Technical Program

SPIE
Smart Structures and Materials *and* NDE for Health Monitoring and Diagnostics

14th International Symposium

Conferences • Courses • Exhibition

18 – 22 March 2007 *Town and Country Resort & Convention Center • San Diego, California USA*

Adaptive Structures & Mechanisms

- **Smart Structures & Vehicles**
- **Actuators and Damping**
- **Biomimetics and Robotic Systems**
- **Multifunctional Materials**
- **Embedded and Self Diagnosis Sensors**
- **Modeling and Control**
- **Sensor Networks**
- **Real-Time NDE**
- **Structural Health Monitoring**

Hear the latest research • Network with your peers • Shape the Future

Technical Program

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SPIE would like to express its deepest appreciation to the symposium chairs, conference chairs, program committees, and session chairs who have so generously given of their time and advice to make this symposium possible. The symposium, like our other conferences and activities, would not be possible without the dedicated contribution of our participants and members.

This program is based on commitments received up to the time of publication and is subject to change without notice.

Symposium Chairs

Yoseph Bar-Cohen
Jet Propulsion Lab.

Alison B. Flatau
Univ. of Maryland/
College Park

Norbert G. Meyendorf
Univ. of Dayton

George Y. Baaklini
NASA Glenn Research Ctr.

SPIE
Smart Structures and Materials *and* NDE for Health Monitoring and Diagnostics

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Welcome!

The Organizing Committee of SPIE's 14th Annual International Symposium on Smart Structures and Materials & Nondestructive Evaluation and Health Monitoring welcomes you to what promises to be an exciting meeting. This unique symposium offers many opportunities to network with colleagues from a variety of disciplines in academia, industry, and government from all over the world. Over the last decade, this meeting has grown from small beginnings in the then-emerging field of smart systems into a premier symposium. This symposium has been the incubator for the emergence of the field of electroactive polymers, also known as artificial muscles, for which the armwrestling contest is now one of its exciting annual events. Complementary techniques and application of smart structures and materials have been discussed in the joint symposium with NDE and Health Monitoring for the past four years. This event has developed into one of the world's most important events to cover the monitoring of structural integrity and adaptive/intelligent structures. Now, both symposia are integrated into a single event. This integration offers new avenues for collaboration and interaction opportunities to bring more advances and address greater challenges that lie ahead. Such challenges include areas of homeland security, and benefiting from exciting fields of biomimetics, nanotechnologies and others.

The Symposium covers all aspects of the evolving fields of materials, enabling technologies, sensor/actuator design and fabrication, MEMS, NEMS and other micro-, nano- and bio-electronic devices, biomimetics, signal processing and control, systems concepts, wireless sensors and sensor networks, modeling and simulation, and applications of these technologies to cover the whole spectrum of life in the 21st century including commercial, medical, aerospace, military uses and many others. It also includes several parallel conferences on a range of topics related to NDE, health monitoring, safety, security, characterization of materials, and detection of materials defects and degradation, application of micro- and nanomaterial systems, health monitoring of structural and biological systems, NDE for aerospace materials and applications, and NDE technologies for homeland security.

The symposium is organized in ten parallel conferences. It has brought together emerging technologies and advanced research in instrumentation, sensing, and measurement science with progressive management and diagnostic approaches and smart systems. Engineers and researchers from government, military, academia and the commercial sector will discuss the current status and future directions of smart structures and materials, NDE, and health monitoring. Case studies, emerging research agendas, and innovative new technologies will be presented.

This meeting is a showcase for multidisciplinary research and provides an excellent opportunity to explore new research areas by teaming with new partners from fields other than your own. Welcome to San Diego!

Executive Committee

Yoseph Bar-Cohen, Jet Propulsion Lab.
Alison B. Flatau, Univ. of Maryland/College Park
Norbert G. Meyendorf, Univ. of Dayton
George Y. Baaklini, NASA Glenn Research Ctr.
Mehdi Ahmadian, Virginia Polytechnic Institute and State Univ.
Marcelo J. Dapino, The Ohio State Univ.
L. Porter Davis, Honeywell, Inc.
Michael A. Demetriou, Worcester Polytechnic Institute
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Kumar Jata, Air Force Research Lab.
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Yuji Matsuzaki, Nagoya Univ. (Japan)
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Eric Udd, Columbia Gorge Research
Vijay K. Varadan, Univ. of Arkansas
Dietmar W. Vogel, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)
H. Felix Wu, National Institute of Standards and Technology
Chung-Bang Yun, Korea Advanced Institute of Science and Technology (South Korea)

SPIE is a not-for-profit international society dedicated to furthering technological innovations.

