

Proceedings of the
**ASME CONFERENCE ON SMART MATERIALS,
ADAPTIVE STRUCTURES AND
INTELLIGENT SYSTEMS
– 2011 –**

VOLUME 2

**MODELING, SIMULATION AND CONTROL
STRUCTURAL HEALTH MONITORING/NDE
BIO-INSPIRED SMART MATERIALS AND STRUCTURES**

presented at
ASME 2011 CONFERENCE ON SMART MATERIALS, ADAPTIVE STRUCTURES, AND
INTELLIGENT SYSTEMS
SEPTEMBER 18-21, 2011
SCOTTSDALE, ARIZONA, USA

A S M E

Three Park Avenue * New York, N.Y. 10016

CONTENTS

MODELING, SIMULATION AND CONTROL	
SMASIS2011-4923	1
Computer-Aided Development of Shape Memory Actuators as an Approach Towards a Standardized Developing Method <i>Horst Meier and Alexander Czechowicz</i>	
SMASIS2011-4924	7
Design and Testing of an Enhanced Shape Memory Actuator Elastically Compensated by a Bi-Stable Rocker-Arm <i>Giovanni Scirè Mammano and Eugenio Dragoni</i>	
SMASIS2011-4930	17
Afterthoughts of a Founding Structural Control Theorist <i>Richard E. Klein</i>	
SMASIS2011-4935	27
Modeling, Manufacturing and Experimental Characterization of NiTi Based Belleville Springs <i>Carmin Maletta, Luigino Filice, and Franco Furgiuele</i>	
SMASIS2011-4939	35
Tracking Control of Piezoelectric Stack Actuator Using Modified Prandtl-Ishlinskii Model <i>Yuansheng Chen, Jose Palacios, Edward C. Smith, and Jinhao Qiu</i>	
SMASIS2011-4942	43
A Constant Stroking Load Regulator for Shock Absorption <i>Gang Wang, Gregory Hiemenz, Wei Hu, and Norman M. Wereley</i>	
SMASIS2011-4943	51
A New Robustness Theorem for the Adaptive Control of Nonlinear Systems <i>Mark J. Balas and James P. Nelson</i>	
SMASIS2011-4953	55
On the Design of Driver Electronics for Dielectric Elastomer Applications <i>Mitja Babic and Jadran Lenarcic</i>	
SMASIS2011-4970	65
Mitigating IPMC Back-Relaxation Effect Through Controlled Activation of Patterned Electrodes <i>Maxwell Fleming, Joel Hubbard, Kwang J. Kim, and Kam K. Leang</i>	
SMASIS2011-4972	73
Potential Well Shaping Through the Use of Impact Barriers for Broadband Electroelastic Energy Harvesting <i>Clark C. McGehee, Zach C. Ballard, and Brian P. Mann</i>	

SMASIS2011-4974	79
Dynamic Finite Element Analysis of a Highly Parallel Robotic Surface <i>Chris Salisbury</i>	
SMASIS2011-4976	89
Repetitive Control Design for Piezoelectric Actuators <i>Yingfeng Shan and Kam K. Leang</i>	
SMASIS2011-4987	97
Characterization and Modeling of Opposing SMA-Wire System for Multifunctional, Resistance-Based Controls Applications <i>Stephen J. Furst, John H. Crews, and Stefan Seelecke</i>	
SMASIS2011-4992	107
Modelling and Experimental Validation of Buckling Dielectric Elastomer Actuators <i>Rocco Vertechy, Antonio Frisoli, Massimo Bergamasco, Federico Carpi, Gabriele Frediani, and Danilo De Rossi</i>	
SMASIS2011-4995	115
Modeling of Piezoelectric Energy Harvester: A Comparison Between Euler-Bernoulli Theory and Timoshenko Theory <i>Yang Zhu, Jean W. Zu, and Minghui Yao</i>	
SMASIS2011-4999	123
Design Equations for Binary Shape Memory Actuators Under Arbitrary External Forces <i>Andrea Spaggiari, Igor Spinella, and Eugenio Dragoni</i>	
SMASIS2011-5000	133
Use of Intrinsic Electrical Resistance Changes in Shape Memory Alloys as Robust Actuator State and Fault Detection Sensors <i>Guillermo A. Herrera, Geoffrey P. McKnight, Xiujie Gao, Nancy Johnson, and Alan L. Browne</i>	
SMASIS2011-5005	139
Unimorph PZT Cymbal Design in Energy Harvesting <i>Changki Mo, Daniel Arnold, William C. Kinsel, and William W. Clark</i>	
SMASIS2011-5008	145
Nonlinear Stochastic Feedback Controllers for Vibratory Energy Harvesters With Power Flow Constraints <i>Ian L. Cassidy, Jeffrey T. Scruggs, and Sam Behrens</i>	
SMASIS2011-5010	155
Adaptive Output Feedback Control of the IPMC Propelled Vehicle With Unknown High Frequency Gain Matrix <i>Shivakanth Gutta, Woosoon Yim, and Sahjendra N. Singh</i>	
SMASIS2011-5011	163
Bias-Dependent Impedance Model for Ionic Polymer-Metal Composite Actuators <i>Yannick Kengne Fotsing and Xiaobo Tan</i>	

