Society for Experimental Mechanics

26th IMAC: Conference and Exposition on Structural Dynamics 2008

IMAC XXVI

February 4-7, 2008
Orlando, Florida, 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: 978-1-60560-066-6

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

The 2008 IMAC XXVI 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

26th IMAC:
Conference and Exposition
on Structural Dynamics
2008

TABLE OF CONTENTS

Volume 1

SECTION 1. SYSTEM IDENTIFICATION

Operational Modal Analysis Using Second-order Blind Identification..... 1
F. Poncelet, G. Kerschen, J.C. Golinval

Modal Properties of a Beam with Loosened Bolted Joint 8
S. Chalumuri, A. Gupta

Understanding Transmissibility Properties 15
N.M.M. Maia, R.A.B. Almeida, A.P.V. Urgueira

Using Photo Modeling to Obtain the Modes of a Structure..... 25
S.C. Richardson, M.H. Richardson

Investigation on the Modal Characteristics of Some Composite Laminate Configurations..... 31
D. Nicgorski, A. Butland, P. Avitabile

SECTION 2. ACTIVE-SENSING STRUCTURAL HEALTH MONITORING I

Structural Health Monitoring from Random Noise 37
K. Sabra, A. Srivastava, F. Lanza di Scalea

Fuzzy Logic Applied to Damage Characterization Through SHM Techniques..... 46
J.R.V. Moura, Jr, S. Park, V. Steffen, Jr., D.J. Inman

Bolted Joint Damage Assessment Using Chaotic Probes 54
T.R. Fasel, M.B. Kennel, M.D. Todd, E.H. Clayton, M.C. Stabb, G. Park

Monitoring of Fatigue Damage of Marine Composites Using Image Analysis..... 62
D.M. Peairs, A. Zhou, S.W. Case, J.J. Lesko, N.L. Post, J.J. Cain

SECTION 3. EXPERIMENTAL TECHNIQUES I

Identifying Multi-reference Frequency Response Matrices Using a Single Measurement..... 71
P. Guillaume, T. De Troyer, K. Deckers, G. De Sitter, C. Devriendt

Crowd Motion Measurement Based on Image Processing..... 79
A. Caprioli, S. Manzoni, E. Zappa

3D Digital Image Correlation Methods for Full-Field Vibration Measurement..... 87
M.N. Helfrick, C. Niezrecki, P. Avitabile, T. Schmidt

Measurement of Rotational FRFs in Isotropic Beams and Plates Using Piezoceramic Bimorphs and Genetic Algorithm Optimization 97
T.R. Cicogna, P.S. Varoto, M.A. Trindade

SECTION 4. AIRCRAFT/AEROSPACE

Modern Solutions for Ground Vibration Testing of Large Aircraft 110
B. Peeters, H. Climent, R. de Diego, J. de Alba, J. Rodriguez Ahlquist, J. Martinez Carreño, W. Hendricx, A. Rega, G. García, J. Deweer, J. Debille

Active Gimbal Control for Surveillance Using Small Unmanned Aircraft Systems 124
W.H. Semke, J. Ranganathan, M. Buisker

Application of Operational Modal Analysis for Wind-tunnel Testing of an Aircraft Wing Model with Control-surface 136
L.M. Zhang, M. Boeswald, D. Göge, H. Mai

Improved Aeroelasticity Predictions Using Measured Modal Data 148
D.M. Pitt, D.P. Haudrich

Identification of Modal Parameters of Aircraft During Taxi 162
M. Boeswald, Y. Govers, D. Göge, L.M. Zhang

SECTION 5. SHOCK AND VIBRATION

AGS Gun and Projectile Dynamic Modeling Correlation to Test Data 172
J.E. Alexander

Some Applications for the Testing of Civil Structures Using Multiple Shaker Excitation Techniques 188
M.A. Underwood, T. Keller

An Historic View of Shock and Vibration 202
H.C. Pusey

Use of Damping in Pseudo Velocity Shock Analysis 209
H.A. Gaberson

Physics of Failure (POF) Application in RAM-T Case to Eliminate/Mitigate Machinery Failures 230
V.M. Whelan

SECTION 6. STRUCTURAL HEALTH MONITORING I

Detective Diagnosis of Spur Gear in Consideration of Dynamic Characteristic of Gear Device 236
N. Okubo, K. Morimoto, T. Toi, T. Okumura

Structural Health Monitoring of a Composite Bridge 244
V. Bungard, M. Waltering, D. Waldmann, S. Maas, A. Zürbes, G. De Roeck

Lamb Waves for Non-destructive Evaluation of Composite Wing Section 254
J. Sheppard, D. Chetwynd, K. Worden, W. Staszewski