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Contents

Daily Schedule 4
Conference Schedule 5-7
Special Events 8-10
Exhibition 13

Technical Conferences

Daily Technical Conference Schedule 14

Mon-Wed	6523	**Modeling, Signal Processing, and Control** *(Lindner)*	14
Mon-Thurs	6524	**EAP Actuators and Devices (EAPAD)** *(Bar-Cohen)*	14
Mon-Thurs	6525	**Active and Passive Smart Structures and Integrated Systems** *(Matsuzaki)*	14
Mon-Thurs	6526	**Behavior and Mechanics of Multifunctional and Composite Materials** *(Dapino)*	14
Mon-Tues	6527	**Industrial and Commercial Applications of Smart Structures Technologies** *(Davis)*	14
Wed-Thurs	6528	**Nano-, Micro- and Bio-Sensors and Systems** *(Varadan)*	15
Mon-Thurs	6529	**Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems** (Tomizuka)	15
Mon-Wed	6530	**Sensor Systems and Networks: Phenomena, Technology and Applications for NDE and Health Monitoring** *(Peters)*	15
Tues-Thurs	6531	**Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security** *(Wu)*	15
Mon-Thurs	6532	**Health Monitoring of Structural and Biological Systems** *(Kundu)*	15

Poster Presentation — Tuesday 30-33
EAP Course 50
General Information 51-52
Travel 54
Facility Map 54
Proceedings of SPIE / Symposium CD-ROMs / Digital Library 55

Don't miss the Exhibition!
See p. 13

Daily Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday
18 March	19 March	20 March	21 March	22 March
Technical Conferences				
	6523 **Modeling, Signal Processing, and Control** *(Lindner)* p. 14			
	6524 **EAP Actuators and Devices (EAPAD)** *(Bar-Cohen)* p. 14			
	6525 **Active and Passive Smart Structures and Integrated Systems** *(Matsuzaki)* p. 14			
	6526 **Behavior and Mechanics of Multifunctional and Composite Materials** *(Dapino)* p. 14			
	6527 **Industrial and Commercial Applications of Smart Structures Technologies** *(Davis)* p. 14			
			6528 **Nano-, Micro- and Bio-Sensors and Systems** *(Varadan)* p. 15	
	6529 **Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems** *(Tomizuka)* p. 15			
	6530 **Sensor Systems and Networks: Phenomena, Technology and Applications for NDE and Health Monitoring** *(Peters)* p. 15			
		6531 **Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security** *(Wu)* p. 15		
	6532 **Health Monitoring of Structural and Biological Systems** *(Kundu)* p. 15			
Course				
SC634 **Electroactive Polymer Actuators and Devices** *(Bar-Cohen, Madden, Pei)* 8:30 am to 5:30 pm, $460 / $545, p. 50				
Plenary Presentations				
	8:00 to 8:15 am **Welcome Remarks and Awards**	8:00 to 8:05 am **Announcements and Awards**	8:00 to 8:05 am **Announcements and Awards**	8:00 to 8:05 am **Announcements and Awards**
	8:15 to 8:30 am ***Funding Agency Talk*, AFOSR - Current and Future Programs and Initiatives**, Victor Giurgiutiu, Air Force Office of Scientific Research (AFOSR) p. 16-17	8:05 to 8:20 am ***Funding Agency Talk,* DARPA - Current and Future Programs and Initiatives**, Don Leo, Defense Advanced Research Projects Agency (DARPA) p. 22-23	8:05 to 8:20 am ***Funding Agency Talk,* NSF - Current and Future Programs and Initiatives**, Shih-Chi Liu, National Science Foundation (NSF) p. 34-35	8:05 to 8:20 am ***Funding Agency Talk,* ONR - Current and Future Programs and Initiatives**, Mike Yu, Naval Air System Command p. 42-43
	8:30 to 9:15 am **Morphing Wings: From Concept to Reality**, Jayanth N. Kudva, NextGen Aeronautics, Inc., p. 8	8:20 to 9:05 am *Plenary Talk* **Piezoelectric Actuators - from IT/Robotics to Ecological/Energy**, Kenji Uchino, The Pennsylvania State Univ., p. 9	8:20 to 9:05 am *Plenary Talk* **Revolutionary Transitions of GE Technology in NDE Prognostics and Health Monitoring**, Ed Hindle, GAEA Technologies (Canada), p. 10	8:20 to 9:05 am *Plenary Talk* **Smart Structures; The Solution to "Cheaper, Faster, Better" in the Space Industry**, Torey Davis, Honeywell Defense and Space, p. 10
	9:15 to 10:00 am **From the Piezo Effect to a New Generation of Fuel Injectors**, Hans Meixner, Siemens AG (Germany), p. 8			
Special Events				
1:00 to 4:00 pm **Technology and Applications Overviews,** Alison B. Flatau, Univ. of Maryland/College Park, p. 8	8:00 am **Smart Structures Product Implementation Award**	10:00 am to 4:00 pm; 6:00 to 7:30 pm **Exhibition,** p. 13		
	4:30 to 5:45 pm **EAP-in-Action Session and Arm Wrestling Challenge Contest,** EAP-in-Action Session, p. 9	12:30 to 1:30 pm **Student Lunch with the Experts - A Networking Event,** Location: Grand Exhibition Hall, p. 9		
	6:00 to 7:30 pm **All Conference Reception,** p. 9	6:00 to 7:30 pm **Poster/Exhibition Reception,** p. 9		