SMASIS2011-5025	171
Geometric Optimisation of Hinge-Less Deployment System for an Active Rotorblade <i>Alexandre Paternoster, Richard Loendersloot, Andre de Boer, and Remko Akkerman</i>	
SMASIS2011-5027	179
Bond Graph Modeling and Simulation of a Constant-Force Dielectric Elastomer Actuator <i>Giovanni Berselli and Gabriele Vassura</i>	
SMASIS2011-5030	189
Parametric Amplification in the Context of Vibratory Energy Harvesting <i>R. Donovan Bode and Mohammed F. Daqaq</i>	
SMASIS2011-5042	199
Parametrically Excited Nonlinear Piezoelectric Wind Energy Harvester <i>M. Amin Karami, Justin R. Farmer, Scott Bressers, Shashank Priya, and Daniel J. Inman</i>	
SMASIS2011-5050	207
Analog Velocity Feedback Controller for Vibration Suppression and Sound Attenuation <i>Utku Boz, Serkan Kulah, Ugur Aridogan, and Ipek Basdogan</i>	
SMASIS2011-5054	215
Energy Harvesting Circuit for Pulse Generator <i>Rashi Tiwari, Alex Schlichting, Yuan Zhang, Danielle Juliana Feldman, and Ephraim Garcia</i>	
SMASIS2011-5055	223
Simulation-Based Optimization of a Piezoelectric Sound Generator by Combining a Finite-Element and Network Model <i>Eric Starke, Uwe Marschner, Günther Pfeifer, and Wolf-Joachim Fischer</i>	
SMASIS2011-5063	231
Fluid Structural Interactions of Flapping Photomechanical Liquid Crystal Polymer Networks <i>Jonghoon Bin, M. Yousuff Hussaini, and William S. Oates</i>	
SMASIS2011-5073	241
A Strain Model for Piezoelectric Materials Operating in Highly Hysteretic Regimes <i>Zhengzheng Hu and Ralph C. Smith</i>	
SMASIS2011-5097	251
Material Characterization and Mid-Span Bending Capacity With Finite Element Simulated Predictions <i>Walter Anderson, Ahmadreza Eshghinejad, and Mohammad Elahinia</i>	
SMASIS2011-5099	261
Power Output and Dissipation of a Negative Capacitance Shunt Coupled to Piezoelectric Transducers <i>Benjamin Beck, Kenneth A. Cunefare, and Manuel Collet</i>	