Structural Health Monitoring Using the Hilbert-Huang Transform and Beating 262
L. Saripalli, D.C. Zimmerman

Global-local Modeling of Guided Waves for Quantitative Damage Detection 272
A. Srivastava, I. Bartoli, F. Lanza di Scalea

SECTION 7A. BIODYNAMICS I

Bus Drivers' Exposure to Mechanical Shocks Due to Speed Bumps 280
J. Granlund, A. Brandt

Evaluating Ride Comfort of Automobiles Considering Human Body Behaviors 290
T. Koizumi, N. Tsujiuchi, H. Abe, J. Ninomiya, N. Takata, K. Yamazaki

Measuring Structural Dynamic Properties of Human Tibia by Modal Testing 297
B. Bediz, H.N. Özgüven, F. Korkusuz

SECTION 8. ACTIVE-SENSING STRUCTURAL HEALTH MONITORING II

Damage Characterization of the Z24 Bridge by Transfer Function Pole Migration 306
R.A. Swartz, J.P. Lynch

Monitoring Buckling of Metal Structures Using PZT Transducers 319
V.G.M. Annamdas, Y.W. Yang, A. Miao

Energy Harvesting Through Electromechanical Transducers 328
D.W. Burt, N.A. Pedrazas, D.M. Schluneker, K.M. Farinholt

False Alarms in Damage Detection Approaches 342
D.D. Bueno, C.R. Marqui, R.B. Santos, S. da Silva, V. Lopes, Jr.

Computation of the Likelihood of a Finite Element Model 352
B.A. Zárate, J.M. Caicedo

Temperature Effects-free Impedance-based Structural Health Monitoring Using Principal Component Analysis 359
K.-Y. Koo, S. Park, J.-J. Lee, C.-B. Yun

SECTION 9. ACOUSTICS

Joint Interface Modes: Numerical 3D-benchmark Studies 365
W. Witteveen, H. Irschik

Concepts for Global Noise Control in Cabins 376
S. Boehme, D. Sachau, H. Breitbach

Utilization of Energy Finite Element Simulations in Multi-discipline Optimization 386
G. Zhang, A. Wang, N. Vlahopoulos

Auralization of Simulated Structural Modifications 398
R. Sottek, B. Müller-Held, P. Blaschke

A Sound Radiation Index for an Efficient Prediction of Radiated Sound Power 406
M. Junge, D. Brunner, L. Gaul

Active Structural Acoustic Source Control of Rotating Machinery Using Piezo Bearings 414
B. Stallaert, S. Devos, G. Pinte, W. Symens, J. Swevers, P. Sas

Propagation of Acoustic Waves in Random Media 424
M. Khenafou, M. Daïri, A. Brezini, M. Sebbani

Study on Identification of Noise Resources and Truck's Noise Reduction 430
H.B. Li, J.C. Liu, W.P. Yuan, Y.F. Shangguan

SECTION 10. ANALYTICAL METHODS

Spacecraft Electrical Cable Harness Structural Test and Analysis Methods 437
J.C. Goodding

The Interaction of Advanced Flight Control System and Elastic Aircraft Structure 444
W.G. Luber

Characteristics of a Spring-mass System Undergoing Centrifuge Acceleration 462
E.F. Romero, R.A. Jepsen

Eigenvalue and Eigenvector Derivatives from the Perspective of Diagonalising Structure-Preserving Equivalences 471
L. Abuazoum, S.D. Garvey

SECTION 11. MODAL TEST METHODS

Impact Testing with a Continuously-scanning LDV 478
R. Ribichini, D. Di Maio, A.B. Stanbridge, D.J. Ewins

Estimation of Impulse Responses: a Novel Method and its Use in Experimental Modal Analysis 491
E. Reynders, G. De Roeck

Low Frequency Vibration Testing of a Pedestrian Walkway with an Active for ce-frequency Shifting Shaker 502
C.J. Hudson, M.W. Trethewey, L.L. Koss

Thermoelastic Modal Stress Analysis 512
R. Marsili, M. Moretti, G.L. Rossi

Applications of Frequency Domain Curve-fitting in the EFDD Technique 518
N.J. Jacobsen, P. Andersen, R. Brincker

Using Operating Deflection Shapes to Detect Misalignment in Rotating Equipment 531
S.N. Ganeriwala, Z. Li, M.H. Richardson

Utilization of Alias Free Polyreference for Mixed Mode Structures 536
R.D. Brillhart, K. Napolitano, D. Osterholt

SECTION 12. STRUCTURAL HEALTH MONITORING II

Effect of Uncertainty on Damage Identification for Closed-loop Systems 543
J.-S. Lew

Detecting Low Energy Impact Damage in a Sandwich Composite Wing 552
E. Aktas, M. Seaver, J.M. Nichols, S.T. Trickey

