

Table of Contents

Committees

Preface

CHAPTER 1: SMART MATERIALS, SENSORS/ACTUATORS AND MICROSYSTEMS

Mechatronics - The Innovation Request	
H. Irschik, M. Krommer, M. Nader and C. Zehetner	1
Current Research Activities in Mechatronic Applications at AM-TUM - Case Studies	
H. Ulbrich	11
Piezoelectricity Experimentation, Modeling and Simulation: Common Practices and Realistic Considerations	
A. Benjeddou	22
Bio-Inspired Autonomic Structures	
R.A. Shoureshi and S.W. Lim	32
Software Development Modules for Microcontroller-Based System	
M.C. Edmondson, L. Tang and A. Kern	45
A Self-Sensing Wedge-Wave Ultrasonic Motor Using Modal Sensors	
T.H. Yu and C.C. Yin	52
Development of a Ferroelectric Shell Finite Element	
W. Zouari, M. Elhadrouz and T. Ben Zineb	57
Dynamic Displacement Tracking for Frame Structures with a Piezoelectric Patch Network Based on Plate Theory	
D. Huber, M. Krommer and H. Irschik	64
Ultrasonic Extension Sensing of Actuators Using Integrated Piezoelectric Transducer for Adaptive Optics	
S.S. Kim, A.E. Uzgur, M. Strachan, J.F. Saillant and K. Kirk	70
Microsystems Technologies for Use in Structures and Integrated Systems	
A. Schönecker and S. Gebhardt	76
Constitutive Model of Shape Memory Alloys: One-Dimensional Phase Transformation Model	
T. Ikeda	84
Damping by SMA in Civil Engineering Structures	
F. Martorell, V. Torra, A. Isalgué, M.L. Perea, P. Terriault and F.C. Lovey	92
Precision Motion Control of a Smart Structure Using an Enhanced Stick-Slip Model	
M.G. Jang, C.H. Lee and S.B. Choi	98
Experimental Investigation of Non-Linear Behaviour of PZT Piezoceramics at Low Temperatures	
M. Nicolai, S. Uhlig, A. Schönecker and A. Michaelis	105
A Self-Sensing Method for IPMC Actuator	
B.G. Ko, H.C. Kwon and S.J. Lee	111
Structure Formation and Strengthening of Hot Deformed Nitrogen-Containing Steels	
V. Prokoshkina, L.M. Kaputkina, A.G. Svyazhin and J. Siwka	116
Electroactive Pressure Sensors for Smart Structures	
F. Martínez, E. Tynan, M. Arregui, G. Obieta and J. Aurrekoetxea	122

CHAPTER 2: INTEGRATION TECHNOLOGIES

Integrated Design of Smart Structures	
G.P. Cimellaro, T.T. Soong and A.M. Reinhorn	127
Adaptive Solution for Intelligent Cable Vibration Mitigation	
L. Faravelli, C. Fuggini and F. Ubertini	137
Optimal Simulation for Large Dynamic Systems	
R.E. Skelton, F.M. Li and M. de Oliveira	147

The Art of Control Algorithms Design and Implementation J. Rodellar, F. Ikhoulane, F. Pozo, G. Pujol, L. Acho and J.M. Rossell	154
Control of Vibratory Energy Harvesting Systems with Optimized Passive Networks J.T. Scruggs	164
Integration of Piezoceramic Modules into Die Castings - Procedure and Functionalities M. Rübner, C. Körner and R.F. Singer	170
Performance Characteristics of a Jetting Dispenser Featuring Piezostack and Flexible Beam Mechanism Q.H. Nguyen, S.B. Choi and C.H. Lee	176
Control Algorithms for Semi-Active Structural Systems: Do they Really Matter? A. Occhiuzzi	182
Model Development and Control Design of Smart Functionally Graded Structures D. Marinova	188
Piezoelectric Sensor System for Structural Health Monitoring B.S. Kim and Y.R. Roh	194

