

SEM Annual Conference and Exposition on Experimental and Applied Mechanics 2009

**Albuquerque, New Mexico, USA
1-4 June 2009**

Volume 1 of 4

ISBN: 978-1-61567-189-2

Printed from e-media with permission by:

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



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

Copyright© (2009) by the Society for Experimental Mechanics
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact the Society for Experimental Mechanics
at the address below.

Society for Experimental Mechanics
7 School Street
Bethel, Connecticut 06801

Phone: 203 790 6373
Fax: 203 790 4472

www.sem.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

1. ACOUSTIC EMISSION I

Energy Emissions from Failure Phenomena: Mechanical, Electromagnetic, Nuclear.....	1
<i>A. Carpinteri, F. Cardone, G. Lacidogna</i>	
Mechanisms of Corrosion-induced Cracks in Concrete Identified by AE Analysis.....	10
<i>M. Ohtsu, K. Mori, K. Ohno</i>	
Analysis of Acoustic Emissions at Low Frequencies in Brittle Materials Under Compression.....	16
<i>A. Schiavi, G. Niccolini, P. Tarizzo, G. Lacidogna, A. Manuello, A. Carpinteri</i>	
Acoustic and Electromagnetic Emissions as Precursor Phenomena in Failure Processes.....	24
<i>G. Lacidogna, A. Manuello, G. Durin, G. Niccolini, A. Agosto, A. Carpinteri</i>	
Piezonuclear Neutrons Emission from Brittle Compression Failure.....	33
<i>F. Cardone, G. Lacidogna, A. Carpinteri</i>	

2. STUDENT PAPER COMPETITION I

Experimental Study and Modeling of Single Yarn Pull-out Behavior of Kevlar 49.....	42
<i>D. Zhu</i>	
Deformation and Performance Measurements of MAV Flapping Wings.....	44
<i>P. Wu</i>	
Study of Fatigue Crack Shielding Forces Using Thermoelastic Stress Analysis (TSA)	46
<i>A.S. Patki</i>	
Determining Multiaxial Properties of Porous Viscoelastic Membrane Using Bubble-inflation Test.....	48
<i>M.A. Haile</i>	
Determination of Dynamic Fracture Parameters Using a Semi-circular Bend Technique in Split Hopkinson Pressure Bar Testing.....	50
<i>F. Dai</i>	

3. NANOENGINEERING 1, MICRO-NANOMECHANICS

On Stress Concentrators and the Elimination of Elastic Singularities: A Gradient Approach	52
<i>E.C. Aifantis</i>	
Microcantilever Dynamics: Effect of Brownian Excitation in Liquids	63
<i>G. Carbone, E. Pierro, L. Soria</i>	

4. THERMOELASTIC STRESS ANALYSIS

Stress and Strain Measurements by Image Correlation and Thermoelasticity.....	70
<i>M. Beccetti, R. Flori, R. Marsili, G.L. Rossi</i>	
Derivation of the Stress Concentrations at Holes in Orthotropic Plates Using Thermoelastic Stress Analysis.....	76
<i>S. Quinn, S. Sambasivam, J.M. Dulieu-Barton</i>	
Enhanced Infrared Radiation Method for Temperature Measurement in Dynamic Experiments	86
<i>I. Negreanu, G. Gary, D. Mohr</i>	
Amount and Locations of TSA Input Data, and Number of Coefficients	89
<i>N.S. Joglekar, R.E. Rowlands</i>	
Measurement of Stress and Strain by a Thermocamera	100
<i>M. Beccetti, R. Flori, R. Marsili, G.L. Rossi</i>	

5. FRACTURE AND FAILURE OF NONTRADITIONAL MATERIALS I

Effects of Z-pins on Dynamic Delamination.....	106
<i>J. Chen, A. Schlueter, K. Herwig, W.W. Chen</i>	

Effect of Pressure Cycling on Polyurethane/Aluminum Adhesive Fracture Energy	112
<i>A. MacIure, V.B. Chalivendra, T. Ramotowski</i>	
Splitting in Dual-phase 590 High Strength Steel Plates.....	119
<i>Y.J. Chao, M. Yang</i>	
Static and Dynamic Compression Response of a Lightweight Interpenetrating Phase Composite (IPC) Foam	123
<i>C. Periasamy, R. Jhaver, H.V. Tippur</i>	

6a. DYNAMIC BEHAVIOR OF LOW IMPEDANCE MATERIALS I

Rate-temperature Superposition in Mechanical Response of a Polymethylene Diisocyanate (PMDI)-based Rigid Polyurethane Foam.....	127
<i>B. Song, W.-Y. Lu, W.W. Chen</i>	

7. HIGH PRESSURE AND SHEAR RESPONSE I

On the Metallurgy of Shock Deformation in Simple Metals	134
<i>N.K. Bourne, J.C.F. Millett, G.T. Gray, III</i>	

8. ACOUSTIC EMISSION II

Quantitative Detection of Microcracks in Bioceramics Using AE Source Characterization.....	136
<i>S. Wakayama, T. Jibiki, R. Ujihashi, J. Ikeda, F. Miyaji</i>	
Damage Assessment of a Two-span Model Masonry Arch Bridge	142
<i>S. Invernizzi, G. Lacidogna, A. Manuello, A. Carpinteri</i>	
Damage Characterization of Inhomogeneous Materials: Experiments and Numerical Simulations of Wave Propagation	150
<i>D.G. Aggelis</i>	
Composite Panel Damage Detection Using Ultrasonic Testing and Neural Networks.....	158
<i>Z. Kral, W. Horn, J. Steck</i>	

9. STUDENT PAPER COMPETITION II

Experimental Methods for Impact of Composite Materials.....	165
<i>B. Gulkler</i>	
Dynamic Fracture of a Zr-based Bulk Metallic Glass	167
<i>G. Sunny</i>	
Dynamic Fracture Initiation Toughness of Ti/TiB FGM Under Thermo-mechanical Loading.....	169
<i>A. Kidane</i>	
Dynamic Compressive Behavior of Pd-based Amorphous Metal Foam	171
<i>A. Bhat</i>	

10. NANOENGINEERING II, EXPERIMENTAL MECHANICS AT THE MICRO-NANO LEVEL

High Accuracy Micro Scale Measurements Using a Conventional Far Field Microscope	173
<i>C.A. Sciammarella, L. Lamberti, F.M. Sciammarella, G. Demelio, A. Dicuonzo, A. Boccaccio</i>	
Photoelasticity in the Nano-range.....	182
<i>C.A. Sciammarella, L. Lamberti</i>	
3D Fourier Method for the Measurement of Vibration Resonant Modes Acquired with a High-speed Camera	192
<i>C. Trillo, F. Mendoza Santoyo, Á.F. Doval, M. de la Torre Ibarra, C.P. López, J.L. Deán, J.L. Fernández</i>	

11. THERMAL METHODS

Detection of Defects in Commercial C/C Composites Using Infrared Thermography	199
<i>Y.P. Pan, R.A. Miller, T.C. Chu, P. Filip</i>	

Thermal Diffusivity Measurements and NDE for C/C Composites Using Infrared Thermography	207
<i>Y.P. Pan, R.A. Miller, T.C. Chu, P. Filip</i>	
Comparative Study of Thermography Systems For C/C Composite Disk Brakes	214
<i>Y.P. Pan, R.A. Miller, T.C. Chu, P. Filip</i>	
PLIF Measurement of Instantaneous Temperature Field within Thermoacoustic Heat Exchangers	221
<i>L. Shi, Z. Yu, A.J. Jaworski</i>	

12. FRACTURE AND FAILURE OF NONTRADITIONAL MATERIALS II

Plastic Zone Formation and Fracture of Zr-based Bulk Metallic Glasses	231
<i>J.-Y. Suh, R.D. Conner, C.P. Kim, M.D. Demetriou, W.L. Johnson</i>	
Cyclic Deformation Behavior of Nickel-Titanium	241
<i>K. Kim, S. Daly</i>	

13. DYNAMIC BEHAVIOR OF LOW IMPEDANCE MATERIALS II

Dynamic Tensile Testing of Polyamide Sheets Using the HSB Technique	247
<i>M. Hokka, V.-T. Kuokkala, S. Ihme</i>	
Wave Speed Measurement in Low-impedance Materials Under Elevated Pressure and Controlled Temperature	254
<i>A.V. Amirkhizi, J. Irion, J. Isaacs, S. Nemat-Nasser</i>	
Investigation of Dynamic Mechanical Properties of Multi-constituent Particulate Composites Based on Factorial Design of Experiments	256
<i>J.L. Jordan, J.E. Spowart, B. White, N.N. Thadhani, D.W. Richards</i>	

14. HIGH PRESSURE AND SHEAR RESPONSE II

Influence of Peak Shock Pressure on the Microstructural Evolution of 1018 Steel	266
<i>E.K. Cerreta, L.M. Dougherty, C.P. Trujillo, G.T. Gray, III, R.D. Field, R. McCabe, J.F. Bingert, D.D. Koller</i>	
Microstructural Analysis of Expanded Stainless Steel 304 Cylinders	268
<i>S.M. Stirk, R.E. Winter, P.T. Keightley</i>	
Influence of Shockwave Profile on Ejecta: A Computational Study	274
<i>M. Zellner, G. Dimonte, T. Germann, J. Hammerberg, P. Rigg, W. Buttler</i>	