SMASIS2011-5103	271
Synergistic Wake Interactions in Aeroelastic Flutter Vibration Energy Harvester Arrays <i>Matthew Bryant, Ranjeev L. Mahtani, and Ephrahim Garcia</i>	
SMASIS2011-5107	279
Generalized Eigensolution to Piecewise Continuous Distributed-Parameter Models of Piezoelectric Energy Harvesters Using the Transfer Matrix Method <i>Adam M. Wickenheiser and Timothy Reissman</i>	
SMASIS2011-5111	289
Amplitude Modulation of Nonlinear Piezoelectric Transducers for Ultrasonic Levitation <i>Sebastian Mojzisch and Joerg Wallaschek</i>	
SMASIS2011-5114	295
On the Maximum Damping Performance of Piezoelectric Switching Techniques <i>Marcus Neubauer and Xu Han</i>	
SMASIS2011-5132	303
Simulation and Control Design for Shape Memory Alloy Torque Tubes <i>David H. Friedman, Stefan Bieniawski, and Darren Hartl</i>	
SMASIS2011-5133	315
Identification of a Force Sensing Resistor for Tactile Applications <i>Mohammad Y. Saadeh and Mohamed B. Trabia</i>	
SMASIS2011-5138	325
Design and Test of an Adaptive Tuned Vibration Absorber for Reducing Cryogenic Cooler Vibrations <i>Robert Sinko, Michael Karnes, Jeong-Hoi Koo, Young-Kaun Kim, and Kyung-Soo Kim</i>	
SMASIS2011-5150	333
Passive Multi-Source Energy Harvesting Schemes: Multiplicity of Piezoelectrics <i>Alex Schlichting, Rashi Tiwari, and Ephrahim Garcia</i>	
SMASIS2011-5151	345
Exact Solution for Bending of Shape Memory Alloy Superelastic Beams <i>Ahmadreza Eshghinejad and Mohammad Elahinia</i>	
SMASIS2011-5167	353
Maximum and Practical Sustainably Harvestable Vibrational Power From Avian Subjects <i>Michael W. Shafer and Ephrahim Garcia</i>	
SMASIS2011-5171	361
Linear and Nonlinear Aeroelastic Energy Harvesting Using Electromagnetic Induction <i>Marcela de Melo Anicézio, Alper Erturk, Carlos De Marqui Junior, and Daniel J. Inman</i>	
SMASIS2011-5174	369
Modeling the Torsional Behavior of Superelastic Wires <i>Zohreh Karbaschi and Mohammad Elahinia</i>	

SMASIS2011-5176	377
Hydroelastic Power and Thrust Generation Using Macro-Fiber Composite Piezoelectrics <i>Alper Erturk and Ghislain Delporte</i>	
SMASIS2011-5179	387
Optimized Biodynamic Shock Attenuation Performance Using an Adaptive Seat Suspension <i>Harinder J. Singh and Norman M. Wereley</i>	
SMASIS2011-5181	397
Stability and Hopf Bifurcation of Impact Dynamics Considering Delay in a Semi-Active Energy Absorbing Suspension System <i>Xiaomin Dong, Wei Hu, Miao Yu, and Norman M. Wereley</i>	
SMASIS2011-5197	405
An Automated Testing Assembly for Characterizing Stiffness of an Ankle Foot Orthosis <i>Minal Y. Bhadane, Charles Armstrong, Mohamed Samir Hefzy, and Mohammad H. Elahinia</i>	
SMASIS2011-5210	411
Dynamic Thermo-Mechanical Properties of Shape Memory Alloy Nanowires Upon Multi-Axial Loading <i>Rakesh P. Dhote, Roderick V. N. Melnik, and Jean W. Zu</i>	
SMASIS2011-5223	419
Service Systems for Shape Memory Technology <i>Sven Langbein, Horst Meier, and Alexander Czechowicz</i>	
SMASIS2011-5239	427
Piezoelectric Vibration Damping Using Autonomous Synchronized Switching on Inductance <i>Tommaso Delpero, Luigi Di Lillo, Andrea Bergamini, and Paolo Ermanni</i>	
SMASIS2011-5254	435
Novel Flow Energy Converter Based on Dielectric Elastomers <i>Jürgen Maas and Christian Graf</i>	
STRUCTURAL HEALTH MONITORING/NDE	
SMASIS2011-4921	443
Intrinsic Hydraulic Hose Condition Monitoring for Prevention of Catastrophic Failure <i>Scott A. Smith and Dallas J. Capesius</i>	
SMASIS2011-4991	447
Computational Setup of Structural Health Monitoring for Real-Time Thermal Verification <i>Derek Doyle, Whitney Reynolds, Brandon Arritt, and Brenton Taft</i>	
SMASIS2011-4993	455
Damage Detection in Flexible Propeller Beam Structures by Exploiting Impact-Induced Coupled Acceleration Signals <i>Ioannis T. Georgiou</i>	

