>Z.S. Wowczuk, K.A. Williams, J.E. Smith</i>	

Computational Simulation of Stress-deformation in Nanoparticle-reinforced Composite Materials	1558
<i>M.V. Kireitseu, L.V. Bochkareva, G.R. Tomlinson</i>	

Dynamic Behavior of Three-wheeled Vehicle Under Random Road Characteristics Using FEM.....	1566
<i>R. Koona, M.K. Naidu, B. Satyanarayana</i>	

3D Finite Element Analysis of the SCS Shear Test Specimen	1577
<i>S.R. Short</i>	

Optics

Digital Determination of the Secondary Principal Stress Parameters in Scattered-light Photoelasticity	1589
<i>H.L. Lee, T.Y. Chen</i>	

A Full-field Heterodyne Polariscope for Using New Image Signal Process	1596
<i>Y.L. Lo, H.W. Chih, C.Y. Yeh</i>	

Smart Structures

Chair: J.L.F. Freire, Catholic University of Rio de Janeiro, PUC-Rio

Cochair: T. Yokoyama, Okayama University of Science

Composites with Negative Refractive Index	1603
<i>A.V. Amirkhizi, S. Nemat-Nasser, T. Plaisted, A. Starr, S. Nemat-Nasser</i>	

Statistical Predictions for Short-Fiber Material Property Behavior with the INV6 Closure	1608
<i>D.A. Jack, D.E. Smith</i>	

Calibration and Performance Evaluation of Hydrogenated Amorphous Silicon Stress Sensors	1616
<i>G. Olmi, A. Freddi, M. Bandini, M. Lanzoni, B. Ricco</i>	

Dynamic Control of Robotic Systems

Axially Moving Beams and Varying Length: Wave Reflection and Propagation Approach	1627
<i>E. Manconi</i>	

Elimination of Singularities in Parallel Robotic Manipulators.....	1635
<i>M. Kumar, A.K. Dash</i>	

Input Laws for Dynamic Control: Theory, Experiments and Robustness	1642
<i>R. Garziera, E. Manconi, M. Silvestri</i>	

FRP Composites for the Infrastructure

Shock and Recovery of Flourinated Polymers	1650
<i>E.N. Brown, C.P. Trujillo, P.J. Rae, G.T. Gray III</i>	

Characterization of Environmental Degradation Mechanisms in Epoxy-clay Nanocomposites	1654
<i>M. Khait, R.P. Singh</i>	
FRP Delamination under Lateral Impact and Inplane Compression	1663
<i>S. Sridharan, Y. Li</i>	
Effect of Mechanical Loading and Environmental Degradation on Carbon Fiber Reinforced Composites.....	1671
<i>A.K. Singh, R.P. Singh</i>	
Blast Response of Carbon-fiber Reinforced Masonry Walls.....	1682
<i>G. Urgessa, A.K. Maji</i>	

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Microstrain Analysis

Organized by: C.A. Sciammarella, Politecnico di Bari, Optical Methods Division

Chair: C.A. Sciammarella, Politecnico di Bari

Cochair: C. Furlong, Worcester Polytechnic Institute

Representative Volume Element of Polycrystalline Silicon for MEMS.....	1691
<i>I. Chasiotis, S.W. Cho</i>	
Strain Analysis of Dislocations in Crystalline Structures	1698
<i>F.M. Sciammarella, C.A. Sciammarella, L. Lamberti</i>	

VOLUME 4

Infrastructure Health Management

Chair: A.K. Ghosh, New Mexico Tech

Finite Element Modeling of Monolithic Dome Structures	1710
<i>H. Sadid, N. South</i>	
Bridge Deflection Measurement Using Digital Image Correlation	1720
<i>S. Yoneyama, A. Kitagawa, S. Iwata, K. Tani, H. Kikuta</i>	
Study of Method of Damage Detection for Pipelines	1730
<i>Z.R. Yang, H.S. Li, X.L. Guo, H.Y. Li, R.Y. Li</i>	

Fatigue Failure in Engineering Materials

Chair: C.-E. Rousseau, University of Rhode Island

Cochair: K. Sakaue, Aoyama Gakuin University

Near Threshold Fatigue Crack Growth in 7075-T651 Aluminum Alloy.....	1742
<i>J.B. Jordon, J.C. Newman Jr., Y. Xue, M.F. Horstemeyer</i>	
Fracture and Fatigue Behavior of Carbon Nano Fiber Reinforced Epoxy	1751
<i>F. Pervin, Y. Zhou, V.K. Rangari, S. Jeelani</i>	
Dynamics of Fatigue Micro Fracture of Porous Ceramics Studied by Source Wave Analysis of Acoustic Emission.....	1759
<i>A. Yonezu, T. Ogawa, M. Takemoto</i>	