CHAPTER 3: SMART STRUCTURES AND INTEGRATED SYSTEMS

Monitoring Prestress Level in Seven Wire Prestressing Tendons by Inter Wire Ultrasonic Wave Propagation I. Bartoli, S. Salamone, R. Phillips, F. Lanza di Scalea, S. Coccia and C.S. Sikorsky	200
A Vibration Exciter for Evaluating Cable Damping of a Cable-Stayed Bridge J.M. Kim, J.J. Lee, S.S. Ahn and J.S. Choi	206
Response Control Performance Evaluation of MR Damper by Shaking Table Tests and Real-Time Hybrid Tests H. Fujitani, H. Sakae, M. Ito and T. Hiwatashi	212
A Reliability Assessment Model for MR Damper Components within a Smart Structural Control Scheme M.H.M. Hassan	218
Ride Comfort Analysis of a Full-Vehicle Featuring Magnetorheological Shock Absorbers K.G. Sung and S.B. Choi	225
Anti-Overturning Control of a Serially Connected Isolation System Using Piezo Electric and MR Tube Support Y.F. Du, Y.H. Liu and H. Li	231
On Behavior of Multi-Layered Bases- Foundations and Seismoisolators L.A. Aghalovyan and R.Z. Hovhannisyann	237
Fault Tolerant Neural Aided Controller for Multi Degree of Freedom Structures Experiencing Online Sensor Failure M. Contreras, S. Nagarajaiah and S. Narasimhan	247
Optimal Placement of MFC Actuators for Vibration Control of Cylindrical Shell Structure J.W. Sohn and S.B. Choi	253
Mitigation of Wind-Induced Vibration with Liquid Column Vibration Absorber H.J. Kim, W.J. Kim, S.G. Lee, J.S. Jo, D.K. Kim and K.J. Lee	259
Fundamental Study on Simple Quantitative Approach of Damping Performance for Variable Hydraulic Damper T. Hiwatashi and H. Fujitani	265
Experimental Assessment of Structural Control Devices Used to Protect Civil Buildings G. Magonette	271
Current Directions of Structural Health Monitoring and Control in USA S. Nagarajaiah, S. Dyke, J.P. Lynch, A. Smyth, A. Agrawal, M. Symans and E. Johnson	277
Examples of Future Potential Smart Civil Structures A.E. del Grosso	287
Chemical Monitoring of Composite Matrices Using Evanescent Wave Spectroscopy P.B.S. Bailey, S.A. Hayes, R.J. Hand and B. Zhang	297
Semi-Adaptive Modal Control of On-Board Electronic Boards Using Frequencies Identification Method B. Chomette, D. Rémond, S. Chesné and L. Gaudiller	303

An Experimental Study on the Use of Active Constrained Layer Damping for Thin Curved Smart Shell Structures	
P. Saini, A. Pandhi and A.K. Darpe	309
Verification of Robustness in Smart Composite Structures	
N. Kipnis, R. Tkach, E. Shpitzer and D. Kipnis	315
Control of Properties of Composite Structures with the Use of Multi-Functional Materials	
W.M. Ostachowicz, A. Zak, P. Malinowski and T. Wandowski	324
Design and Development of a Green Storage Tank for Thermo-Controlled Water Supply	
H.C. Tsai, H.J. Tsai and F.K. Hung	334
Remotely Controllable SHM System for a Concrete Box-Girder Bridge	
J.J. Lee, K.Y. Koo, J.Y. Hong and C.B. Yun	339
Some Advances in Energy Recycling Semiactive Vibration Suppression	
J. Onoda	345
Experimental Investigation of Effectiveness of Smart Passive System for Seismic Protection of Building Structures	
H.J. Jung, D.D. Jang, H.J. Lee and S.J. Moon	355
Amplification of Interstory Drift and Velocity for the Passive Control of Structural Vibrations	
M. Di Paola, F. Lo Iacono and G. Navarra	363
Modeling and Identification of a Large-Scale Magnetorheological Fluid Damper	
A. Rodriguez, N. Iwata, F. Ikhoulane and J. Rodellar	374
Characterisation of Force-Deflection Behaviour of Piezoelectrically Actuated Bistable Composite Laminate under Two-Axis Constraint	
P.F. Giddings, C.R. Bowen and H.A. Kim	380