Experimental Validation of Damage Monitoring Techniques in Variable Temperature Conditions 561
D. Siegert, L. Mevel, M. Goursat

The Local Flexibility Method for Vibration-based Damage Localization and Quantification 571
E. Reynders, G. De Roeck

Training Damage Classifiers in the Absence of Damage Data 586
E. Papatheou, G. Manson, K. Worden

Component Modal Tests for Frequency Verification of Large Space Structures 598
M. Misawa, M. Matsuo, S. Kojima

SECTION 13. ROTATING MACHINERY MEASUREMENT AND ANALYSIS METHODS

Critical Speed Determination of Rotating Structures with an Optical Technique 607
W.O. Wong

Determination of an Operating Systems' Receptance FRF Data 611
D. de Klerk

Volume 2

Adaptive Amplitude Demodulation (AAD) as an Order Tracking Method 621
P. Van Vlierberghe, K. Janssens, H. Van der Auweraer

Evaluation of Order Tracking Techniques on Practical Data 633
B.J. Dilworth, J.R. Blough

Review of State-of-the-Art Order Tracking Techniques for High Speed Turbocharger Testing 646
A. Menon

Non Contact Measurements of Stress Fields on Rotating Mechanical Components by Thermoelasticity 653
A. Di Renzo, R. Marsili, G.L. Rossi

SECTION 14. ACTIVE-SENSING STRUCTURAL HEALTH MONITORING III

A Circuit Design for Remote Structural Health Monitoring 661
Z. Zhao, S.R. Wang, C. You

Sensor Diagnostics for Autonomous Digital Structural Health Monitoring Systems 670
B.L. Grisso, J. Kim, D.S. Ha, D.J. Inman

External Disturbance Effect in Damage Detection Using Electrical Impedance 678
C.R. Marqui, D.D. Bueno, F.G. Baptista, R.B. Santos, J.V. Filho, V. Lopes, Jr.

Novel Wireless Sensor Network Technologies for Rapid Assessment Monitoring of Civil Structures 688
D.L. Mascarenas, E. Flynn, M.D. Todd, G. Park, C.R. Farrar

Altshuller Innovation Theories Applied to SHM of Aircraft Structures 695
J.R.V. Moura, Jr., C.A. Oliveira, V. Steffen, Jr.

Optimum Sensor Localization Based on Sensitivity of Incomplete Damage Indexes 702
R. He, C. Huang, Q. Qin

SECTION 15. STRUCTURAL HEALTH MONITORING – CIVIL

A Guided Wave Health Monitoring Approach for Civil Structures 712
J.L. Rose, R.L. Royer, Jr.

Dynamic Monitoring of Historical Masonry Structures for Damage Identification 722
L.F. Ramos, L. Mevel, P.B. Lourenço, G. De Roeck

Effect of Parameter Variations on the Structural Response of the Drip Shield – An Engineered Barrier of a Potential Geologic Repository 732
R.V. Kazban, L.F. Ibarra

SECTION 16. BIODYNAMICS II

Videogrammetry-based Position Monitoring Using Inherent Surface Targets 741
A.M. Sims, S.C. Kienle, J. Leifer

Initial Mechanical Stability of Cementless Porous Titanium Patellar Components 754
R.P. Eason, N. Ledford, T. Lerro, P. Cornwell, P. Rae, B.R. Willms, R.M. Meneghini, A. Hanssen

Full-field Transient Acceleration Measurement Using Videogrammetry 765
S.C. Kienle, A.M. Sims, J. Leifer

SECTION 18. MEMS DYNAMICS

Large Deflections of Clamped Composite Circular Plates with Initial In-Plane Tension 779
B.A. Griffin, B. Homeijer, M.D. Williams, B.V. Sankar, M. Sheplak

Air-drag Damping on Micro-cantilever Beams 788
H. Sumali, T.G. Carne

Experimental/Analytical Evaluation of the Effect of Tip Mass on Atomic force Microscope Calibration 795
M.S. Allen, H. Sumali, E.B. Locke

Design Optimization of a MEMS Magneto-static Linear Actuator 805
S.W. Park, C.D. McCoy, A. Mehr, J.H. Kuypers, A.P. Pisano

Optimal Design and Characterization of a Metal MEMS MicroGimbal Platform 813
C.D. McCoy, Y.-M. Chen, D.C. Walther, A.P. Pisano

Evaluation of the Metrological Performances of a MEMS Accelerometers to the Aim of Their Application in Structural Health Monitoring 824
A. Cigada, M. Lurati, M. Redaelli, M. Vanali

SECTION 19. NONLINEAR I

Nonlinear Normal Modes, Part I: An Attempt to Demystify Them 833
G. Kerschen, M. Peeters, J.C. Golinval, A.F. Vakakis