Time-Dependent Constitutive Behavior IV

Organized by: H. Lu, Oklahoma State University and Y. Miyano, Kanazawa Institute of Technology,

SEM Time Dependent Materials Division

Chair: I. Emri, University of Ljubljana

Testing System Development for Creep Characterization of Polymers.....	1767
<i>R. Steinberger, Sz. Vezer, Z. Major, R.W. Lang</i>	

Simultaneous Measurement of Two Independent Material Functions of Viscoelastic Materials	1773
<i>Y. Uchiyama, M. Fujikawa, M. Takashi</i>	
Thermo Viscoelastic Analysis with Heat Generation Under Cyclic Load	1780
<i>J. Nakamura, K. Sakaue, M. Takashi</i>	
Use of Operational Viscoelastic Material Properties from Time-dependent Experiments	1786
<i>R.J. Arenz</i>	
Composite Materials	
Organized by: L.R. Xu, Vanderbilt University and W. Chen, Purdue University, SEM Composite Materials and Dynamic Behavior of Materials Divisions	
Chair: L.R. Xu, Vanderbilt University	
Cochair: R. Rhorer, National Institute of Standards and Technology	
Through-thickness Characterization of Thick Composite Laminates	1793
<i>P.M. Schubel, J.J. Luo, I.M. Daniel</i>	
Blast Loaded Thin Composite Plates – An Experimental Study	1801
<i>S.A. Tekalur, A. Shukla, P. Ruggiero</i>	
Crashworthiness of Adhesively Bonded Composite Structures and their Strain-rate Sensitivities	1808
<i>J.M. Starbuck, G.C. Jacob, D.A. Dillard, D.J. Pohlit</i>	
Interlaminar and In-plane Shear Strengths of a Unidirectional Carbon/Epoxy Laminated Composite under Impact Loading	1820
<i>T. Yokoyama, K. Nakai</i>	
Experimental Techniques in Musculoskeletal Systems	
Organized by: K.J. Grande-Allen, Rice University and J.J. Mason, Zimmer Inc., SEM Biological Systems and Materials Division	
Chair: K.J. Grande-Allen, Rice University	
Cochair: J.J. Mason, Zimmer Inc.	
Preventing Bone Loss Improves Tendon-Bone Healing in a Canine Model	1829
<i>S. Thomopoulos, H. Matsuzaki, M. Zaegel, R.H. Gelberman, M.J. Silva</i>	
A Novel Loading Method for Stimulation of Trabecular Bone Growth in Mice	1834
<i>B.A. Christiansen, M.J. Silva</i>	
Intervertebral Disc Dynamics and Degeneration	1841
<i>D.J. Nuckley, P.A. Kramer, A. Del Rosario, N. Fabro, R.P. Ching</i>	
Mechanical Microsensors for Biological Applications	
Organized by: B.C. Prorok, Auburn University, SEM Biological Systems and Materials Division	
Chair: B.C. Prorok, Auburn University	
Cochair: H.A. Bruck, University of Maryland, College Park	
Detection of Cancer Markers via Nanoparticle-based Mass Enhancement	1849
<i>C.A. Savran, P.S. Low, W.A. Hanne, D. Dooreweerd, J. Lee</i>	
Enhancing the Mass Sensitivity of Microcantilever Sensors for Application in Liquid Mediums	1857
<i>S. Morshed, B.C. Prorok</i>	
A Novel Test Method for the Assessment of Self Tapping Performance of Bone Screws	1865
<i>B.L. Kincaid, J.J. Mason, L. Schroder</i>	

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Characterization of Nanoscale Materials

Organized by: H. Espinosa, Northwestern University, SEM MEMS & Nanotechnology Division

Chair: I. Chasiotis, University of Illinois at Urbana-Champaign

Cochair: P.R. Guduru, Brown University

Influence of Surface Properties on the Fracture of MEMS Beams 1872

T. Alan, A.T. Zehnder

Optimization Method for Acquiring High Resolution Mapping of Elastic Moduli 1880

D. Shilo, Y. Ganor

Bio-inspired Structures

Nanoindentation of Cr₃C₂-Ni Cermets 1888

X. Du, I. Jasiuk, I. Hussainova

Shock and Vibration Characteristics of a Bio-inspired Structure Under Blast Loading 1896