Conference Schedule

Monday 19 March

	6523	6524 Room 1	6524 Room 2	6525 Room 1	6525 Room 2	6526 Room 1	6526 Room 2	6527	6528 Room 1	6528 Room 2	6529 Room 1	6529 Room 2	6530	6531	6532
8:00 to 10:00 am	Plenary Session														
10:00 to 10:30 am	Coffee Break														
10:30 am to 12:10 pm	Smart Devices I	EAP as Emerging Actuators and Biomimetic Technologies		Energy Harvesting I		Ferroelectrics I		Space Applications			Invited Lectures		Sensor Systems and Packaging for Harsh Environments		SHM for Aerospace Applications
12:10 to 1:30 pm	Lunch Break														
1:30 to 3:10 pm	Aircraft Wing Design and Control	Electronic EAP		Energy Harvesting II		Ferroelectrics II		Structural Health Monitoring Applications			Piezoelectric and Integrated Sensors I	Novel Sensors I	Sensor Networks for NDE Imaging		Guided Waves for SHM I
3:10 to 3:30 pm	Coffee Break														
3:30 pm to end of day	Smart Devices II	EAP-in-Action		Magnet-Rheological Systems		Ferroelectrics III		Mechanisms and Sensing Applications			Piezoelectric and Integrated Sensors II	Novel Sensors II	New Sensing Principles		Guided Waves for SHM II

Tuesday 20 March

	6523	6524 Room 1	6524 Room 2	6525 Room 1	6525 Room 2	6526 Room 1	6526 Room 2	6527	6528 Room 1	6528 Room 2	6529 Room 1	6529 Room 2	6530	6531	6532
8:00 to 8:55 am	Plenary Session														
9:00 to 10:00 am	Control of Systems with Hystersis	Ionic EAP I		Smart Aerospace Systems	Damping and Isolation I	Ferroelectrics IV		Aircraft Applications			Monitoring Systems	Corrosion Detection	Sensing of Guided Waves I		Guided Waves for SHM of Pipes and Rods
10:00 to 10:30 am	Coffee Break														
10:30 am to 12:10 pm	Robust Control	Memorial Honoring of Alberto Mazzoldi		Biology-Inspired and Related Systems I	Damping and Isolation II	Ferroelectrics V		Biological and Medical Applications			Ultrasonics for SHM	SHM for Civil Structures	Applications of Sensor Systems to SHM I		Guided Waves for SHM III
12:10 to 1:30 pm	Lunch Break														
1:30 to 3:10 pm	Control Theory	New and Other EAP I		Biology-Inspired and Related Systems II		Magnetic Field-Based Multifunctional Composites		Automotive Applications			Modeling and Design of Smart Systems	Data-Driven Techniques for SHM I	Applications of Sensor Systems to SHM II	Nondestructive Detection in Structural and Mechanical Systems	Damage Detection
3:10 to 3:30 pm	Coffee Break														
3:30 pm to end of day	Identification of Complex Structures	New and Other EAP II		Shape Memory Materials and Applications		Multifunctional Polymers		Energy Harvesting and Absorption Applications			Novel Sensors III	Data-Driven Techniques for SHM II	Embeded Sensors: Modeling and Structural Integrity	Nondestructive Detection in Structural and Mechanical Systems (cont.)	Nonlinear Methods in SHM