Nonlinear Normal Modes, Part II: Practical Computation Using Numerical Continuation Techniques 869
M. Peeters, R. Viguié, G. Sérandour, G. Kerschen, J.C. Golinval

Experimental and Numerical Analysis of Two Vibro-impacting Beams 891
N. Leib, S. Nacivet, F. Thouverez, L. Jézéquel

An Improved H2 Algorithm for Frequency Response Function and Nonlinear Parameter Estimation 900
M. Haroon, D.E. Adams

Vibration Mitigation of Nonlinear Vibrating Structures Using Nonlinear Energy Sinks 910
R. Viguié, M. Peeters, G. Kerschen, J.C. Golinval

Mapping Some Functions and Four Arithmetic Operations to Multilayer Feedforward Neural Networks 925
J.-S. Pei, E.C. Mai, J.P. Wright

Development of Small Wood Models to Demonstrate Nonlinear Dynamics 938
E.C. Mai, Y.P. Sugeng, J.-S. Pei, S.M. Zimmermann, C.V. Borchard, Y. Li, K. Piyawat

Experimental Non-linear System: Application of the Proper Orthogonal Decomposition Method 949
S. Dequand, P. Lubrina

SECTION 20. DYNAMICS OF BRIDGES

Implementation of a Dynamic Monitoring System at Coimbra Footbridge 967
C. Moutinho, W.-H. Hu, E. Caetano, Á. Cunha

Serviceability of Pedestrian Structures Exposed to Vibrations During Marathon Events 979
M. Kasperski, C. Sahnaci

F.E. Modelling of a Cable-stayed Bridge Based on Operational Modal Analysis 987
F. Benedettini, C. Gentile

Real-time Operation Modal Analysis of Tamar Bridge 997
J.M.W. Brownjohn, P. Carden

Ambient Testing and Model Updating of a Bridge for High-speed Trains 1005
R. Cantieni, M. Brehm, V. Zabel, T. Rauert, B. Hoffmeister

Experimental Dynamic Analysis of the Sesia Viaduct, a Composite High-speed Railway Bridge 1014
G. Chellinii, L. Nardini, K. Liu, E. Reynders, B. Peeters, G. De Roeck, W. Salvatore

Ambient Vibration Testing of Bridges with Integral Deck-abutments 1028
J.C. Carvajal, C.E. Ventura, S. Huffman, F. Yao

SECTION 21. DYNAMICS OF STADIUM STRUCTURES

An Aspect of Dynamic Human-structure Interaction 1035
L. Pedersen

Numerical Modeling and Experimental Modal Analysis of a Concrete Grand-stand Structure to Structural Health Monitoring Purposes 1043
A. Cigada, A. Caprioli, M. Redaelli, M. Vanali

Utilization of Simple Dynamic Models to Explore Load Estimation Method Based on In-service Structural Responses 1051
K.A. Salyards

Experimental Verification of Novel 3DOF Model for Grandstand Crowdstructure Dynamic Interaction 1059
A. Pavic, P. Reynolds, University of Sheffield

Assessments of Level of Comfort on a Vibrating Structure 1073
L. Pedersen

SECTION 22. SUBSTRUCTURING (NUMERICAL METHODS)

Modes and Regular Shapes. How to Extend Component Mode Synthesis Theory 1081
E. Balmes

Design Optimization Utilizing Dynamic Substructuring and Artificial Intelligence Techniques 1094
D. Akçay Perdahcioglu, M.H.M. Ellenbroek, P.J.M. van der Hoogt, A. de Boer

Reduced Models of Thermo-Mechanical Systems for Efficient Analysis in the Concurrent Design Facility at the European Space Agency 1104
P. Nachtergaele, I. Klapka, D.J. Rixen, A. Mestreau-Garreau, S. Fransen, J. Etchells, A. Caldwell

SECTION 22A. EXPERIMENTAL TECHNIQUES II

Transducer Response Equalization 1115
S. Gade, T. Schack, O. Thorhauge, H. Herlufsen

Accelerometer Noise Floor Evaluation Using a Folded Pendulum Isolator 1123
J.M.W. Brownjohn, T. Botfield

Improvements in Modal Parameter Extraction Through Post-processing Frequency Response Function Estimates 1131
B.M. Gur, C. Niezrecki, P. Avitabile

Expansion of Real Time Operating Data for Improved Visualization 1142
C. Chipman, P. Avitabile

SECTION 23. MVUQ: UNCERTAINTY QUANTIFICATION

A Statistical Analysis of Modal Parameters for Uncertainty Quantification in Structural Dynamics 1155
D.A. Pape, S. Adhikari

Frequency Response Based Sensor Placement Method for the Mid-frequency Range 1163
S. Nimityongskul, D.C. Kammer