J. Mathews, J. Metzger, A.K. Ghosh

Bio-inspired Structure: The Human Skull..... 1913

N. Spinhirne, A.K. Ghosh, A. Williams

Effects of Crack Path on Fracture

The Profile of Mode-I Crack Path in a Heterogeneous Material 1919

C. Liu

Experimental Investigation of Crack Path Instabilities in a Quenched Plate 1929

K. Sakaue, M. Takashi

Deflection and Penetration Behavior of Propagating Mode-I Cracks Towards Weak Inclined Interfaces 1935

V.B. Chalivendra, A.J. Rosakis, S. Hong

Effect of Processing on Inelastic Fracture Behavior of 2024 Aluminum 1942

M.N. Cavalli, V. Mandava

Time-Dependent Constitutive Behavior V

Organized by: H. Lu, Oklahoma State University and Y. Miyano, Kanazawa Institute of Technology, SEM Time Dependent Materials Division

Chair: R.J. Arenz, Loyola Marymount University

Adhesion, Roughness and Friction Characterization on Time-dependent Materials: Example with Fibrous Structures 1948

S. Fontaine, C. Marsiquet, M. Renner

Effect of Crystallinity on Creep Behavior of GFRPOM..... 1954

K.Y. Yamada, S.S. Somiya

Formulation for Time-temperature Dependent Fatigue Strength of CFRP Laminates 1960

Y. Miyano, J. Noda, M. Nakada

Time-dependent Behavior of Climbing Ropes..... 1968

I. Emri, B.S. von Bernstorff, A. Nikonov, B. Zupančič

Fatigue Behavior and Design of Wood Composites as Furniture Components 1976

L. Dai, J. Zhang

Experiments in Fracture

Chair: I.M. Daniel, Northwestern University

Cochair: Y. Du, University of Rhode Island

Mixed-mode I/III Crack Growth in Ductile Materials; Part I: Experiments 1987

J.H. Yan, M.A. Sutton, X. Deng, C.-S. Cheng

Mixed-mode I/III Crack Growth in Ductile Materials; Part II: Simulations 1993

Z. Wei, X. Deng, M.A. Sutton, C.-S. Cheng

Crack Propagation in Lamellar TiAl Under Mode I Loading 1999

F.-P. Chiang, Y. Ding, G. Uzer, A. Ho, A.H. Rosenberger

Towards Real Time Crack Monitoring Using Image Correlation 2006

P. López-Crespo, A. Shterenlikht, E.A. Patterson, J.R. Yates, P.J. Withers, R. Burguete

Brazilian Tests in Lamellar TiAl 2014

F.-P. Chiang, G. Uzer, Y. Ding, A. Ho, A.H. Rosenberger

Dynamic Behavior of Materials III

Organized by: D. Frew, Sandia National Laboratories, SEM Dynamic Behavior of Materials Division

Chair: M.J. Forrestal, Consultant, Sandia National Laboratories

A Shock Tube Based Facility for Impact Testing 2021

Q. Li, D. Liu, D. Templeton, B.B. Raju

Analytical Model to Facilitate the Generation of Constant Strain Rate SHPB Experiments 2028

A.D. Puckett

An Analysis of Impact Test Systems 2038

Y.J. Chao

The Dynamic Behaviour of Concrete 2046

K. Tsembeis, D.J. Chapman, C.H. Braithwaite, W.G. Proud

SYMPOSIUM ON MEMS & NANOTECHNOLOGY:

Characterization of Nanoscale Materials

Organized by: W.C. Crone, University of Wisconsin, Madison, SEM MEMS & Nanotechnology Division

Chair: W.C. Crone, University of Wisconsin, Madison

MEMS Education: Design, Fabrication, and Characterization 2052

W. Han, C. Furlong, R.J. Pryputniewicz

Experimental Techniques and Analytical Validation

Organized by: A.K. Ghosh, New Mexico Tech

Chair: A. Voloshin, Lehigh University

Cochair: K. Genovese, DIFA-Università della Basilicata

Dynamic Analysis of Damped Parametrically Excited Laminated Composite Curved Panels Under Non-uniform Loading 2062

R.S. Udar, P.K. Datta

Optimized Designed with Experimentally Verified Finite Element Modeling Using DMI Strain Gage Technology 2071

W.F. Ranson, R.I. Vachon

Residual Stress Determination Using Digital Shearography 2079

D. Findeis, J. Gryzagoridis, P. Park-Ross

Novel Techniques for Soft Tissue Analysis

Organized by: K.J. Grande-Allen, Rice University and M. Peterson, University of Maine,
SEM Biological Systems and Materials Division

Chair: K.J. Grande-Allen, Rice University

Cochair: M.L. Peterson, University of Maine

Direct and Indirect Measurements of Smooth Muscle Elastic Components 2085

R.A. Meiss

Cell and Matrix Mechanics Determined by Cyclic Stretch of Bioartificial Tissues 2094