Conference Schedule

Wednesday 21 March

	6523	6524 Room 1	6524 Room 2	6525 Room 1	6525 Room 2	6526 Room 1	6526 Room 2	6527	6528 Room 1	6528 Room 2	6529 Room 1	6529 Room 2	6530	6531	6532
8:00 to 8:55 am	Plenary Session														
9:00 to 10:00 am	Wavelets	EAP Characteristics and Database		Autonomous Materials I		Bill Armstrong Memorial Session I			Nanowire and Nanotube I		Damage Detection	Structural Control	Sensing of Guided Waves II	Nondestructive Evaluation in Composite Materials and Aerospace Engineering	Novel Instrumentation and Sensing I
10:00 to 10:30 am	Coffee Break														
10:30 am to 12:10 pm	Algorithms for Damage Detection	Ionic EAP II		Autonomous Materials II		Bill Armstrong Memorial Session II			Nanowire and Nanotube II		Fiber Optic Sensors for SHM I	System ID and Signal Processing I	Sensor and Sensor System Performance Assessments and Issues	Nondestructive Evaluation in Composite Materials and Aerospace	Novel Instrumentation and Sensing II
12:10 to 1:30 pm	Lunch Break														
1:30 to 3:10 pm	Material Modeling	Nano and Micro EAP		Controlled Systems I		Autonomous Materials Workshop I			Micro/Nano Devices and MEMS		SHM for Composite Materials	System ID and Signal Processing II	Multi-Sensor Data Fusion and Signal Processing I	Civil Infrastructure Health Monitoring	Civil Infrastructure Applications
3:10 to 3:30 pm	Coffee Break														
3:30 pm to end of day		Modeling		Controlled Systems II		Autonomous Materials Workshop II			Applications I		Vibration SHM and Other Sensors	Novel Sensors IV	Multi-Sensor Data Fusion and Signal Processing II	Civil Infrastructure Health Monitoring (cont.)	Damage Detection and Prediction

Thursday 22 March

	6523	6524 Room 1	6524 Room 2	6525 Room 1	6525 Room 2	6526 Room 1	6526 Room 2	6527	6528 Room 1	6528 Room 2	6529 Room 1	6529 Room 2	6530	6531	6532
8:00 to 8:55 am	**Plenary Session**														
9:00 to 10:00 am		Applications of EAP I	Applications of EAP III	Smart Devices and Systems		Active Composites	Ferro-magnetic Shape Memory Materials		Nano-structures		Signal Processing and Damage Control I	Wireless for SHM I		Progress in Nondestructive Evaluation	Biological and Medical Applications I
10:00 to 10:30 am	**Coffee Break**														
10:30 am to 12:10 pm		Applications of EAP I (cont.)	Applications of EAP III (cont.)	Sensors, Actuators, and Devices		Active Polymer Nano-composites	FSMA/SMA		Biosensors and BioMEMS		Signal Processing and Damage Control II	Modeling and Design of Smart Systems II		Progress in Non-destructive Evaluation (cont.)	Biological and Medical Applications II
12:10 to 1:30 pm	**Lunch Break**														
1:30 to 3:10 pm		Applications of EAP II		Active Control I		CNT-Based Nano-composites I	Shape Memory Materials		Biosensors and BioMEMS	Packaging/ Integrated Nano- and Micro-Structures	Fiber Optic Sensors for SHM II	Modeling and Design of Smart Systems III		Remote Sensing and Homeland Security Applications	Guided Waves and Vibration Based Techniques for SHM
3:10 to 3:30 pm	**Coffee Break**														
3:30 pm to end of day		Applications of EAP II (cont.)		Active Control II		CNT-Based Nano-composites II	Magneto-strictive Materials		Applications II	Fabrication and Characteri-zation	Fiber Optic Sensors for SHM III	Wireless for SHM II		Applied Imaging	