The Effects of Uncertainties Within Acoustic Emission Modelling 1174
D. Chetwynd, K. Worden, A. Spencer, J. Hensman

Uncertain Models of Bifurcating Chaotic Systems 1186
D. Chetwynd, G. Manson, K. Worden

Uncertainty Analysis of Damage Identification Results Based on Finite Element Model Updating Method 1200
B. Moaveni, J.P. Conte, F.M. Hemez

Analysis of Numerical Solution Error and Uncertainty Using Statistical Effect Screening 1210
F.M. Hemez, M. Marcilhac

Volume 3

SECTION 24. STRUCTURAL HEALTH MONITORING III

Detection Feature Influence on Optimized Excitations for Structural Health Monitoring 1238
C.C. Olson, M.D. Todd

A Low Order Frequency Domain Approach for Structural Damage Detection 1249
W. Zhao, R.J. Allemang

Sensor Optimisation Using an Immune System Metaphor 1262
J. Zhang, K. Worden, W.J. Staszewski

A Variation of Transfer Entropy for Improved Damage Identification in Structures 1272
L.A. Overbey, M.D. Todd

Load Estimation and Damage Detection in Helicopter Rotor Blades 1282
B.R. Zwink, E.M. Prewett, D.E. Adams, D.J. Koester

Crack Detection of a Structure by Impulsive Response. Test Simulation and Experiment Data 1296
C. Opritescu, C. Caplescu, T.Gh. Cioara

Modal Testing of Bridges Using Low-weight Pneumatic Artificial Muscle Actuators 1304
K. Deckers, P. Guillaume, D. Lefeber, G. De Roeck, E. Reynders

Non-linear Resonance Vibrations of Cracked Beams in Condition of Driving force Parameters Variation 1311
A.P. Bovsunovsky, O.A. Bovsunovsky

SECTION 25. DAMPING OF MATERIALS AND MEMBERS I (TUTORIAL)

Tutorial Guideline VDI 3830: Damping of Materials and Members 1318
L. Gaul

SECTION 26. TESTING OF LARGE CIVIL ENGINEERING STRUCTURES

Modal Characteristics of Direct Embedded Concrete Poles 1324
K.S. Dai, S.E. Chen

A Review of Deep Earth Vibration Sensing 1331
W. Qi, S.E. Chen

Infrasound Measurements of a Railroad Bridge 1339
M.H. McKenna, P.F. Mlakar

Virtual Sensing in Structural Health Monitoring 1347
M. Ettouney, S. Alampalli

SECTION 28. SUBSTRUCTURING (EXPERIMENTAL TECHNIQUES)

Promises and Pitfalls of Decoupling Procedures 1354
W. D'Ambrogio, A. Fregolent

How Measurement Inaccuracies Induce Spurious Peaks in Frequency Based Substructuring 1361
D.J. Rixen

Solving the RDoF Problem in Experimental Dynamic Substructuring 1376
D. de Klerk, D.J. Rixen, S.N. Voormeeren, F. Pasteuning

Combining Experimental and Analytical Substructures with Multiple Connections 1385
R.L. Mayes, P.S. Hunter, T.W. Simmermacher, M.S. Allen

Estimation of Transmitted Loads Using Experimental Substructuring 1398
M. Corus, O. Sauvage, E. Balmès

SECTION 29. MVUQ: MODAL VALIDATION METRICS

Validation of Random Vibration Environments 1411
R.V. Field, Jr., T.L. Paez, D.O. Smallwood

Validation of Mathematical Models Using Weighted Response Measures 1427
T.L. Paez, J.E. Massad, T. Hinnerichs, C. O'Gorman, P. Hunter

An Energy Based Approach for Comparing Test and Analysis Response in the Frequency Domain 1436
D.C. Kammer, S. Nimityongskul

Response Measures for Validation of Structural Dynamic Systems 1456
P. Raghavendra, T.L. Paez

Frequency of Hammershock Exceedances of Structural Design Parameters 1467
W.G. Luber, D. Parisse

SECTION 30. MODEL CORRELATION AND UPDATING

Covariance Subspace Identification: Numerical Analysis of Spurious Mode Stability 1498
M. Goursat, L. Mevel

Use of Damped Updated FE Model for Predicting Dynamic Characteristics 1506
V. Arora, S.P. Singh, T.K. Kundra

Avoiding the Resonance of Plate Structure by Cutting Out Circular Holes 1519
S. Han, C.-W. Lee

Optimisation of Neural Network Weights for Robustness to Data Uncertainty 1527
G. Manson, S.G. Pierce, K. Worden, N.D. Sims

On the Lack-of-knowledge (LOK) Theory in Robust Design 1540
P. Enjalbert, P. Ladevèze, F. Louf, T. Romeuf