CHAPTER 4: STRUCTURAL MONITORING

SHM System Integration and Supporting Algorithms	
A. Mita	386
Piezoelectric Impedance Sensor-Based Structural Health Monitoring for Critical Members of Civil Infrastructures	
C.B. Yun and S.H. Park	395
Damage Detection with Auxiliary Subsystem	
F. Vestroni, J. Ciambella, F. dell'Isola and S. Vidoli	401
Development of a Structural Health Monitoring System for Guangzhou New TV Tower	
Y.Q. Ni, Y. Xia, W.Y. Liao and P. Zhang	414
Wireless Sensing and Embedded Monitoring Algorithm for Damage Diagnosis in PSC Girders	
J.H. Park, D.S. Hong, J.T. Kim, K.Y. Koo, C.B. Yun and G. Park	420
Smart Nonlinear Acoustic Based Structural Health Monitoring System	
U. Polimeno, M. Meo and D.P. Almond	426
Strain Monitoring of FRP Elements Using an Embedded Fibre Optic Sensor	
G. Luyckx, E. Voet, W. De Waele, W. van Paepegem, J. Degrieck and J. Vlekken	435
High Strain Monitoring during Fatigue Loading of Thermoplastic Composites Using Imbedded Draw Tower Fibre Bragg Grating Sensors	
E. Voet, G. Luyckx, I. De Baere, J. Degrieck, J. Vlekken, E. Jacobs and H. Bartelt	441
Self-Detection of Delamination in Active Fiber Composites	
D.W. Wang, W.C. Tsai and C.C. Yin	447
Stochastic Vector Identification and Uncertain Modal Parameter Estimation for a Smart Composite Beam	
J.D. Hios and S.D. Fassois	453
Optimization of Signal Pre-Processing for the Integration of Cost-Effective Local Intelligence in Wireless Self-Powered Structural Health Monitoring	
T. Monnier, P. Guy, M. Lallart, L. Petit, D. Guyomar and C. Richard	459
Numerical Simulation for Concrete Structure Health Monitoring Based on Smart Piezoelectric Transducer Array	
S. Yan and W. Sun	469
Advanced Ultrasonic Structural Monitoring of Waveguides	
M. Cammarata, D. Dutta, H. Sohn, P. Rizzo and K.A. Harries	477

Damage Detection in Beam-Like Structures Using Deflections Obtained by Modal Flexibility Matrices K.Y. Koo, J.J. Lee, C.B. Yun and J.T. Kim	483
Development of a Structural Health Monitoring Benchmark Problem for High-Rise Slender Structures Y. Xia, Y.Q. Ni, J.M. Ko and H.B. Chen	489
Continuing Structural Health Monitoring after Repair: Starting from Scratch? J. Kullaa	495
Multivariate Statistical Analysis for Detection and Identification of Faulty Sensors Using Latent Variable Methods M.R. Hernandez-Garcia and S.F. Masri	501
A Numerical Method for the Dynamic Analysis of Buildings Provided with Viscoelastic Devices G. Muscolino and A. Palmeri	508
Optimization Algorithms for System Integration C. Papadimitriou and E. Ntotsios	514
Linking the Impact Force History with Residual Mechanical Characteristics and NDI - A Smart Way to Perform SHM in Composites N. Constantin, V. Anghel, M. Găvan and Ş. Sorohan	524
Embedding Intelligence for RTM Process Monitoring and Control R. Caponetto, G. Cicala, G. Dongola, F. Filippino and G. Recca	530
 CHAPTER 5: ONGOING AND PERSPECTIVE APPLICATIONS	
Biologically Inspired Shape Changing Aerodynamic Profiles and their Effect on Flight Performance of Future Aircraft C. Boller, C.M. Kuo and N. Qin	534
Innovations in Smart Materials and Integrated Structural Health Monitoring in the Australian Defence Force M.E. Ibrahim and C.M. Scala	545
Vibration Damage Reduction of On-Board Electronic Boards Using Modal Active Control B. Chomette, S. Chesné, D. Rémond and L. Gaudiller	551
Monitoring Data for Retrofit Assessment S. Casciati, S. Florida, N. Impollonia and E. Reale	557
Protection of Mediterranean Historical Structures against Earthquakes Using Fragility Curves C.A. Syrmakizis and M.T. Kosta	563
Wireless Sensor Node Development for Bridge Condition Assessment C.W. Kim, M. Kawatani, M. Tsukamoto and N. Fujita	573
Quantifying the Benefits of Smart Technologies in a Life-Cycle Context D.M. Frangopol and T.B. Messervey	579
Wing Mechanization Design and Wind Tunnel Testing for a Perching Micro Air Vehicle J.M. Lukens, G.W. Reich and B. Sanders	589
Dynamic Material Application for Architectural Purposes C. Lelieveld and L. Voorbij	595
Multifunctional Textiles for Protection against Natural Hazards D. Zangani	601
Adaptive Impact Absorption and Applications to Landing Devices J. Holnicki-Szulc, P. Pawłowski, M. Mikułowski and C. Graczykowski	609
Tunable Dielectric Resonator Antennas Using Voltage-Controlled Mechanical Deformation A. Mahanfar, C. Menon, R.G. Vaughan, F. Carpi, M. Parameswaran and K. Daheshpour	614