Special Events

Sunday 18 March

1:00 to 4:00 pm

Technology and Applications Overviews

Golden West Room

Overview Chair: **Alison B. Flatau,** Univ. of Maryland/College Park

These technology and applications overviews are intended to give the 'big picture' of issues and opportunities of the enabling technologies such as materials, devices for sensors and actuators, control systems, power supplies, signal processing and systems integration that drive applications. The applications areas reflect the current trend of opportunities. The overview presentations will be given by the conference chairs of the various SSM and NDE chairs, and should be of interest to all symposium attendees.

1:00 to 1:10 pm: **Opening Remarks,** Alison B. Flatau, Univ. of Maryland

1:10 to 1:25 pm: 6523
Modeling, Signal Processing, and Control, Douglas K. Lindner, Virginia Polytechnic Institute and State Univ.

1:25 to 1:40 pm: 6524
EAP Actuators and Devices (EAPAD), Yoseph Bar-Cohen, Jet Propulsion Lab.

1:40 to 1:55 pm: 6525
Smart Structures and Bionics, Yuji Matsuzaki, Nagoya Univ. (Japan)

1:55 to 2:10 pm: 6526
Behavior and Mechanics of Multifunctional and Composite Materials, Marcelo J. Dapino, The Ohio State Univ.

2:10 to 2:25 pm: 6527
Industrial and Commercial Applications, L. Porter Davis, Honeywell, Inc.

2:25 to 2:40 pm: 6528
Nano-, Bio- and Info-Technologies and their application in engineering and medicine, Vijay K. Varadan, Univ. of Arkansas

2:40 to 2:55 pm: 6529
Sensors and Smart Structures Technologies for Civil, Mechanical and Aerospace Systems, Chung-Bang Yun, Korea Advanced Institute of Science and Technology (South Korea); Victor Giurgiutiu, Univ. of South Carolina

2:55 to 3:15 pm **Coffee Break**

3:15 to 3:30 pm: 6530
Advances in Sensor Systems and Networks for NDE and Health Monitoring, Kara J. Peters, North Carolina State Univ.

3:30 to 3:45 pm: 6531
Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security, Peter Shull, Pennsylvania State Univ.

3:45 to 4:00 pm: 6532
Health Monitoring of Structural and Biological Systems, Tribikram Kundu, The Univ. of Arizona; Kumar V. Jata, Air Force Research Lab.

Monday 19 March

8:00 to 8:15 am
Awards Presentations and Lifetime Achievement Award

Town and Country Room

SSM Lifetime Achievement Award

Dr. Jayanth N. Kudva, NextGen Aeronautics, Inc.

Biography: Dr. Kudva received his BS in Aeronautical Engineering from the Indian Institute of Technology in 1973 and his MS and PhD degrees in Aerospace Engineering from Virginia Tech in 1976 and 1979, respectively. He worked at Northrop Grumman Corporation from 1980 to 2002. At Northrop, he managed a structures R&D group and led the division activities on smart materials and adaptive aircraft. In 2003, he founded NextGen Aeronautics with the explicit purpose of developing revolutionary technologies and designs for the next century of flight. He is an Associate Fellow of AIAA.

NDE Lifetime Achievement Award

Don E. Bray, Don E. Bray, Inc. Ultrasonic Research, Nondestructive Evaluation, Mechanical Engineering

Biography: Dr. Don E. Bray is a Professor Emeritus of Texas A&M Univ., and has over thirty years of experience in nondestructive evaluation, working with industry and the U. S. Federal Government before joining academia. He holds Fellow Membership rank with ASNT, the American Society of Mechanical Engineers (ASME), the Acoustical Socety of America (ASA) and the Permanent Way Institute (PWI) in the UK. He is a Past Chairman of the ASME NDE Engineering Division, is a registered professional engineer in Texas and Oklahoma, and a frequent consultant to industry on NDE matters. He is the author of three books on Nondestructive Evaluation, and numerous journal papers. In 1997, he served as a consultant to the University of Technology in Papua New Guinea in the development of their center on nondestructive evaluation. His recent research activities have been in the area of ultrasonic stress measurement in steel, aluminum and titanium plates, and in the development of novel ID surface wave techniques for boiler tubing inspection.