Polyreference Frequency-domain Least-squares Estimation with Confidence Intervals 1548
T. De Troyer, P. Guillaume, B. Peeters

SECTION 31. DAMPING OF MATERIALS AND MEMBERS II

Experimental Investigation and Numerical Treatment of Viscoelastic Materials 1557
A. Schmidt, L. Gaul

Joint Damping Prediction by Thin Layer Elements 1567
S. Bograd, A. Schmidt, L. Gaul

CMS Methods for Efficient Damping Prediction for Structures with Friction 1577
J. Becker, L. Gaul

Modeling of Contact Interfaces in Built-up Structures by Zero-thickness Elements 1590
L. Gaul, M. Mayer

Semiactive Nonlinear Control of a Building Structure Equipped with Magnetorheological Dampers 1599
Y. Kim, R. Langari, S. Hurlebaus

Damping Estimation Using Operational Modal Analysis 1612
S. Chauhan, A.W. Phillips, R.J. Allemang

Robust Multi Degree of Freedom Hybrid Vibration Absorption 1633
A. Shahaj, S.D. Garvey

The Earthquake Response Analysis of Isolation Structure with Piezoelectric Friction Damper 1642
W.-B. Hu, W. Hu

SECTION 32. EDUCATION/CASE STUDIES

NDOF: a MATLAB GUI for Teaching and Simulating Structural Dynamics 1652
J.M.W. Brownjohn, A. Pavic

Development of a Summer Educational Program in Dynamic Systems 1660
B.H. Emory, W.D. Zhu

Introducing the Environments for Fostering Effective Critical Thinking (EFFECTs) 1682
J.M. Caicedo, J. Flora, C. Pierce, A. Nichols, W. Graf, B. Timmerman

Mounting Design of a Compressor for Improving Sound Rating of an Outdoor Unit 1690
P.H. Mathuria, M. Mézache

Optimization of Dynamic Vibration Absorbers for Vibration Suppression in Plates 1695
Y.L. Cheung, W.O. Wong

SECTION 33. CONTROL

Achieving Stable Diagonalising Filters for Second Order Systems 1701
S.D. Garvey

Active Noise Reduction in Bedrooms 1709
D. Sachau, T. Kletschkowski, K. Kochan

Active Control of Human Induced Floor Vibrations 1718
D.S. Nyawako, P. Reynolds

Structural Real Time Control Using Fluid Magnetorheologic Damper 1728
C. Mesquita Neto, R.B. Santos, D.D. Bueno, C.R. Marqui, V. Lopes, Jr.

Theoretical Analysis on Active Vibration Isolation and Underwater Sound Radiation 1740
Z. Zhang, Y. Chen, X. Yin, H. Hua

SECTION 34. SUBSTRUCTURING METHODS

Modal and Frequency Based Substructuring Using Rotational DOF Considerations 1748
A. Williams, C. Chipman, P. Avitabile

Vibroacoustic Optimization of Complex Structures Using Vibration Criteria Between Substructures 1762
S.B. Besset, L. Jézéquel

Experimental Issues Related to Frequency Response Function Measurements for Frequency Based Substructuring 1778
D. Nicgorski, P. Avitabile

A Reduced Order, Test Verified Component Mode Synthesis Approach for System Modeling Applications 1792
A. Butland, P. Avitabile

Estimation of Rigid Body Modes for System Model Development 1809
A. Williams, P. Avitabile

SECTION 35. MVUQ: SUBSTRUCTURE AND MODEL REDUCTION UNCERTAINTY

Reducing Variability of a Set of Structures Assembled from Uncertain Substructures 1823
W. D'Ambrogio, A. Fregolent

Uncertainty Propagation in Experimental Dynamic Substructuring 1832
D. de Klerk, S.N. Voormeeren

Probabilistic Investigation of Sensitivities of Advanced Test-Analysis Model Correlation Methods 1843
E.J. Bergman, M.S. Allen, D.C. Kammer, R.L. Mayes

Volume 4

SECTION 35A. HEALTH MONITORING AND SYSTEM IDENTIFICATION FOR CIVIL STRUCTURES

Stochastic Change Detection in Uncertain Nonlinear Systems Using Data-Driven System Identification Methods 1862
H.-B. Yun, S.F. Masri, J.P. Caffrey

Evaluation of Time-Variant Bridge Reliability Using Structural Health Monitoring 1867
M. Susoy, F.N. Catbas, D.M. Frangopol

Artificial Boundary Condition Approach for Structural Identification: a Laboratory Perspective 1877
Y. Lu, Z.G. Tu

Demonstration of a Computer Vision and Sensor Fusion for Structural Health Monitoring on UCF 4-Span Bridge 1887
R. Zaurin, F.N. Catbas