J.J. Wille, E.L. Elson, R.J. Okamoto

The Role of the Stress Environment on Fibrocartilage Development..... 2101

S. Thomopoulos, G. Genin, R. Das, V. Birman

Investigation of Pig Kidney Mechanical Properties Under Uniaxial Load 2106

Y.-J. Chen, B.-V. Nguyen, N.-S. Liou

Model Validation and Uncertainty Quantification

Chair: A. Urbina, Sandia National Laboratories

Experimental Uncertainty in Temperature Dependent Material Properties of Composite Laminates..... 2113

B. Smarslok, L. Speriatu, W. Schulz, R.T. Haftka, P.G. Ifju, T.F. Johnson

Safety-based Integrated Structural Optimization in the Presence of Uncertainties 2123

A. Azad, J.S. Hansen

Using 3D Digital Imaging Correlation Techniques to Validate Tire FEM..... 2131

R.A. Moser, J.G. Lightner III

Static Finite Element Validation of a Flexible Micro Air Vehicle 2142

B.K. Stanford, R. Albertani, P.G. Ifju

Development of an Anisotropic, Energy Dependent Model for PZT..... 2154

T. Simmermacher, S.C. Jones, A. Urbina, D.T. Griffith, D. Reeder

Bio-inspired, Modular, and Multifunctional Thermal and Impact Protected (TIPed) Embedded Sensing Controls Actuation Power Element (ESCAPE) Structures..... 2163

L.S. Gyger Jr., B.W. Spranklin, S.K. Gupta, H.A. Bruck

Fracture in Polymers and Composites

Chair: M. Cavalli, University of North Dakota

Cochair: C. Pappalettere, Politecnico di Bari

Effect of Particle Size on Fracture Behavior of Polyester/Al₂O₃ Composites 2175

Y. Du, N. Jain, A. Shukla

Influence of Crack Tip Sharpness on the Strain Distribution in Rubbers..... 2181

Ch. Feichter, Z. Major, R.W. Lang

Fatigue and Fracture Mechanism of Cast AE44 Magnesium Alloys..... 2191

Y. Xue, H. El Kadiri, M.F. Horstemeyer, J. Fan, D.L. McDowell

Fracture Simulation of Renovated Sewage Pipes 2199

Y. Arimitsu, Y. Kawakami, S. Namiki, Y. Sogabe, Z. Wu, T. Tamaogi

In-class Paper Experiments for Mechanics Education 2207

L.R. Xu

Electronic Packaging

Chair: B.T. Han, University of Maryland, College Park

Adhesion Features of Bonded Interfaces Interpreted by Taguchi Technique.....	2214
<i>C.-H. Chien, T.Chen, C.-C. Hsieh</i>	
Sensor Data-fusion for Prognostication of Extreme Environment Electronics	2222
<i>P. Lall, M. Hande, C. Bhat, N. Islam, K. Rahim, J.C. Suhling, J. Lee</i>	
Physical Aging Effects in Solders and Underfill Encapsulants	2237
<i>H. Ma, C. Lin, J.C. Suhling, P. Lall</i>	

Posters

Development and Characterization of a Miniaturized PEM Fuel-cell for MEMS Applications.....	2250
<i>J.D. Kupperts, C. Furlong</i>	
Novel Thermal Management Technique Using Thermoelectric Microcoolers.....	2258
<i>F.A. Abidi</i>	
Viscoelastic Properties of Polyurea.....	2260
<i>A.V. Amirkhizi</i>	
Effect of Particle Size on Fracture Behavior of Polyester/Al₂O₃ Composites	2262
<i>Y. Du</i>	
Dynamic Design of Structure Using Operational Modal Analysis	2264
<i>A.C. Gondhalekar</i>	
Dynamic Behavior of Soda Lime Glass Under Biaxial Loading	2266
<i>X. Nie</i>	
Plasticity and Energy Dissipation in Metals.....	2268
<i>H.A. Padilla</i>	
Formation and Effects of Anisotropy in Wire Drawing	2270
<i>M. Pinto</i>	
Mechanical Behavior of Lightweight Shotcrete Containing Cenospheres	2272
<i>P. Ruggiero</i>	
Effects of Surface Morphology and Loading Rates on Dynamic Interfacial Fracture.....	2274
<i>C.-J. Syn</i>	
Modeling of Damage and Failure Using CDM (Continuum Damage Mechanics) in Plastic Deformation	2276
<i>P.R. Zagade</i>	
A New Method for Vibration Modal Analysis.....	2278
<i>W. Zhou</i>	

Author Index