SMASIS2011-5031	465
Simultaneous Measurement of Deformation and Fracture of Composite Structures Using Fiber Bragg Grating Sensors	
<i>Hong-Il Kim, Jae-Hung Han, Hyung-Joon Bang, Soo-Hyun Kim, and Bongwan Lee</i>	
SMASIS2011-5033	473
Tower Deflection Monitoring of a Wind Turbine Using an Array of Fiber Bragg Grating Sensors	
<i>Hyung-Joon Bang, Hong-Il Kim, Moonseok Jang, and Jae-Hung Han</i>	
SMASIS2011-5065	481
Multidirectional Circular Microstrip Patch Antenna Strain Sensor	
<i>Ali Daliri, Chun H. Wang, Sabu John, Amir Galehdar, Wayne S. T. Rowe, and Kamran Ghorbani</i>	
SMASIS2011-5067	489
Numerical Analysis of Composites Embedded With Magnetostrictive Material for Sensing Capability	
<i>Jonathan Rudd and Oliver Myers</i>	
SMASIS2011-5069	495
Damage Localization in Complex Composite Panels Using Guided Wave Based Structural Health Monitoring System	
<i>Yingtao Liu, Seung Bum Kim, Aditi Chattopadhyay, and Derek Doyle</i>	
SMASIS2011-5100	503
Operational Risk Assessment of Wind Turbine Structures Using Probabilistic Analysis of Aerodynamically Induced Vibrations	
<i>Antonio Velazquez and R. Andrew Swartz</i>	
SMASIS2011-5101	513
Damage Localization in a Stiffened Composite Panel Using a Lamb Wave Based Tomography Approach	
<i>Anthony J. Vizzini II, Yingtao Liu, and Aditi Chattopadhyay</i>	
SMASIS2011-5116	519
Lamb Wave Propagation Through Off-Axis Media	
<i>Jacob Brown, Whitney Reynolds, Derek Doyle, and Andrei Zagrai</i>	
SMASIS2011-5190	525
Predictive Modeling of Space Structures for SHM With PWAS Transducers	
<i>Matthieu Gresil, Bin Lin, Yanfeng Shen, and Victor Giurgiutiu</i>	
SMASIS2011-5191	535
Insight Into Active Health Monitoring Methods Using Machine Learning	
<i>Whitney Reynolds, Derek Doyle, and Brandon Arritt</i>	
SMASIS2011-5219	545
Active Detection of Structural Damage in Aluminum Alloy Using Magneto-Elastic Active Sensors (MEAS)	
<i>David Conrad and Andrei Zagrai</i>	

SMASIS2011-5225	555
Effect of Lamb Wave Excitation Frequency on Detection of Delamination in Composite Plates <i>Inho Kim and Ratneshwar Jha</i>	
SMASIS2011-5235	563
Structural Health Monitoring Technology for Aerospace Composite Propellant Tank <i>Sourav Banerjee, Piero Messidoro, Adriano Ferrarese, Shawn Beard, and Ritubarna Banerjee</i>	
BIO-INSPIRED SMART MATERIALS AND STRUCTURES	
SMASIS2011-4931	571
Fish Inspired Biomimetic Ionic Polymer Metal Composite Pectoral Fins Using Labriform Propulsion <i>G. Karthigan, Sujoy Mukherjee, and Ranjan Ganguli</i>	
SMASIS2011-4934	581
The Effect of Scale on Fluid-Filled Flexible Composite Actuators <i>Larry D. Peel, Luis Muratalla, Jeff Baur, and Dean Foster</i>	
SMASIS2011-4946	591
Fully Coupled Three-Scale Finite Element Model for the Mechanical Response of a New Bio-Inspired Composite <i>Erick I. Saavedra Flores, Senthil Murugan, Michael I. Friswell, and Eduardo A. de Souza Neto</i>	
SMASIS2011-4959	599
Bioinspired Vasculatures for Self-Healing Fibre Reinforced Polymer Composites <i>Chris Norris, Ian Bond, and Richard Trask</i>	
SMASIS2011-4962	607
Tailored Fluidic Composites for Stiffness or Volume Change <i>Bin Zhu, Christopher D. Rahn, and Charles E. Bakis</i>	
SMASIS2011-5015	613
Polypyrrole Bridge as a Support for Alamethicin-Reconstituted Planar Bilayer Lipid Membranes <i>Robert Northcutt, Vishnu-Baba Sundaresan, Sergio Salinas, and Hao Zhang</i>	
SMASIS2011-5028	621
Limit-Cycle Oscillation Suppression of Bioinspired Ornithopter: Wind Tunnel Testing <i>Jun-Seong Lee, Dong-Kyu Lee, Juho Lee, and Jae-Hung Han</i>	
SMASIS2011-5038	629
Electrochemical Analysis of Alamethicin Reconstituted Planar Bilayer Lipid Membranes Supported on Polypyrrole Membranes <i>Hao Zhang, Vishnu Baba Sundaresan, Sergio Salinas, and Robert Northcutt</i>	