A New Methodology for Identification, Localization and Quantification of Damage by Using Time Series Modeling 1895
*Mustafa Gul, F. Necati Catbas**

SECTION 36. SENSORS AND INSTRUMENTATION I

A Method for Generating Pseudo Single-point FRFs from Continuous Scan Laser Vibrometer Measurements 1905
M.S. Allen, M.W. Sracic

Ultra-low-noise 10 V/G Compact IEPE Seismic Accelerometer 1920
F.A. Levinzon

The Industry's Lowest Noise 10 V/G Seismic IEPE Accelerometer 1928
F.A. Levinzon, R.D. Drullinger

Enhanced FRF Determination Using a 3D Impedance Head 1936
D. de Klerk, S.N. Voormeeren, T. Petzsche

Impact Testing with a High-speed Multipoint Vibrometer 1944
S. Earl, T. Wu, J.D.C. Jones, A.J. Moore, P. Daborn, A. Tribe, P. Hayden, P. Ind, G. Smith

Measure the Actual Tire Shape in Rolling Condition by Scanning LDV 1950
P.C. Castellini, M.B. Ballatore

SECTION 37. SPORTS EQUIPMENT DYNAMICS

Measuring the Hardness of Softballs 1960
L.V. Smith

Describing the Performance of Cricket Bats and Balls 1968
H. Singh, L.V. Smith

Experimental Characterization of Ice Hockey Sticks and Pucks 1976
R.L. Anderson, L.V. Smith

Comparison of Dynamic Characteristics of Various Performance Level Snowboards 1984
A. Butland, D. Nicgorski, P. Avitabile

SECTION 37A. ROTATING MACHINERY

Bending Frequency Alteration of Rotating Shafts 1992
A.J. Mazzei, Jr., R.A. Scott

Rotordynamics of Ultra High Speed Lightweight Compact Cryocooler 2002
F.A. Moslehy, L. Chow, J. Kapat, T. Wu, G. Barnes, L. Zhou

SECTION 38. CIVIL ENGINEERING STRUCTURES I

Sensitivity of Modal Parameters of Historic Monuments to Geometric Distortion 2012
S. Atamturktur, A. Pavic, P. Reynolds

Validation of a Simple Method for Assessing Typical Floor Vibration Issues 2022
A.J. Gorton, the Papadimos Group

Modeling of Fillets in Thin-walled Beams Using Shell/Plate and Beam Finite Elements 2029
K. He, W.D. Zhu

Human Walking and Running for ces: Novel Experimental Characterization and Application in Civil Engineering Dynamics 2064
V. Racic, J.M.W. Brownjohn, A. Pavic

SECTION 39. NONLINEAR II

Errors in Nonlinear System Parameter Estimation Using Wavelet Transform 2074
R. Porwal, N.S. Vyas

Estimating the Location of Structural Nonlinearities from Random Data 2082
A. Josefsson, M. Magnevall, K.A. Ahlin

On Parameter Estimation and Simulation of Zero Memory Nonlinear Systems 2093
M. Magnevall, A. Josefsson, K.A. Ahlin

Extension of the Destabilization Paradox to the Limit Cycles of a Non-Linear System Subject to Friction-Induced Vibrations 2107
B. Hervé, J.-J. Sinou, H. Mahé, L. Jézéquel

The Auto-bispectral Density Function for Multi-Degree-of-Freedom Systems: Theory, Estimation, and Detection 2115
J.M. Nichols, P. Marzocca, A. Milanese

Non-destructive Damage Assessment Using Non-linear Vibration 2123
M. Waltering, V. Bungard, A. Zürbes, S. Maas, D. Waldmann, G. De Roeck

Nonlinear Contact Analysis of Gear Teeth for Malfunction Diagnostics 2133
D. Kong, J.M. Meagher, C. Xu, X. Wu, Y. Wu

SECTION 40. COMPUTATIONAL METHODS FOR CIVIL STRUCTURES

Investigation of the Pre-stress Loss in the Dynamical Behaviour of Concrete Beams 2142
M. Bruggi, A. Caprioli, M. Vanali, P. Venini

Vibration Serviceability Assessment of Slender Structures Using VSATs Software 2150
S. Živanovic, A. Pavic, J.M.W. Brownjohn

Dynamic Features of Precast Waffle Slabs in Cleanroom Design 2161
N. Tang, C. Wu, B. Xiong, M. Gendreau, H. Amick, S.Y.-L. Yin, T.-L. Wu

Experimental Validation of the Dynamic Interaction Analysis Between High-speed Trains and the Sesia Viaduct 2173
K. Liu, E. Reynders, G. De Roeck

A Two-state-variable Approach for SDOF Systems with Piecewise Strong-form Restoring force 2185
K. Piyawat, J.S. Pei, J.P. Wright