15. FRACTURE MECHANICS I

Triaxial State of Stress at Crack Tips Studied by Caustics	276
<i>E.E. Gdoutos</i>	
Mixed-mode Crack Growth of Ductile Thin Sheet Materials	282
<i>J.H. Yan, M.A. Sutton, X. Deng, P. Zavattieri, Z.G. Wei</i>	
Mesh-size Effect Study of Ductile Fracture by Non-local Approach	292
<i>Y. Li, T. Wierzbicki</i>	
Ductile Fracture Calibration and Validation of Anisotropic Aluminum Sheets	302
<i>M. Luo, T. Wierzbicki</i>	
Geometric Effects in DCDC Fracture Experiments	313
<i>C. Nielsen, A.V. Amirkhizi, S. Nemat-Nasser</i>	
Initiation and Crack Growth Process in Viscoelastic Orthotropic Materials	316
<i>R. Moutou-Pitti, F. Dubois, C. Chazal</i>	

16. STUDENT PAPER COMPETITION III

Microcompression Experiments on Single Crystal Magnesium	322
<i>C.M. Byer</i>	
Blast Performance of Sandwich Composites with Discretely Layered Core	324
<i>N. Gardner</i>	
In-situ Self-healing Via Microvascular Networks	326
<i>A.R. Hamilton</i>	

Quantifying Grain Behavior with Digital Image Correlation	328
<i>J. Carroll</i>	
Uniaxial and Confined Dynamic Compression of Aluminum Nitride	330
<i>G.L. Hu</i>	
Measuring Hygrothermal Stresses in Proton Exchange Membranes	332
<i>Y. Li</i>	

17. DIGITAL CORRELATION TECHNIQUES METHODOLOGY

Insect-inspired Flapping Wing Kinematics Measurements with Digital Image Correlation	334
<i>P. Wu, B. Stanford, P.G. Iffu</i>	
Thermal Strain Development in Sol-Gel Derived PZT Thin Films Using DIC	342
<i>T.A. Berfield, N.R. Sottos</i>	
MATLAB® Based Image PreProcessing and Digital Image Correlation of Objects in Liquid	350
<i>M.A. Haile, W. Yin, P.G. Iffu</i>	
Measuring Errors in DIC Invoking Deformation Fields Generated by Plastic Finite Element Analysis	361
<i>P. Lava, S. Cooreman, S. Coppierets, D. Debruyne</i>	
Uncertainty Quantification for Digital Image Correlation	368
<i>P.L. Reu, M.A. Sutton, Y. Wang, T.J. Miller</i>	

18. OPTICAL TECHNIQUES

A New Experimental Method for Calculating K_I and K_{II} Using Photoelasticity,	375
<i>F.A. Diaz, E.A. Patterson, P. Siegmann</i>	
Ambiguity Elimination of Photoelastic Phase Map	382
<i>M.J. Huang, B.C. Song</i>	
A Study of Dynamic Crack-inclusion Interactions Using Digital Image Correlation and High-speed Photography	390
<i>K. Jajam, H.V. Tippur</i>	

19. ELECTRONIC PACKAGING

Copper-rubber Interface Delamination in Stretchable Electronics	397
<i>J.P.M. Hoefnagels, E.J.L. van der Zanden, P.H.M. Timmermans, O. van der Sluis, M.G.D. Geers</i>	
Cohesive-Zone Modeling and Life-Prediction of Leadfree Electronics Under Shock-Impact	399
<i>P. Lall, S. Shantaram, A. Angral, M. Kulkarni</i>	
Fault-Detection and Isolation Algorithms for Health Monitoring of Electronics Subjected to Shock and Vibration	417
<i>P. Lall, P. Gupta, A. Angral, D. Panchagade</i>	
Multifunctional Structures Using Filled Polymers for In-mold Assembly of Embedded Electronic Components	436
<i>W. Bejgerowski, S.K. Gupta, H.A. Bruck</i>	
Aging Effects in SAC Solder Joints	449
<i>Y. Zhang, Z. Cai, J.C. Suhling, P. Lall, M.J. Bozack</i>	

20. REAL TIME MONITORING OF HIGH STRAIN RATE DEFORMATION

High Strain Rate Tissue Simulant Measurements Using Digital Image Correlation	463
<i>S.P. Mates, R. Rhorer, R.K. Everett, K.E. Simmonds, A. Bagchi</i>	
Measurement of Full-Field Transient Deformation of the Back Surface of Multi-layered Kevlar KM2 Fabric Configurations During Impact for Material Model Validation	472
<i>T. Weerasooriya, C.A. Gunnarsson, P. Moy</i>	
Measuring Full-field Transient Plate Deformation Using High Speed Imaging Systems and 3D DIC	481
<i>V. Tiwari, M.A. Sutton, G. Shultz, S.R. McNeill, S. Xu, X. Deng, W.L. Fourney, D. Bretall</i>	
High Strain Rate Deformation Analysis of UFG Aluminum Sheet Samples	489
<i>J. Kokkonen, V.-T. Kuokkala, J.D. Seidl, A. Walker, A. Gilat, L. Olejnik, A. Rosochowski</i>	

Machining Process Measurements: A Titanium Machining Example	496
<i>R. Rhorer, E. Whitenton, T. Burns, S. Mates, J. Heigel, A. Cooke, J. Soons, R. Ivester</i>	

21. HIGH PRESSURE AND SHEAR RESPONSE III

The Shock Induced Shear Strength in a Silastomer	498
<i>J.C.F. Millett, G. Whiteman, S.M. Stirk, N.K. Bourne</i>	
Shock Loading Response of 5083 Aluminium	504
<i>M. Chu, J.C.F. Millett, N.K. Bourne, I.P. Jones, G.J. Appleby-Thomas, P.J. Hazell, G.T. Gray, III</i>	
Uniaxial Compression and Combined Compression-and-Shear Response of Amorphous Polycarbonate at High Loading Rates	506
<i>N. Mehta, V. Prakash</i>	

22. MECHANICAL BEHAVIOR OF NANO COMPSITE MATERIALS

Uncertain Mechanical Properties of Nanocomposite Materials with Polymeric Matrices	531
<i>L.R. Xu, A. Krishnan, C.M. Lukehart</i>	
Multiscale Mechanical Behavior of Hierarchically-structured Polymer Composites	536
<i>A.L. Gershon, H.A. Bruck</i>	
Mechanical Properties of Individual Carbon Nanofibers	545
<i>T. Ozkan, M. Naraghi, I. Chasiotis</i>	

23. USING MECHANICAL VIBRATIONS AS A SENSOR

Modeling of Rock Surface Generated by a Coring Bit Subject to Dynamic Drilling.....	552
<i>M.A. Elsayed, A. Abhayankar, C. Aissi</i>	
Tapping Mode Study of a Surface Quality Sensor: Application to the Characterization of the Surface Quality of Fibrous Structures.....	566
<i>S. Fontaine, P. Blondel, M. Renner</i>	
Recurrence Plots for Determinism Analysis of a Blade-disk Tribometer	574
<i>S. Dia, S. Fontaine, M. Renner</i>	

24. FATIGUE

Turning Point Based Fatigue Testing Using Amplitude Adapted Time Waveform Replication	581
<i>K. Deckers, P. Guillaume, D. Lefebvre, D. De Baere</i>	
Fatigue Life Enhancement of Fiber Metal Laminate Materials as a Result of Hole Cold Expansion	588
<i>D. Backman, E.A. Patterson</i>	

25. METALS I

Effect of Alloying Elements on the Damage of Interstitial Free Steels	593
<i>E. Bayraktar, J.-P. Chevalier, D. Kaplan, L. Devillers</i>	
Corrosion Behaviour of the Welded Steel Sheets Used in Automotive Industry (Tailored Welded Blanks, TWBs)	601
<i>D. Katundi, A. Tosun-Bayraktari, E. Bayraktar, D. Toueix</i>	
Interaction of Hydrogen and Deformation in 316L Stainless Steel	607
<i>B.R. Antoun, B. Song</i>	

26. FRACTURE MECHANICS II

The Design of Dynamic Tests to Infer Rate Dependence in Large-scale Crack Bridging	612
<i>C. Lundsgaard-Larsen, R. Massabò, B.N. Cox</i>	
Challenges in Continuum Modeling of Intergranular Fracture	620
<i>V.R. Coffman, J.P. Sethna, G. Heber, M. Liu, A.I. Ingraffea, N.P. Bailey, E.I. Barker</i>	

Thermodynamic Approach About Fracture Modeling Under Mechano-sorptive Loading	625
<i>F. Dubois, R. Moutou-Pitti, J.M. Husson</i>	
Biaxial Fracture Test Using Full Thickness Specimens and Curved Grips	632
<i>M. Rossi, T. Wierzbicki</i>	

27. FAILURE MECHANISMS

Stochastic Reliability of Brittle Microsystems	639
<i>B.L. Boyce</i>	
Fracture Process Zone in Concrete Beams: Experimental Investigation and Numerical Modeling	645
<i>H. Hadjab</i>	

28. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 1: DYNAMIC RESPONSE

A Split Hopkinson Technique Using Viscoelastic Pressure Bars and its Applications	656
<i>Y. Sogabe, T. Tamaogi, T. Yokoyama</i>	
Attenuation and Dispersion Characteristics in Viscoelastic Bars	664
<i>T. Tamaogi, Y. Sogabe</i>	
Response of the EDAM Cheese to Low Velocity Impact	671
<i>J. Buchar, Š. Nedomová, L. Severa</i>	
Compressive Behavior of Glass Fiber Reinforced Polyurethane Foam	678
<i>H. Luo, Y. Zhang, B. Wang, H. Lu</i>	

29. OPTICAL METHODS FOR RESIDUAL STRESS

Keynote Presentation: Residual Stress Determination with Hole Drilling and Optical Methods	686
<i>D.V. Nelson</i>	
Residual Stress Determination Using Cross-slitting and Dual-axis ESPI	697
<i>Y. An, G.S. Schajer</i>	
Residual Stress Characterization of Plain Woven Composites	707
<i>W.Q. Yin, N.M. Strickland, T.C. Chen, M. Haile, P.G. Ifju</i>	

VOLUME 2

31. DYNAMIC FAILURE OF MATERIALS I

Origin of Pulverized Rocks During Co-seismic Slip	714
<i>F. Yuan, V. Prakash</i>	

32. ENERGETIC MATERIALS I

Ratchet Growth in Recycled PBX 9502	724
<i>D.G. Thompson, G.W. Brown, J.T. Mang, B.M. Patterson, B. Olinger, R. DeLuca, S. Hagelberg</i>	
Dynamic and Quasi-static Measurements of PBXN-5 and Comp-B Explosives	731
<i>G.W. Brown, J.A. Tencate, R. DeLuca, P.J. Rae, S.N. Todd</i>	
Damage Initiated Reaction Model: Experimental Results for High Explosive Families	739
<i>M.U. Anderson, S.N. Todd, T.L. Caipen</i>	

33. MICROCRAKING & POROSITY

Defect and Damage Mechanics in Complex Geological Materials	747
<i>J. Gran, J.B. Rundle, D.L. Turcotte, J. Holliday, W. Klein, H. Gould</i>	
Tracking the Locations of Failure Events in a 2-D Model	753
<i>M. Ferer, D.H. Smith</i>	

Spatiotemporal Thermal Inhomogeneities During Adiabatic Compression of Highly Textured Zirconium.....	759
<i>H. Padilla, J. Lambros, A. Beaudoin, I. Robertson</i>	

34. RESIDUAL STRESS AND RELIABILITY IN MEMS AND NEMS

Residual Stress Monitoring of Post-processed MEMS Fixed-fixed Beams	769
<i>L.A. Starman, R.A. Couturier, Jr.</i>	
Experimental Stress Mapping of Etched Cavity Semiconductor Devices	779
<i>R. Inzinga, G.P. Horn, H.T. Johnson</i>	
Residual Stress and Profile Evaluation on an Optical MEMS Device.....	786
<i>C.J. Tay, C. Quan, R. Akkipeddi, M. Gopal</i>	

35. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 2: DYNAMIC RESPONSE

Dynamic Response of a Multilayer Corrugated Structure with History-dependent Properties Subjected to Transient Loads	792
<i>M.A. Sek</i>	
Finite Deformation Waves in Rubber	802
<i>J. Niemczura, K. Ray-Chandar</i>	
The Influence of Deposition Technique on the Strain Rate Dependent Behavior of Nanocrystalline Gold Films.....	807
<i>L. Wang, B.C. Prorok</i>	

36. INTERFEROMETRY, LOCAL AND TWO DIMENSIONAL METHODS

In-situ Surface Deformation and Temperature Measurement of SOFC Button Cell	815
<i>H. Guo, G. Iqbal, B.S. Kang</i>	
Pixel Quality Evaluation and Correction Procedures in ESPI.....	825
<i>Y. An, G.S. Schajer</i>	
Assessment of Strain Localization in Magnesium Welded Joints.....	832
<i>R. Rotinat, L. Commin, F. Pierron</i>	

38. DYNAMIC BEHAVIOR OF LOW IMPEDANCE MATERIALS III

Acoustic Wave-energy Management in Composite Materials	840
<i>A. Tehranian, A.V. Amirkhizi, S. Nemat-Nasser</i>	
Dynamic Compressive Behavior of Bovine Liver.....	842
<i>F. Pervin, W.W. Chen, T. Weerasooriya</i>	
Tensile Deformation and Fracture of Ballistic Gelatin as a Function of Loading Rate	848
<i>P. Moy, C.A. Gunnarsson, T. Weerasooriya</i>	
Dynamic Characterization and Simulation of Ballistic Gelatin.....	856
<i>D.S. Cronin, C. Falzon</i>	

39. HIGH PRESSURE AND SHEAR RESPONSE IV

Shock Response of Transition Metallic Oxide Materials (LA-14777)	862
<i>D. Dennis-Koller</i>	
Investigation of Dynamic Dry Friction Using the FN8 Configuration	869
<i>R.E. Winter, P.T. Keightley, S.M. Stirk, L. Markland</i>	
Exploring the Micro-mechanical Behavior of Al-MnO₂-Epoxy Under Shock Loading While Incorporating the Epoxy Phase Transition.....	876
<i>A. Fraser, J.P. Borg, J.L. Jordan, G.T. Sutherland</i>	
Plate Impact Experiments to Investigate Shock-induced Inelasticity in Westerly Granite.....	882
<i>F. Yuan, V. Prakash</i>	

Dynamic Compression and Release Properties of Masonry Materials	893
<i>W.D. Reinhart, L.C. Chhabildas</i>	

40. RESEARCH IN PROGRESS

A New Ultrasonic Speckle Interfering Method	902
<i>H.M. Zhu, Z.H. Luo, W.H. Zheng</i>	
Single Molecule Tracking of siRNA Dynamics in Living Cells	907
<i>S. Berezhna, A.A. Deniz, A. Voloshin</i>	

41. MICROCACKING & POROSITY II

Recent Progress in Micromechanics-based Modeling of Void Coalescence.....	912
<i>T. Pardoen, F. Scheyvaerts, C. Tekoglu, L. Lecarme, D. Fabrègue, P.R. Onck</i>	
Direct Damage Quantification Techniques – A Comparative Study.....	919
<i>J.P.M. Hoefnagels, C.C. Tasan</i>	
Relationship Between Inhomogeneous Deformation and Local Texture in Zirconium from Multiscale Image Correlation.....	921
<i>H. Padilla, J. Lambros, A. Beaudoin, I. Robertson</i>	

42. TESTING AND CHARACTERIZATION

Nanoindentation Characterization of Graded Shape Memory Alloy and Multilayer Thin Films	931
<i>D.P. Cole, H.A. Bruck</i>	
The Manifestation of Substrate Effects in Thin Film Nanoindentation	938
<i>B. Zhou, B.C. Prorok</i>	

43. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 3: METALLICS

Dynamics of Plastic Deformation Based on a Field Theory	945
<i>S. Yoshida, T. Sasaki, G.A. Gaffney</i>	
Thermo-viscoplastic Deformation of Metal Alloys.....	954
<i>F.H. Abed</i>	
Dynamic Tension and Compression Properties of Extruded AM30 Magnesium Alloy	960
<i>S.I. Hill, S. Xu, A.L. Luo, D.A. Wagner</i>	

44. CELEBRATING 75TH ANNIVERSARY OF HOLE DRILLING TECHNIQUE (INVITED SESSION)

Hole-drilling Residual Stress Measurement at 75: Origins, Advances and Opportunities.....	969
<i>G.S. Schajer</i>	
Study of Residual Stress Distribution in Advanced Materials	978
<i>J. Lu, Y.H. Huang, H.H. Ruan</i>	
Numerical Study on Calibration Coefficients for Hole-drilling Residual Stress Measurement.....	990
<i>B. Xiao, K. Li, Y. Rong</i>	
ESPI Residual Stress Determination in Shot-peened Aluminum and Steels	998
<i>T.J. Rickert</i>	

45. DIC FOR MICRO/NANO SCALE APPLICATIONS

Image Matching Error Assessment in Digital Image Correlation	1003
<i>Y.Q. Wang, M.A. Sutton, P.L. Reu, T.J. Miller</i>	
Mixed Mode Crack Tip Deformation in Lamellar TiAl Mapped by Digital Electron Speckle Photography	1008
<i>F.P. Chiang, G. Uzer</i>	
A Novel Digital Image Correlation Procedure for Discontinuous Displacement Fields	1016
<i>J. Poissant, F. Barthelat</i>	

Nanoscale Characterization of Cr Films on PET Substrates	1026
<i>H. Jin, W.-Y. Liu, M.J. Cordill</i>	

46. DYNAMIC BEHAVIOR OF LOW IMPEDANCE MATERIALS IV

An Experimental Investigation of Transmitted Waveforms Through Ottawa Sand	1030
<i>J.P. Borg, T.J. Vogler, M. Morrissey, C. Perich, A. Fraser</i>	
Dynamic Characterization of Granular Materials.....	1038
<i>G. Fenton, G. Daehn, G. Taber, T. Vogler, D. Grady</i>	
Dynamic Compressive Response of Sand Under Confinements	1046
<i>H. Lu, H. Luo, R. Komaduri</i>	
The High-rate Behavior of a Fine Grain Sand	1053
<i>B.E. Martin, W.W. Chen</i>	