8:15 to 8:30 am
Funding Agency Talk

Town and Country Room

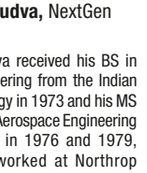
AFOSR—Current and Future Programs and Initiatives

Victor Giurgiutiu, Air Force Office of Scientific Research (AFOSR)

8:30 to 9:15 am
Plenary Presentation

Town and Country Room

Morphing Wings: From Concept to Reality



Dr. Jayanth N. Kudva, NextGen Aeronautics, Inc.

Biography: Dr. Kudva received his BS in Aeronautical Engineering from the Indian Institute of Technology in 1973 and his MS and PhD degrees in Aerospace Engineering from Virginia Tech in 1976 and 1979, respectively. He worked at Northrop Grumman Corporation from 1980 to 2002. At Northrop, he managed a structures R&D group and led the division activities on smart materials and adaptive aircraft. In 2003, he founded NextGen Aeronautics with the explicit purpose of developing revolutionary technologies and designs for the next century of flight. He is an Associate Fellow of AIAA.

Abstract: Morphing aircraft wings are defined as wings that undergo very large changes in geometry (span, area, chord, sweep, etc.) such that the wing configuration is optimized for widely varying flight conditions (e.g., loiter, dash and high-speed maneuvers). They represent the next step in aircraft wing design, and will lead to multi-role, multi-function aircraft.

Under a three-year program entitled "Next Generation Morphing Aircraft Structures (NMAS)," sponsored by DARPA and monitored by AFRL, NextGen has designed and developed a revolutionary morphing aircraft wing and successfully tested it in a wind tunnel at transonic Mach numbers and operational load conditions. The morphing wing design incorporates several key innovations including:

- Development and successful testing of highly flexible (in-plane strains greater than 100%), load bearing wing skin to withstand local air loads up to 400 psf. This represented the first application of highly flexible shearing skins to large areas of the upper and lower wing surfaces.
- Full-scale, self-contained, powered actuation and control systems to accurately create wing geometry changes in less than 10 seconds during high speed flight with aerodynamic flight loads at wind tunnel Mach numbers of 0.9 and test conditions corresponding to flight altitudes varying from sea-level to 50,000 ft.
- Innovative, kinematic, and structurally efficient substructure which accommodates large morphing geometry changes.

This talk will present a background of morphing wing concepts, details of the design and development work performed under NMAS and other related programs, and the future of morphing aircraft.

9:15 to 10:00 am
Plenary Presentation

Town and Country Room

From the Piezo Effect to a New Generation of Fuel Injectors

Hans Meixner, Siemens AG (Germany)

Biography: Professor Meixner and his team are the recipients of the recent innovation award of the German President (Bundespräsident) for the development of the piezo fuel injection system.

Until the fall of 2004, physicist Hans Meixner headed the Department of Sensor and Actuator Systems at Siemens Corporate Technology. This is where he and his team had carried out the basic research for the development of the piezo injection systems at Siemens. Since starting at Siemens' corporate R&D department in 1973, he had been involved in a wide range of research fields, such as semiconductor laser diodes, semiconducting barium-lead titanate ceramics, new color printing techniques, fundamental applications of piezoelectric materials for sensor and actuator applications, scanning and tunnel microscopy as well as chemo and bio-sensorics. The 67-year old Meixner still acts as a consultant for Siemens Corporate Technology. In the course of his R&D career, he has registered over 300 patents, in particular in 1980 a patent for piezo injectors designed for fuel injection together with his colleagues. This was followed by many more patents in this field.

In addition to his research activities at Siemens, Meixner is also involved with the University of the German Army and the Technical University of Budapest, where he supervises and trains diploma and doctoral students.

He is a member of several committees, such as the Industrial Advisory Board of the Berkeley Sensor and Actuator Center at the University of California, Curator of the Fraunhofer Association and Advisor to the Karlsruhe Research Center.

Since 2006, Meixner has been organizing the cluster platform for sensorics and power electronics in Bavaria that acts within the state's innovation promotion program by networking between business and science.