SMASIS2011-5053	637
Energy Harvesting From Turbulence-Induced Vibration in Air Flow: Artificial Piezoelectric Grass Concept <i>Jared D. Hobeck and Daniel J. Inman</i>	
SMASIS2011-5072	647
Field Driven Stiffness Control of Legged Robotic Structures Using Dielectric Elastomers <i>Jeff Morton, Duncan Haldane, Michael Hays, Jonathan Clark, and William S. Oates</i>	
SMASIS2011-5092	653
Modeling, Analysis, and Experiments of Interfiber Compaction Effects in FMC Actuators for Bio-Inspired Applications <i>Zhiye Zhang and Michael Philen</i>	
SMASIS2011-5095	663
Formation and Encapsulation of Biomolecular Arrays for Developing Arrays of Membrane-Based Artificial Hair Cell Sensors <i>Stephen A. Sarles, Kevin L. Garrison, Taylor T. Young, and Donald J. Leo</i>	
SMASIS2011-5096	673
Piezoresistive Reponse of Aligned Carbon Nanotube Arrays for Flow Sensing Applications <i>Matthew R. Maschmann, Gregory J. Ehlert, and Jeffery W. Baur</i>	
SMASIS2011-5104	681
Design of a Bio-Inspired Smart Ear Prototype <i>Rolf Müller, Sajjad Z. Meymand, Mittu Pannala, Ojili Praveen Kumar Reddy, and Li Gao</i>	
SMASIS2011-5105	691
Design and Development of a Biomimetic Jellyfish Robot That Features Ionic Polymer Metal Composites Actuators <i>Joseph Najem, Barbar Akle, Stephen A. Sarles, and Donald J. Leo</i>	
SMASIS2011-5109	699
The Development of a Closed-Loop Flight Controller for Localized Flow Control and Gust Alleviation Using Biomimetic Feathers on Aircraft Wings <i>Christopher J. Blower and Adam M. Wickenheiser</i>	
SMASIS2011-5117	707
Modeling the Conductance of the Peptide Alamethicin With and Without Ion Gradients <i>M. Austin Creasy and Donald J. Leo</i>	
SMASIS2011-5134	715
FlexLegs: Flexible Legs Actuated by Shape Memory Alloy <i>Alex Villanueva, Colin Smith, Shashank Priya, and Richard Bachmann</i>	
SMASIS2011-5168	725
Bio-Inspired Flow Sensors Fabricated From Carbon Nanomaterials <i>Preston A. Pinto, Stephen A. Sarles, Donald J. Leo, Michael Philen, Hunter A. Champion, Sarah B. Black, and Harry C. Dorn</i>	

SMASIS2011-5198	733
Testing of Novel Compliant Spines for Passive Wing Morphing <i>Aimy Wissa, Yashwanth Tummala, James E. Hubbard, Jr., Mary Frecker, and Alexander Brown</i>	
SMASIS2011-5207	743
Design Optimization of a Compliant Spine for Dynamic Applications <i>Yashwanth Tummala, Aimy Wissa, Mary Frecker, and James E. Hubbard, Jr.</i>	
SMASIS2011-5238	753
Stimuli Triggered Deployment of Bio-Inspired Self-Healing Functionality <i>Richard Trask, Ian Bond, and Chris Norris</i>	
Author Index	759