47. HIGH PRESSURE AND SHEAR RESPONSE V

Line-imaging ORVIS Measurements of Interferometric Windows Under Quasi-isentropic Loading	1059
<i>T. Ao</i>	
Mechanics of Hypervelocity Impact Induced Damage	1061
<i>L. Lamberson, V. Eliasson, A.J. Rosakis, M. Adams</i>	
High Strain Rate Compressive Yielding of Aluminum.....	1065
<i>P. Miller, J. Wang</i>	

48. CONTACT MECHANICS

Modified Herbert Hardness Tester	1067
<i>M. Matsubara, K. Sakamoto</i>	
A Load-based Micro-indentation Technique for Mechanical Property and NDE Evaluation.....	1071
<i>B.S. Kang, C. Feng, J.M. Tannenbaum, M.A. Alvin</i>	

49. METALS

Experiments for Validation of Elastic-plastic Fracture Modeling of Hydrogen Affected Materials	1085
<i>B.R. Antoun, S. Hong, Y. Ohashi, A. Brown, K. Connolly</i>	
Experimental Quantification of Phase Transformation in Austenitic Stainless Steel.....	1094
<i>A.M. Beese, D. Mohr</i>	
Microstructure and Local Deformation Behavior of NiTi Plate	1101
<i>G. Murasawa, S. Yoneyama, A. Nishioka, K. Miyata, T. Koda</i>	

50. APPLICATIONS OF EXPERIMENTAL MECHANICS TO WIND ENERGY SYSTEMS

Boundary Condition Considerations for Validation of Wind Turbine Blade Structural Models	1117
<i>D.T. Griffith, P.S. Hunter, D.W. Kelton, T.G. Carne, J.A. Paquette</i>	
Wind Turbine Operational and Emergency Stop Measurements Using Point Tracking	
Videogrammetry.....	1128
<i>U. Schmidt Paulsen, O. Erne, T. Moeller, G. Sanow, T.E. Schmidt</i>	
Small-scale Tests to Verify Modes of Failure for Large-scale, Megawatt Wind Turbine Blades.....	1138
<i>V. Weissberg, A. Green, R. Guedj, Z. Yosef, G.D. Yehia, H. Mey-Paz</i>	

51. AUTOMOTIVE STRUCTURAL DYNAMICS

Investigation on Motorvehicle Structural Vibrations Caused by Engine Unbalances (1st part- Handlebar)	1146
<i>S. Agostoni, A. Barbera, E. Leo, M. Pezzola, M. Vanali</i>	
Investigation on Motorvehicle Structural Vibrations Caused by Engine Unbalances (2nd part- Footplate).....	1156
<i>S. Agostoni, A. Barbera, E. Leo, M. Pezzola, M. Vanali</i>	

Dynamics of a Bi-unit Impact Vibration Absorber with Staggered Clearances.....	1165
<i>S. Ekwaro-Osire, F.M. Alemayehu, I. Durukan, J.F. Cárdenas-García</i>	

52. VIBRATIONS

Component Modal Tests to Identify the Dynamic Characteristics of Large Structures - Effect of Modeling Errors	1167
<i>M. Misawa, H. Kawasoe</i>	
Vibration Behaviour Analysis of Optical Linear Encoders Based on Different Scanning Methods.....	1176
<i>J. López, M. Artés, I. Alejandre</i>	
Investigations of Flow Morphology Around Thermoacoustic Parallel-plate Stack and Heat Exchangers.....	1182
<i>X. Mao, L. Shi, Z. Yu, A.J. Jaworski</i>	

53. LARGE SCALE STRUCTURES

Evaluating Tests of Downhole Optical Sensors in Deep Water Scenario.....	1190
<i>F.R. Gutterres, C.M.C. Jacinto, C.F.G Eira</i>	
Load Testing of Bridges Using Tiltmeters	1197
<i>K. Ozakgul, O. Caglayan, E. Uzgider</i>	
Strength and Serviceability Evaluation of a R/C Slab Bridge Retrofit	1210
<i>B. Carpenter, D.V. Jáuregui</i>	
Structural Health Monitoring of a Prototype Bridge	1224
<i>M. Azarbayejani, E. Foley, A. El-Osery, M. Reda Taha</i>	

54. FATIGUE AND FRACTURE IN NON-METALLIC MATERIALS

Impact Fatigue Deformation and Residual Stress Evolution in Dental Ceramics.....	1233
<i>H. Bale, N. Tamura, P. Coelho, J.C. Hanan</i>	
Full-field Characterization of Mixed-mode Fracture Criteria of Polymer Foam	1240
<i>S. Hong, H. Jin, W.-Y. Lu</i>	
High-frequency Deflection-regulated Mechanically-powered Fatigue Testing Device	1247
<i>J. Kessler, J.O. Nelson, K.L. Devries, D.O. Adams</i>	

55. MICROCRAKING AND & POROSITY

Discrete Dislocation Dynamics Approach to Dynamic Dimple Fracture Toughness	1253
<i>H.N. Tran, H. Homma</i>	
Comparison of Compression Behaviour of PU Foam and 3D Nonwoven.....	1264
<i>R.L. Dupuis, N. Njeugna, D.C. Adolphe, L. Schacher, E. Aubry, J.-B. Schaffhauser, P. Strehle</i>	

56. MEMS & NANOTECHNOLOGY KEYNOTE PRESENTATIONS

Keynote Presentation: Direct Quantification of Mechanical Behavior and Electromechanical Coupling in Semiconducting Nanowires	1270
<i>H.D. Espinosa, R. Agrawal, B. Peng</i>	

57. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 4: MORPHOLOGICAL INFLUENCES

Time Effects in Rock Mechanics	1272
<i>N.D. Cristescu</i>	
Crystallization Effect at Low Temperature of CF/PEEK on Creep Behavior.....	1281
<i>S. Somiya, Y. Kawabata</i>	
Effect of Magnetic Annealing on the Vicoelastic Behavior of Epoxies	1289
<i>M. Tehrani, M. Al-Haik, D.S. Li, H. Garmestani</i>	

58. CASE STUDIES

- Dynamic Characterization of Metallic Micro-wires Under Impulsive Load** 1297
D. Bortoluzzi, M. Benedetti, C. Zanoni

59. FIBER OPTIC SENSORS

- Performance Studies of Travelling-wave Thermoacoustic Engine for Selected Low-Cost Regenerators** 1308
A.S. Abduljalil, Z. Yu, A.J. Jaworski
Invited Presentation: R&D of Optical Fiber Based Sensors and Their Applications 1318
Z. Zhou, J. Ou, G. Chen
Temperature-insensitive Fiber Pressure Sensor Based on Fabry-Pérot Interferometry..... 1331
C.-W. Lai, Y.-L. Lo, J.-P. Yur

60. DYNAMIC FAILURE OF MATERIALS II

- Commonalities of Adiabatic Shear Resistance and Fracture Toughness in Metals** 1337
D.E. Grady
Experimental Investigation of the Failure Characteristics of 2024-T351 Aluminum 1343
J.D. Seidt, A. Gilat
Dynamic Strain Localization and Fracture of Al Tubes..... 1354
H. Zhang, K. Ravi-Chandar

61. ENERGETIC MATERIALS II

- Measure of Dynamic Toughness Parameters for High Explosive Mock Material Using Instrumented Charpy Impacts** 1356
L. Ferranti, Jr., K.S. Vandersall
Thermal and Loading Dynamics of Energetic Materials 1358
C.M. Cady, C. Liu, P.J. Rae, M.L. Lovato

62. MECHANICS OF HARD BIOLOGICAL MATERIALS II

- Strain Distribution Around Dental Implants in Cortical/Cancellous Bone Models Using DIC Method** 1365
Y. Morita, L. Qian, M. Todo, Y. Matsushita, K. Arakawa
Influence of Storage Duration on Retaining Original Fracture Toughness..... 1371
N.W. Smith, S. Ekwaro-Osire, M. Khandaker, J. Hashemi
The Bending Properties of Caladium and Giant Taro Stems 1378
T.-C. Nguyen, M.-C. Lu, S.-S. Tsai, N.-S. Liou

63. EXPERIMENTAL AND ANALYTICAL STUDIES

- Experimental and Numerical Analysis of Full-locked Coil Ropes Fire Behaviour** 1383
V. Fontanari, B.D. Monelli, F. Degasperi
Applying Modified Weibull Failure Theory on a Polysilicon MEMS Structure 1393
M. Khandaker, D. Brantley, S. Ekwaro-Osire

64. SMALL-SCALE ADHESION AND FRICTION I

- Atomic Scale Mechanisms of Energy Dissipation in Friction.....** 1399
M. Salmeron

65. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 5: VISCOELASTICITY

- An Incremental Formulation for Linear Viscoelastic Analysis: Creep Differential Approach** 1401
C.C. Chazal, R.M. Pitti

Strain Accumulation Process in Time-dependent Materials Exposed to Periodical Loading	1407
<i>B. Zupancic, A. Nikonorov, U. Florjancic, I. Emri</i>	
Analysis of Creep Behavior in Thermoplastic Based on Visco-elastic Theory	1411
<i>T. Sakai, S. Somiya</i>	
Frequency Dependent Mechanical Behaviour of Elastomers Under Uniaxial Cyclic Loading	1420
<i>M. Sasso, G. Palmieri, G. Chiappini, D. Amadio</i>	