Abstract: The mobility of the individual in our society has a high standing and is still growing. That leads to a constant increase - not only in Europe - of registration of new cars. The fast development of the mobility produces not only positive consequences, but causes also problems: consumption of precious raw materials, ecological damage due to the production of combustion exhaust gases. These are only some of the important problems on which R&D teams worldwide research and try to find a solution making the burning process in the motor of the car more efficient, That means reduction of fuel consumption and exhaust gas production. As a leader in the field of piezo materials and their application (techniques, technologies) Siemens started the production of the Piezo-Diesel-Injectors in the year 2000. The advantages of the piezo injector are a great innovational push for fuel- and exhaust gas reduction. All competitors and car manufactures started in the year 2004 with this new technique of piezo injectors for diesel - and gasoline engines worldwide. Other application fields of this piezo-stack technique allow innovative solutions as piezo-motors and pumps, active noise and vibration control.

Monday 19 March

4:30 to 5:45
EAP-in-Action Session and Arm Wrestling Challenge Contest

Town and Country Room

Eap-in-Action Session

This Session is intended to turn the spotlight on Electroactive Polymers (EAP) materials and their applications as well as increase the recognition of their potential. It offers a forum of interaction between the technology developers and potential users as well as "hands-on" experience with this emerging technology. The attendees are given a great opportunity to see the capability of state-of-the-art of EAP as potential actuators-of-choice. This year, we are going to have six research and industry presenters demonstrating their latest EAP actuators and devices. The highlight of these demos includes a large blimp that will fly indoor and steered by EAP-actuated controlled surfaces. Also, new commercial EAP actuated prototypes will be shown including loudspeaker and generator powering a wireless communication device. The affiliation of the presenters includes Artificial Muscle, Inc.; EMPA - Materials Science & Technology, Switzerland; Hyper Drive Corporation, Japan; Intelligent Materials for Prosthetics & Automation, Ras Labs, L.L.C.; SRI International; and University of Pisa, Research Centre "E. Piaggio", Italy.

Preliminary EAP Demonstrations

Silvain Michel and Gabor Kovacs, Empa (Switzerlang) Materials Science & Technology
Demonstrating: A large EAP-Blimp performing indoor flying demonstration using controlled surfaces

Federico Carpi, Univ. of Pisa (Italy), Research Centre "E. Piaggio"
Demonstrating: Contractile folded dielectric elastomer actuators; Buckling dielectric elastomer actuators

Roy Kornbluh, SRI International
Demonstrating: An EAP generator

Seiki Chiba, SRI International
Demonstrating: Extending applications of dielectric elastomer artificial muscle

Lenore Rasmussen, Ras Labs, L.L.C. Intelligent Materials for Prosthetics & Automation
Demonstrating: Electroactive Polymer Materials: Beauty in Motion

Charlie Duncheon, Artificial Muscle, Inc.
Demonstrating: The first high volume standard commercial product - DLP95 lens positioner; Standard Universal Muscle Actuator platform; UMA based prototype products (including proportional valve)

More information about the EAP-in-Action Session can be found at:
http://ndeaa.jpl.nasa.gov/nasa-nde/lommas/eap/EAPIA/EAP-in-Action-Demos-2007.htm

6:00 to 7:30 pm

Poolside by Terrace Pavilion

Welcome Reception

Sponsored by: San Diego Town and Country Resort & Convention Center, and SPIE.

All attendees are invited to relax, socialize and enjoy refreshments at the Town and Country resort poolside. Please remember to wear your conference registration badge. Dress is casual.

Tuesday 20 March

8:00 to 8:05 am
Announcements and Awards

Town and Country Room

8:05 to 8:20 am
Funding Agency Talk

Town and Country Room

DARPA—Current and Future Programs and Initiatives

Don Leo, Defense Advanced Research Projects Agency (DARPA)

8:20 to 9:05 am
Plenary Presentation

Town and Country Room

Piezoelectric Actuators - from IT/ Robotics to Ecological/Energy

Kenji Uchino, The Pennsylvania State Univ.