SECTION 41. MVUQ: MODAL VALIDATION APPLICATIONS

Modal Testing and Model Updating of Nuclear Fuel Tube 2195
H.I. Moon, N.G. Park, H.N. Rhee, Y.K. Jang, S.T. Lee, J.I. Kim

Dynamic Characterization of a Washing Machine: Numerical Multi-Body Analysis and Experimental Validation 2202
A. Agnani, F. Cannella, M. Martarelli, G. Merloni, E.P. Tomasini

Noise Prediction of a Washing Machine Considering Panel Vibration 2210
T. Koizumi, N. Tsujiuchi, S. Matsumoto, Y. Hirasawa

Model Validation of a Complex Aerospace Structure 2217
A.E. Rice, T.G. Carne, D.W. Kelton

Modeling and Uncertainty Quantification of Particulate Composite Materials 2230
S.E. Guerrero, G. Khoury, K. Miles, D.W. Allen, M.A. Buechler, A.D. Puckett

SECTION 42. SENSORS AND INSTRUMENTATION II

The Effect of High Transverse Inputs on Accelerometer Calibration 2239
R.W. Bono, E.J. Seller

Embedded Hilbert Transform-based Algorithm Within a Field Programmable Gate Array to Classify Nonlinear SDOF Systems 2248
J.D. Jones, J.-S. Pei, M. Tull

Zero-power Seismic Sensors for Discrimination of Foot and Vehicle Traffic 2261
E.A. Moro, M.K. O'Brien, D.A. Whisler, R. Nemzek, G. Park

A Reconfigurable Hardware Application for Machining of Metal Parts 2284
W.D. Cash, S. Schnelle, S. Lee, J. Frigo, P. Graham, M. Bement

Indirect Vibration Sensing and Optimal Sensor Placement 2294
P. Sjövall, T. Abrahamsson, T. McKelvey

Extended MinMAC Algorithm and Comparison of Sensor Placement Methods 2307
D.-S. Li, C.P. Fritzen, H.-N. Li

SECTION 43. SHOCK AND VIBRATION

Response of High Frequency Floors to a Footfall 2325
C.J. Middleton, J.M.W. Brownjohn

Operational Displacement Shape Based Estimation for Vibration Borne Stress Variation in a Pipeline 2333
A.S. Vepsä

Vibration and Buckling of Orthotropic Rectangular Plates 2347
D. Lakhlan, R. Lal

Time Domain Analysis of Shock Response of Pipeline on Ship 2355
H.W. Wang, Y. Wang, G. Chen

Effects of the Wall Flexibility on the Response of Box Shape R.C Buildings Due to V.C.E 2361
N.H. Tehrani, B. Pilehchian, A. Mirnezami, A. Zakeri

SECTION 44. CIVIL ENGINEERING STRUCTURES II

Application of OMA Algorithms to US Grant Bridge at Portsmouth, Ohio 2374
S. Chauhan, J.S. Saini, S. Kangas, A.J. Helmicki, V.J. Hunt, R.J. Allemang

Investigation of Dynamic Human Walking and Running 2389
M. Pirner, S.H. Urushadze

Dynamic Performance of the Guarda Footbridge 2398
C. Rebelo, H. Pimenta, L. Simões da Silva

Dynamics Study of a Special Crane Serving a Power Plant Tall Chimney 2404
T.Gh. Cioara, D. Cristea, I. Cires, A. Tîrdea, I.V. Nicolae, L. Timar

Non-Damage Modal Parameter Variations on a 22 Story Reinforced Concrete Building 2410
R.L. Boroschek, P. Lazcano

Modal Estimation of Civil Structures Subject to Ambient and Harmonic Excitation 2416
P. Andersen, R. Brincker, C.E. Ventura, R. Cantieni

SECTION 45. NONLINEAR III

Modal Identification of Non-Linear Structures and the Use of Modal Model in Structural Dynamic Analysis 2424
Ö. Arslan, H.N. Özgüven, Middle East Technical University

Influence of Misfit Mechanisms on Jointed Structure Response 2437
B.R. Resor, M.J. Starr

Metrics for Non-linear Model Updating in Mechanical Systems 2446
S. da Silva, S. Cogan, E. Foltête, F. Buffe

SECTION 48. AUTOMOTIVE

Truck Applications of Operational Modal Analysis 2454
B. Peeters, J.-S. Servaye, J. De Cock

A Decision-making Methodology for the Robust Design of Spot Welds in Automotive Structures 2466
M. Ouisse, S. Cogan

Measurement and Analysis of Booming Noise in Pick-up Truck Cab 2474
P. Hao, S. Zheng, H. Xia, X. Lian, K. Li

Author Index