66. DIGITAL IMAGE CORRELATION IN FATIGUE AND FRACTURE OF METALS

Stress Intensity Factor Evaluation Using DIC on an Aerospace Component.....	1426
<i>Y. Du, F.A. Diaz Garrido, R.L. Burguete, E.A. Patterson</i>	

VOLUME 3

Observations of Grain Level Damage Accumulation in Fatigue	1433
<i>J. Carroll, C. Efstatithou, W. Abuzaid, J. Lambros, H. Sehitoglu, B. Hauber, S.M. Spottswood, R. Chona</i>	
Calculation of Strain Life Parameters for Die Cast Aluminum.....	1442
<i>J.D. Wong, E.M. Johnson, K.T. The</i>	

67. PHOTOLEASTICITY I

Measurement of Circular and Linear Birefringence with Rotating-Wave-Plate Stokes Polarimeter	1448
<i>J.-F. Lin, C.-J. Weng, Y.-L. Lo</i>	
A Method for Evaluating Full-field Stress Components for the Study of Time-varying Problems	1456
<i>S. Yoneyama, H. Kamihoriuchi</i>	
Imaging Polaroscope for the Characterization of Linear Birefringence Materials in Full-scale Range of Phase Retardation and Principal Axis.....	1467
<i>H. Shan, T.-C. Yu, Y.-L. Lo</i>	

68. DYNAMIC FAILURE OF MATERIALS III

Static and Dynamic Constitutive Behavior and Fracture of Titanium Based FGM Under Thermo-mechanical Loading.....	1477
<i>A. Kidane, A. Shukla</i>	
High Loading-rate Fracture of a Zr-based Bulk Metallic Glass	1484
<i>G. Sunny, V. Prakash, J. Lewandowski</i>	
Dynamic Fracture Initiation Toughness and Propagation Toughness of PMMA	1491
<i>S. Huang, S. Luo, K. Xia</i>	
Deformation and Failure of Polycarbonate During Impact as a Function of Thickness	1500
<i>C.A. Gunnarsson, B. Ziemska, T. Weerasooriya, P. Moy</i>	
Characterization of High Strength Steels Submitted to Shear Fracture and Underwater Blast Loadings	1512
<i>F. Latourte, L.F. Mori, Z. Feinberg, G.B. Olson, H.D. Espinosa</i>	

69. COMPOSITE MATERIALS I

Invited Presentation: Design Study: Composite Asymmetric Fairing for Large Payloads	1514
<i>J.E. Higgins</i>	
Study on the Degradation of Dynamic Compressive Properties of Nanophased E-Glass/Epoxy Composites by Ultraviolet (UV) Radiation and Condensation	1524
<i>S. Zainuddin, M.V. Hosur, A. Tcherbi-Narte, A. Kumar, S. Jeelani</i>	
Impact Response of Nanophased Foam Core/Braided Face Sheet Sandwich Composites	1535
<i>M.V. Hosur, M.A. Bhuiyan, S. Jeelani</i>	
Flutter Response to Damage of Composite Aircraft Control Surfaces.....	1547
<i>F. Palter, M.E. Tuttle, E. Livne</i>	

70. MECHANICS OF HARD BIOLOGICAL MATERIALS I

A Hybrid Evaluation of Toughening in Human Dentin	1552
<i>A. Nazari, D. Bajaj, D. Zhang, D. Arola</i>	
On the Fracture Toughness and R-Curve Behavior of Human Enamel	1558
<i>D. Bajaj, A. Nazari, S. Park, G.D. Quinn, D. Arola</i>	
Micromechanics of Fracture in Sheet and Columnar Nacre.....	1564
<i>F. Barthelat, R. Rabiei</i>	

71. EXPERIMENTAL AND COMPUTATIONAL STUDIES

Axial-torsion Testing Plastic-bonded Explosives to Failure	1567
<i>F.J. Gagliardi, B.J. Cunningham</i>	
Mechanical Characterization of Metallic Materials by Instrumented Spherical Indentation	1574
<i>M. Beghini, V. Fontanari, B.D. Monelli</i>	
Concrete Behavior Under Very High Stresses	1585
<i>Y. Malecot, X.H. Vu, L. Daudeville, E. Buzaud</i>	
Failure Detection and Optimization of a Centrifugal-pump Volute Casing	1593
<i>M. Golbabaei Asl, R. Torabi, S.A. Nourbakhsh, K. Sedighiani</i>	

72. SMALL-SCALE ADHESION AND FRICTION II

Torsional Spring Constant Measurement of a T-shaped Atomic Force Microscope Cantilever	1599
<i>M.G. Reitsma, R.S. Gates, R.F. Cook</i>	

73. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 6: NONLINEAR AND THERMOMECHANICAL MODELING

Viscoelastic and Non-linear Mechanical Behavior of Lightly Cross-linked PMMA	1604
<i>E.W. Lee, R.A. Stamm, G.A. Medvedev, J.M. Caruthers</i>	
Physical Aging Characterization of PPS Near the Glass Transition Temperature	1608
<i>Y. Guo, N. Wang, R.D. Bradshaw</i>	
Investigation of Thermo-mechanical Behavior of Shape Memory Polymers	1616
<i>F. Castro, H.J. Qi</i>	

74. RESIDUAL STRESS I

Keynote Presentation: The Contour Method: A New Approach in Experimental Mechanics.....	1621
<i>M.B. Prime</i>	
Distortion in Ferritic Nitrocarburized SAE 1010 Plain Carbon Steel.....	1630
<i>C. Nan, D.O. Northwood, R.J. Bowers, X. Sun</i>	
Residual Stress and Plastic Anisotropy in Indented 2024-T351 Aluminum Disks	1639
<i>B. Clausen, M.B. Prime, S. Kabra, D.W. Brown, P. Pagliaro, P. Backlund, S. Shah, E. Criss</i>	

75. HIGH SPEED FULL-FIELD OPTICAL MEASUREMENTS I

Application of SEE Method on a Multiphase Steel.....	1647
<i>F. Lauro, D. Morin, G. Haugou, B. Bennani</i>	
Shock Enhancement Due to Shock Front Propagation in Cellular Materials	1658
<i>S. Pattofatto, I. Elnasri, H. Zhao, F. Hild</i>	
Full-field Strain Measurements at High Rate on Notched Composites Tested with a Tensile Hopkinson Bar	1663
<i>R. Moullart, F. Pierron, S.R. Hallett, M.R. Wisnom</i>	
Dynamic Compressive Behavior of Bulk Metallic Glass Foam.....	1669
<i>H. Luo, A. Bhat, M.D. Demetriadou, H. Lu, J.C. Hanan</i>	

3D and 2D High Speed Image Correlation for Dynamic Testing.....	1676
<i>T.E. Schmidt, J. Tyson</i>	

76. NOVEL TESTING TECHNIQUES I

Low Strain Rate Testing Based on Weight Drop Impact Tester	1688
<i>G. Li, D. Liu</i>	
Non-uniform Impact Excitation of a Bar in SHPB System.....	1693
<i>B. Karp, A. Dorogoy, Z. Wang</i>	
A New Type of Crash Test Simulation for Thin Sheet Welded Joints	1703
<i>E. Bayraktar, D. Kaplan, M. Grumbach</i>	

77. ENERGETIC MATERIALS III

Experimental Characterization of Energetic Materials Subjected to Non-uniform Elevated Temperatures	1709
<i>S.K. Marley, S.N. Todd, S.J. Smith, D.W. Gilbert, S. Mahoney, C. Jensen</i>	
Numerical Simulation of Mid-scale Explosives Experiments.....	1711
<i>D.K. Zerkle</i>	
Energetic Initiation and Output Composite Representation.....	1713
<i>K.N. Lappo, D.L. Damm</i>	
Design and Analysis of Planar, Energetically-driven Shock Waves	1715
<i>D.L. Damm, K.N. Lappo, K.J. Fleming</i>	
Damage Initiated Reaction Model: Numerical Results.....	1721
<i>S.N. Todd, M.U. Anderson, T.L. Caipen, B. Lee</i>	
Modeling TNT Ignition with Flow.....	1729
<i>M.L. Hobbs, M.J. Kaneshige</i>	

78. CONSTITUTIVE RELATIONS OF SOFT MATERIALS

Stress-strain Curve Transition Region Demonstrates Heart Valve Collagen Fiber Alignment.....	1736
<i>K.J. Grande-Allen, E.H. Stephens, M. McNeill, N. de Jonge</i>	
Young's Modulus of Collagen as a Function of Displacement Rate	1738
<i>M.d.C. Lopez-Garcia, D.J. Beebe, W.C. Crone</i>	
Mechanical Properties of Pig Skin	1745
<i>G. Uzer, A. Ho, R.A.F. Clark, F.P. Chiang</i>	
Growth-induced Microcracking and Repair Mechanisms of Fruit Cuticles	1751
<i>E.A. Curry</i>	

79. HIGH SPEED FULL-FIELD OPTICAL MEASUREMENTS II

Restrictive Environment for High Speed Videos of Bursting Tests.....	1758
<i>P. Amblard, N. Frémy, E. Fraizer</i>	
Development of a Versatile Pulsed Magneto-polariscope.....	1767
<i>A.R. Conway, R.A. Tomlinson, G.W. Jewell</i>	

80. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 7: NANOINDENTATION

Methods for Transferring the SI Unit of Force from Millinewtons to Piconewtons	1776
<i>G.A. Shaw, K.-H. Chung, D.T. Smith, J.R. Pratt</i>	
A Technique for Force Calibration MEMS Traceable to NIST Standards	1782
<i>K. Abbas, Z.C. Leseman</i>	
On-chip Testing Laboratory for Nanomechanical Characterization of Thin Films	1793
<i>A. Boé, M. Coulombier, A. Safi, T. Pardoën, J.-P. Raskin</i>	
Nanoindentation and the Mechanical Characterization of Viscoelastic Solids.....	1800
<i>E.G. Herbert, W.C. Oliver, A. Lumsdaine, G.M. Pharr</i>	
Viscous Behavior in Berkovich Nanoindentation of Bone.....	1803
<i>S.E. Olesiak, M.L. Oyen, V.L. Ferguson</i>	

Examination of the Nonlinear Mechanical Behavior of Polymers Subjected to Nanoindentation.....	1810
<i>R.J. Arenz</i>	

82. RESIDUAL STRESS II

Influence of Residual Stress Relaxation on Plain and Notch Fatigue of Shot Peened Al-7075-T651.....	1817
<i>M. Benedetti, V. Fontanari</i>	
Correlation Between Residual Stresses and Fatigue Life in Tubes for Hydraulic Cylinders.....	1830
<i>P. Bortot, M.E. Cristea, H.J. Desimone, E. Palermo</i>	

83. DIGITAL CORRELATION TECHNIQUES, APPLICATIONS

Measurement of Steel Plate Perforation Tests with Digital Image Correlation	1836
<i>P.L. Reu, D.J. VanGoethem, T.E. Córdova</i>	
Synchronization Errors in High-speed Digital Image Correlation.....	1846
<i>P.L. Reu, T.J. Miller</i>	
Measurement of Mechanical Properties and Deformation of Artificial Mesh by Digital Image Correlation Method	1852
<i>W.-C. Wang, K.J. Yu, C.B. Liu, T.P. Chu, H.T. Shen, T.Y. Chang</i>	
Sheet Metals Testing with Combined Fringe Projection and Digital Image Correlation	1861
<i>M. Sasso, M. Rossi, G. Chiappini, G. Palmieri</i>	
Variation of Mechanical Properties in a Multi-pass Weld Measured Using Digital Image Correlation	1868
<i>M. Acar, S. Gungor, S. Ganguly, P.J. Bouchard, M.E. Fitzpatrick</i>	
Integrating Experimentation, Modeling, and Visualization Through Full-field Methods.....	1876
<i>D.A. Johnson</i>	

84. NOVEL TESTING TECHNIQUES II

A Newly Developed Kolsky Bar.....	1885
<i>B. Song, K. Connelly, J. Korellis, W.-Y. Lu, B.R. Antoun</i>	
A Semi-circular Bend Method to Determine the Dynamic Tensile Strength of Brittle Solids.....	1887
<i>F. Dai, K. Xia, S.-N. Luo</i>	
A Modified Hopkinson Pressure Bar Experiment to Evaluate a Damped Piezoresistive MEMS Accelerometer	1896
<i>D.J. Frew, H. Duong</i>	
Dynamic Compressive Strength Determined by Strain Measurements in Long Bars	1904
<i>J.C. Johnson, W.A. Hustrulid</i>	
A Small Diameter Kolsky Bar for High-rate Compression	1916
<i>D.T. Casem</i>	
Determination of Material Properties of Golf Ball and Optimization of Golf Clubhead	1924
<i>Z.Q. Wu, Y. Sogabe, Y. Arimitsu</i>	

85. COMPOSITES II

Shock-release and Shock-reshock Response of S2-glass Fiber Reinforced Polymer Composites	1932
<i>F. Yuan, V. Prakash</i>	
Experimental Study on the Performance of Sandwich Composites with Stepwise Graded Cores Subjected to a Shock Wave Loading	1934
<i>E. Wang, N. Gardner, A. Shukla</i>	
Impact Response of Quasi-three-dimensional Woven Composites.....	1945
<i>D. Liu, K. Rosario</i>	
Stab Characterization of Hybrid Ballistic Fabrics.....	1952
<i>H. Rao, M.V. Hosur, J. Mayo, Jr., S. Burton, S. Jeelani</i>	
Impact Mechanics of Transparent Multi-layered Polymer Composites	1963
<i>J.S. Stenzler, N.C. Goulbourne</i>	
High-Strain-Rate Constitutive Behavior of an Al/α-Al₂O₃ Composite	1983
<i>H. Zhang, K. Ravi-Chandar, C.-F. Yen, K. Cho</i>	

Microstructure Evolution and Impact - Toughness Properties of TiB₂ Reinforced Steel Matrix Composites (TiB₂-RSMC)	1985
<i>E. Bayraktar, F. Ayari, D. Katundi, J.-P. Chevalier, F. Bonnet</i>	

86. NOVEL BIOMATERIALS, TOOLS AND TECHNIQUES

Keynote Presentation: Mechanical Performance of Dental Fillers Based on Alumina Nanoparticles	1992
<i>M. Al-Haik, C. Hanson, C. Luhrs, M. Tehrani, J. Phillips, S. Miltenberger</i>	

87. MY FAVORITE EXPERIMENT

Interacting with the Public Using Images of the Nanoscale	2000
<i>W.C. Crone, K.A. Duncan, M.M. Anderson, D. Meshoulam, M. Sims, K. Luster, A. Johnson, H. Williamson, E. Hood, G.M. Zenner</i>	
Experiments for Statics	2005
<i>J.D. Helm</i>	
Demonstration of Diagonal Tension.....	2010
<i>D. Goldar</i>	

88. BIO-MEMS/NEMS

Nanofountain Probes for Direct-write Biological and Functional Nanoparticle Arrays	2015
<i>O.Y. Loh, H.D. Espinosa</i>	
Mechanics of Magnetoelastic MEMS Sensors for Bio-detection.....	2017
<i>C. Liang, B.C. Prorok</i>	

89. TIME-DEPENDENT CONSTITUTIVE BEHAVIORS 8: NANOCOMPOSITES

Time-dependent Behavior of Polymer Nanocomposites with 1D Titanate Nanostructures	2024
<i>I. Emri, U. Florjancic, B. Zupancic, M. Huskic, P. Umek, D. Arcon</i>	
Fabrication-Properties Relationships in Polymeric Nanofibers	2032
<i>M. Naraghi, I. Chasiotis</i>	

90. ORDERED MATERIALS AND POLYMERIC MIXTURES I

Topological Defects in Liquid Crystals	2038
<i>G. Andrej, S. Kralj</i>	

91. GENERAL INVERSE PROBLEMS

Experiment Study of Dynamic Force Identification by a Parameter Estimation Method.....	2045
<i>Y.-M. Mao, X.-L. Guo</i>	
Inverse Identification of Flow Curves and Interface Friction for FE Simulations of Clinch Forming	2052
<i>S. Coppiepers, S. Cooreman, R. Van Hecke, P. Lava, D. Debruyne</i>	
An Inverse Problem Technique for Spur Gears with Asymmetric Teeth.....	2058
<i>S. Ekwaro-Osire, F. Karpat, I. Durukan, F.M. Alemayehu, J.F. Cárdenas-García</i>	
Cryptographic Applications Based on Time Average Geometric Moiré.....	2060
<i>M. Ragulskis, A. Fedaravicius, K. Lukoseviciute</i>	

92. NOVEL TESTING TECHNIQUES III

Semi-circular Bend Technique for Determining Dynamic Fracture Parameters.....	2067
<i>R. Chen, K. Xia</i>	

Dynamic Bulging Technique for Testing Fracture in Intermediate Strain Rates	2073
<i>C.L. Walters</i>	

93. COMPOSITE MATERIALS III

Fluid-structure Interaction in Liquid-filled Composite Tubes Under Impulsive Loading.....	2083
<i>K. Inaba, J.E. Shepherd</i>	
Experimental and Numerical Study of the Energy Absorption Capacity of Pultruded Tubes Under Blast Load.....	2091
<i>D.A. Kakogiannis, D. Van Hemelrijck, J. Wastiels, J. Van Ackeren, S. Palanivelu, W. Van Paepengem, J. Vantomme, G.N. Nurick, S. Chung Kim Yuen</i>	

94. POLYURETHANE FOAMS

Effect of Cure Temperature on Dynamic Mechanical Behavior of Rigid Polyurethane Foam.....	2099
<i>S. Mohan, M.C. Saha</i>	
Stress Relaxation Behavior of Thermoset Polyurethane Foams	2107
<i>M. Saha, B. Barua, A. Balakrishnan</i>	

95. FATIGUE AND FRACTURE

Fatigue Initiation in Crack-like Discontinuities by Critical Distance Theory	2117
<i>S. Chattopadhyay</i>	
Effects of Testing Parameters on Corrosion-fatigue of 2024-T351 Aluminum.....	2124
<i>M.N. Cavalli, E. Okoro</i>	
Fracture of Sheets on Die Radius: Experiments vs. FE Simulation.....	2129
<i>D.L. Issa, T. Wierzbicki</i>	
Additional Test Results and Analysis of Pipeline Containing Irregular Shaped Corrosion Defects	2136
<i>A.C. Benjamin, A.R. Franzoi, J.J. Leal C., J.L.F. Freire, R.D. Vieira, J.L.C. Diniz</i>	

VOLUME 4

96. FABRICATION AND TESTING

Residual Stress for Assembling, Partially Assembling and Actuating MEMS Devices	2146
<i>N.R. Coleman, L.A. Starman, R.A. Couturier, Jr.</i>	
CMOS Semiconductor Manufacturing Integration on Sub-micron Gate Spacer	2154
<i>C.-J. Weng, J.-F. Lin</i>	
Fabrication of Highly-ordered Monolayer Nanoarray and Its Application to Experimental Mechanics at Nanoscale	2162
<i>Z. Wang, H. Du, W. Gong</i>	
Defects Reduction of Nano-semiconductor Dual Damascene Process Development.....	2166
<i>C.-J. Weng</i>	

97. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 9: COMPOSITES LIFE PREDICTION

An Approach for Nonlinear Modeling of Polymer Matrix Composites	2174
<i>U. Santhosh, J. Ahmad</i>	
Multiscale Analysis of Composites	2183
<i>P. Woelke, N. Abboud, J. Cipolla</i>	
Advanced Accelerated Testing Methodology for Life Prediction of Polymer Composites	2185
<i>Y. Miyano, M. Nakada, Y. Hanatani</i>	

98. VIBRATION IDENTIFICATION METHODS

An Experimental Technique for Detection of Naturally Grown Cracks Using Vibration Parameters	2195
<i>G.E. Carr, L.F. Jaureguizahar, M.D. Chapetti</i>	
Limitations of Fourier-based Spectral Analysis for Monitoring Structural Integrity	2202
<i>M. Lamb, V. Rouillard</i>	
Adaptive Impulse Response for Determining Damage During Fatigue Testing.....	2209
<i>M. Lamb, M.A. Sek, V. Rouillard</i>	
Detecting Crack Initiation Through Mapping Nonlinear Parametric Models	2216
<i>T.A. Doughty</i>	

99. IDENTIFICATION FROM FULL-FIELD MEASUREMENTS I

Development of an Inverse Method for Material Characterization Using a Biaxially Loaded Cruciform Composite Specimen.....	2224
<i>C. Ramault, A. Makris, H. Sol, D. Van Hemelrijck, D. Lecompte, E. Lamkanfi, W. Van Paepegem</i>	
Hyperelastic Materials Characterization by Planar Tension Tests and Full-field Strain Measurement	2232
<i>G. Palmieri, G. Chiappini, M. Sasso, S. Papalini</i>	
Identification of the Plastic Material Behaviour Through Inverse Modelling and DIC: Influence of the Specimen's Geometry	2239
<i>D. Debruyne, S. Cooreman, P. Lava, S. Coppeters</i>	

100. MATERIALS RESPONSE I

Perforation of 5083-H116 Aluminum Armor Plates with Ogive-nose Rods and 7.62mm APM2 Bullets	2247
<i>T. Børvik, M.J. Forrestal, T.L. Warren</i>	
Effect of Prior Deformation on the Dynamic Behavior of Metastable Austenitic Stainless Steel	2273
<i>M. Isakov, V.-T. Kuokkala, R. Ruoppa</i>	
Dynamic Behaviour of Welded Stainless Steels Used in Automotive Industry.....	2282
<i>E. Bayraktar, D. Katundi, J. Claeys</i>	
Effects of Strain-rate and Pressure in a Zr-based Bulk Metallic Glass.....	2288
<i>G. Sunny, F. Yuan, V. Prakash, J. Lewandowski</i>	

101. MODELING DYNAMIC RESPONSE I

Simulation of Experimental Variability with Spatially Heterogeneous Models	2290
<i>B. Leavy, E. Strack, R. Brannon, R. Jensen, J. Houskamp</i>	
Parametric Analysis of the Dynamic Compressive Strength Enhancement in Brittle Materials.....	2293
<i>F. Huang, M. Zhang, Q. Li, H. Wu</i>	
Subscale Modeling and Characterization for Ballistic Response of Geometrically Complex Structures.....	2300
<i>H.A. Bruck, M. Chowdhury</i>	
State Based Peridynamic Modeling of Dynamic Fracture	2312
<i>J.T. Foster, S.A. Silling, W.W. Chen</i>	

102. RECENT ADVANCES IN COMPOSITE MATERIALS

Stress Distribution on the Interfacial Shear Strength Measurements.....	2318
<i>A. Krishnan, L.R. Xu</i>	
Interfacial Micro-mechanics of Fluorinated-epoxy Carbon Fiber Composites.....	2327
<i>C.H. Karelly, G. Pandey, R.P. Singh, J. Hinkley</i>	
Dynamic Compressive Response of Bi-continuous Mesoporous Silica Aerogel.....	2329
<i>H. Luo, N. Leventis, H. Lu</i>	
Effect of Surface Treatments on Environmental Degradation of Carbon Fibers	2330
<i>D. Jeevan Kumar, R.P. Singh</i>	
Effect of Testing Parameters on Data Scatter in Microbond Testing.....	2341
<i>G. Pandey, C. Karelly, R.P. Singh</i>	

103. FATIGUE, FRACTURE AND BUCKLING OF COMPOSITES

Effects of Manual Shot Peening Conditions on High Cycle Fatigue.....	2349
<i>H. Bae, M. Ramulu, H. Diep</i>	
Fracture Induced by Cold Rolling in Metal/Polymer Composites.....	2357
<i>B.O. Calcagno, C. Rinaldi, T.A. Osswald, W.C. Crone</i>	
Using Digital Image Correlation in Split-D Tensile Tests of Carbon Fiber Composite Rings	2365
<i>P. Moy, R.P. Emerson, R.L. Karkkainen, R.P. Kaste, J.T. Tzeng</i>	

104. FULL-FIELD OF VIEW MEASUREMENTS

Strain Rate and Creep Response of Au and Ni Thin Films.....	2373
<i>N. Karanjaokar, I. Chasiotis, D. Peroulis, K. Jonnalagadda</i>	
Larger Surface Profile Measurement of Microstructures by White-light Phase-shifting Interferometry and Image Stitching.....	2382
<i>T.Y. Chen, L.C. Yeh</i>	
Measure the Mechanical Behavior of Thin Films Using Four Step Phase-shifting Methods on the Novel Paddle Cantilever Beam	2387
<i>M.-T. Lin, C.-J. Tong, Y.-C. Cheng, K.-J. Chung, J.-H. Hsu</i>	
Identification of Reconstruction Distance in Phase-shifting Digital Holography for Microscope	2394
<i>R. Nisitani, M. Fujigaki, Y. Morimoto</i>	

105. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 10: COMPOSITES DEGRADATION AND DAMAGE

Effect of Moisture and Temperature on the Mechanical Properties of Concrete	2401
<i>S.N. Shoukry, G.W. William, M.Y. Riad, B. Downie</i>	
Blistering and Delamination in High Temperature Polymer Matrix Composites.....	2410
<i>A.T. Zehnder, M.W. Czabaj</i>	
Framework for Constitutive Modeling and Life Prediction for Polymeric Matrix Composites	2416
<i>P. Woelke, N. Abboud, I. Sandler</i>	

106. FUNCTION AND DAMAGE OF BONES AND TISSUES IN MUSCULOSKELETAL

Keynote Presentation: Modeling and Experiments to Understand Tissue Function	2419
<i>N.G. Shrive, C.A. Gibbons-Kroeker, J.V. Tyberg, C.B. Frank, G.M. Thornton, S.M. Adeeb</i>	
Examining Damage Accumulation in Osteoporotic Distal Femur Fracture Repair	2427
<i>C. Salas, D. Mercer, K. Firoozbakhsh, T. DeCoster, M.M. Reda Taha</i>	
The Effect of Locking Screw Threads on the Fatigue Strength in Intramedullary Nail Fixation of Femur Fractures	2436
<i>S. Lovald, T. Khraishi, T. DeCoster, S. Bozorgnia</i>	
Creep and Relaxation of Osteoporotic Bones.....	2439
<i>S. Neidigk, C. Salas, E. Soliman, D. Mercer, M.M. Reda Taha</i>	

107. IDENTIFICATION FROM FULL-FIELD MEASUREMENTS II

Mechanical Characterization of Thin Film Using DIC and Inverse Approach.....	2447
<i>C.-H. Chien, J.-C. Wu, C.-C. Chen, T. Chen</i>	
Inverse Characterization of Arterial Segments on the Basis of In-vitro Whole-body Deformation Measurement.....	2456
<i>S. Avril, K. Genovese, J.P. Vassal, J.-P. Favre</i>	
Mechanical Characterization of Trabecular Bone Using the Virtual Fields Method	2464
<i>M. Rossi, L. Omini, S. Papalini</i>	

108. MATERIALS RESPONSE II

Dynamic Strength Measurements on Transparent Materials Using Bar Impact.....	2472
<i>J. Tolman, S. Bless, S. Levinson</i>	
Uniaxial and Confined Dynamic Compressive Behavior of Aluminum Nitride.....	2475
<i>G.L. Hu, K.T. Ramesh, J.W. McCauley, B. Cao</i>	
Grain Size Dependent Shear Instability Induced by Geometry Softening for NC/UFG Materials Under Dynamic Loading.....	2477
<i>Y.Z. Guo, Y.L. Li, Z. Pan, F.H. Zhou, Q. Wei</i>	

109. MODELING DYNAMIC RESPONSE II

A New Material Constitutive Model for High Strain Rate Behavior of Metals.....	2479
<i>Y.J. Chao, K. Wang</i>	
Dynamic Constitutive Behavior of Eutectic Solder at Strain-rates up to 200 s⁻¹	2483
<i>B.L. Boyce, L.N. Brewer, M.K. Neilsen</i>	
A Viscoelastic, Viscoplastic Model of Cortical Bone.....	2490
<i>T.P.M. Johnson, S. Socrate, M.C. Boyce</i>	

110. TESTING OF COMPOSITE MATERIALS

Specimen Design for Through-thickness Testing of 3D Woven Textile Composites	2492
<i>R.L. Karkkainen, P. Moy</i>	
Confined Creep Testing of Plastic-bonded Explosives	2499
<i>B.J. Cunningham, F.J. Gagliardi</i>	

111. FAILURE BEHAVIOR OF COMPOSITES

Biaxial Failure Envelopes for Glass Fibre Reinforced Composite Laminates.....	2507
<i>A. Makris, C. Ramaut, D. Van Hemelrijck, E. Lamkanfi, W. Van Paepengem</i>	
Enhancing Paper Strength by Optimizing Defect Configuration	2518
<i>J. Considine, W. Skye, W. Chen, D. Matthys, D. Vahey, K. Turner, R.E. Rowlands</i>	
Rate Dependency of CFRP Composites Under Low Velocity Impact Loading.....	2526
<i>T.M. Briggs, M. Ramulu</i>	
Experimental and Numerical Investigation of Nanoindentation of Self-consolidating Concrete.....	2545
<i>A.K. Reinhardt, M. Sheyka, M. Tehrani, M. Al-Haik, M.M. Reda Taha</i>	
Failure Behavior and Energy Absorption of Sandwich Composites Under Dynamic Loading	2553
<i>S.A. Tekalur, E. Wang, M. Jackson, A. Shukla</i>	

112. MODELING AND SIMULATION

Effects of Release Hole Size on Microscale Phononic Crystals	2562
<i>Y.M. Soliman, D.F. Goettler, Z.C. Leseman, I. El-Kady, R.H. Olsson, III</i>	

113. TIME-DEPENDENT CONSTITUTIVE BEHAVIOR 11: MECHANO-DIFFUSIVE SYSTEM

Time-dependent Model for the Elastin-water Subsystem in Arteries	2571
<i>H.W. Haslach, Jr.</i>	
Modeling of the Mechano-sorptive Behavior as a Time Memory-shape Alloy	2579
<i>J.-M. Husson, F. Dubois, N. Sauvat</i>	
Viscoelastic Constitutive Model of Collagen Dermal Implants.....	2586
<i>M.A. Haile, R. Hernandez, P.G. Ifju</i>	
Cross-validation of Experimental Methodologies to Characterize the Behavior of Hydrogels.....	2597
<i>K. Toohey, S. Kalyanam, M. Insana</i>	
Using Digital Image Correlation on Pressure-loaded Blister Testing of PEM.....	2603
<i>J.R. Grohs, C.M. Siuta, E. Mieritz, S.W. Case, D.A. Dillard, M.W. Ellis, Y.-H. Lai, Y. Li, C. Gittleman</i>	

Determining Multiaxial Properties of Porous Viscoelastic Membrane Using Bubble-inflation Test.....	2618
<i>M.A. Haile, J. Faleris, P.G. Ifju</i>	

114. MOIRÉ METHODS, SHAPE AND DEFORMATION MEASUREMENTS

Experimental Investigation of Aggregate Effects on Shrinkage Behavior in Concrete Materials	2628
<i>T.C. Chen, W.Q. Yin, P.G. Ifju</i>	
Dynamic Shape Measurement Using Whole-space Tabulation Method with Sampling Moiré.....	2637
<i>M. Fujigaki, R. Murakami, A. Masaya, Y. Morimoto</i>	
Recent Advances in 3D Shape Measurement and Imaging Using Fringe Projection Technique.....	2644
<i>Z. Wang, D.A. Nguyen, J. Barnes</i>	
Open-source Internet Platform for Automatic Image and Data Processing in Optical Methods	2654
<i>Z. Wang</i>	
Characterization of Tensile Behavior in Friction Stir-welded Titanium Alloy, Ti-6Al-4V	2659
<i>T. Greenwell, M. Ramulu, P. Labossiere</i>	

115. IDENTIFICATION FROM FULL-FIELD MEASUREMENTS II

Influence of Strain Field Heterogeneities on Inverse Identification of Titanium Constitutive Parameters	2669
<i>T. Pottier, F. Toussaint, P. Vacher</i>	
Identification of a Kinematic Hardening Elasto-plastic Model with the Virtual Fields Method	2678
<i>F. Pierron, V.T. Tran, S. Avril</i>	
Local Energy Analysis of High-cycle Fatigue Using Field Measurements	2686
<i>F. Latourte, A. Chrysochoos, B. Berthel, A. Galtier, S. Pagano, B. Wattisse</i>	
Enhanced Handshaking Between DIC and FE Computed Deformation Fields in an Inverse Method	2694
<i>B. Belkassem, S. Bossuyt, H. Sol</i>	

116. MODEL VALIDATION AND UNCERTAINTY QUANTIFICATION

Drucker-Prager Finite Element Constitutive Model of Microindentation in Polycrystalline Alumina.....	2704
<i>I. Mijangos, K.U. O'Kelly</i>	
Stochastic Modeling of Cell Phones.....	2713
<i>P. Raghavendra, T.L. Paez</i>	
Strength Analysis and Simulation of Multiple Spot-welded Joints	2728
<i>X. Zhang, B Liu</i>	
Centrifuge Based Laser Tracker Uncertainty Quantification and Capability Development, a Two Part Series.....	2735
<i>E. Romero, T. Miller, T. Brown, T. Paez</i>	
Extending Digital Image Correlation to Moving Field of View Application: Error Assessment Using Outdoor Centrifuge	2743
<i>T.J. Miller, E.F. Romero, H.W. Schreier, M.T. Valley</i>	
Using Selective Laser Sintering to Produce Scaled Structural Models	2752
<i>W.R. Cooke, R.A. Tomlinson, R.L. Burguete, D. Johns, G.J.C. Vanard, C.A. Featherston</i>	

117. ORDERED MATERIALS AND POLYMERIC MIXTURES II

Alignment of Nanotubes in Nematic Liquid Crystals	2762
<i>V. Popa-Nita, S. Kralj, M. Cvetko</i>	
Giant Electrocaloric Effect in Ferroelectric Relaxor Materials.....	2769
<i>B. Rožić, Z. Kutnjak</i>	
Structural Behavior of a Mixture of Ferromagnetic Nanoparticles and Nematic Liquid Crystals	2775
<i>M. Krasna, M. Ambrožić, S. Kralj</i>	
Optimal Stochastic Resonance in a Locally Perturbed Soft Matter System	2782
<i>M. Gosak, M. Perc, Z. Kutnjak, S. Kralj</i>	
Memory Effects in Randomly Perturbed Systems Exhibiting Long Range Orientational Ordering	2790
<i>M. Cvetko, M. Ambrožić, S. Kralj</i>	
Structures and Forces in Nanoconfined Liquid Crystals	2797
<i>S. Kralj, M. Cvetko</i>	

118. ADVANCED COMPOSITE MATERIALS AND SYSTEMS

Effect of Braid Angle on the Flexural Kink Resistance of Braided Metal Wire-reinforced Polymer Composite.....	2804
<i>H. Zhang, P. Zhou, R. He</i>	
Effect of Reinforcement Volume Fraction on Physical Properties of Glass/Polyester Composites.....	2810
<i>N.K. Abid AL-sahib, L.S. Yousuf</i>	
Structural Response of Aluminium Foam Sandwich Under Compressive and Tensile Loading	2822
<i>C. Casavola, V. Dell'Orco, R. Giannoccaro, C. Pappalettere</i>	
Creep Characterization of Bendable UAV Wing – Long Term Creep Measurement and Material Characterization	2834
<i>V.N. Jagdale, P.G. Ifju</i>	

250. STUDENT PAPER & POSTER SESSION

Luminescent Photoelastic Coating Image Analysis on a Three-dimensional Grid.....	2843
<i>E. Esirgemez</i>	
Stress Intensity Factor Dependence of Hg-LME in Aluminum	2845
<i>S.G. Keller</i>	
Effects of Crack Arresting Delaminations in Aluminum Lithium Alloys	2847
<i>M. Hernquist</i>	
Effect of Interfacial Stress Distribution on Material Interface Shear Strength	2849
<i>A. Krishnan</i>	
On the Development and Application of a Novel Indentation Technique	2851
<i>Y. Xuan</i>	
Digital Image Correlation Analyses Using Moving Least Squares Approximation	2853
<i>H. Yao</i>	
Hypervelocity Impact: Investigating Damage Mechanisms Using Optical Diagnostics.....	2855
<i>L. Lamberson</i>	
Evaluation of Incident, Reflected and Deformation Energies During Blast Experiments.....	2857
<i>E. Wang</i>	
Dynamic Mechanical Behavior of Thermoplastic Thin Polyurethane Films.....	2859
<i>A. Balakrishnan</i>	
Author Index	