Biography: Kenji Uchino, one of the pioneers in piezoelectric actuators, is Director of International Center for Actuators and Transducers and Professor of EE at Penn State University. He is also Senior vice President of Micromechatronics Inc., State College, PA. After being awarded his Ph. D. degree from Tokyo Institute of Technology, Japan, he became Research Associate in physical electronics department at this university. Then, he joined Sophia University, Japan as an Associate Professor in physics in 1985. He then moved to Penn State in 1991. He was also involved with Space Shuttle Utilizing Committee in NASDA, Japan during 1986-88, and Vice President of NF Electronic Instruments, USA, during 1992-94. He is the Chair of Smart Actuator/Sensor Study Committee sponsored by Japanese MITI. He is also the associate editor for Journal of Advanced Performance Materials, J. Intelligent Materials Systems and Structures and Japanese Journal of Applied Physics. His research interests are in development of solid state actuators for precision positioners, ultrasonic motors, etc. He has authored 500 papers, 54 books and 21 patents in the ceramic actuator area. He is a Fellow of American Ceremic Society from 1997, and also is a recipient of the ASME Adaptive Structures Prize (2005), Outstanding Research Award from Penn State Engineering Society (1996), Academic Scholarship from Nissan Motors Scientific Foundation (1990), Best Movie Memorial Award at Japan Scientific Movie Festival (1989), and the Best Paper Award from Japanese Society of Oil/Air Pressure Control (1987).

Abstract: The first mass-production application of the piezoelectric actuators is a dot-matrix printer by NEC, which was motivated by the invention of the co-fired multilayer actuator (MLA) developed by the Penn State University. Camera applications such as shutter with a bimorph by Minolta and auto focus mechanism with an ultrasonic motor by Canon were commercialized successively. In parallel, the piezoelectric actuators were utilized for precise x-y stages in late 80s owing to the demand by semiconductor manufacturers. Automobile applications of the MLA started after getting into 90s; Toyota introduced the MLA to the damper, i.e., electronic modulated suspension. Siemens succeeded to use the MLA even in a considerably severe high temperature condition for the diesel injection valve control.

This paper reviews the developments of piezoelectric actuators and foresees the future of them. The developments are considered from the "need-pull" viewpoint; that is, information technology, robotics, bio- and medical engineering, ecological and energy engineering. In addition to popular office equipment, micro-positioning applications, ultrasonic technologies for cleaning, piezoelectric energy harvesting, and their integration trends with sophisticated drivers are introduced.

12:30 to 1:30 pm

Student Lunch with the Experts: A Networking Event

Grand Exhibit Hall

Tickets required. Seating is limited.

Combine food, fun, and valuable networking opportunities at this complimentary event hosted by SPIE Student Services. Join experts willing to share their collective wisdom and experience at this casual and lively event. Noted guests include:

Dr. Yoseph Bar-Cohen, Jet Propulsion Lab

Prof. Yuji Matsuzaki, Nagoya University

Prof. Kenji Uchino, The Pennsylvania State Univ.

Dr. H. Felix Wu, National Institute of Standards and Technology (NIST)

...and more!

Students receive one complimentary ticket with registration.

6:00 to 7:30 pm

Poster/Exhibition Reception

Grand Exhibit Hall

The exhibition hall will be open Tuesday evening in conjunction with the poster session, to allow attendees specific exhibition and poster viewing time during the symposium. Take the opportunity to see the exhibits and talk with company representatives as well as review posters. Refreshments will be served.

Special Events

Wednesday 21 March

8:00 to 8:05 am
Award Presentation

Town and Country Room

Smart Structures Product Implementation Award

This award is intended to recognize those individuals or companies who have taken the critical step of transitioning smart structures technologies into viable industrial and commercial products. These visionaries are required for this important field of science and engineering to be recognized and accepted in the world at large.

A panel of independent experts selects the best product based on its importance, uniqueness, and usefulness to defense or commercial industries. We are looking for the most innovative—but realistic—products using smart structures and materials technologies. System integration aspects are very important criterion as well.

The award will be presented during SPIE's 2007 Smart Structures and Materials Symposium in front of a group of peers and potential customers. SPIE will publish information about the winner and the product in OE Reports; and news items will be sent to appropriate trade journals. In addition, the winning company will be able to use the recognition associated with this award in any of its subsequent marketing and promotional endeavors.

8:05 to 8:20 am
Funding Agency Talk

Town and Country Room

NSF—Current and Future Programs and Initiatives

Shih-Chi Liu, National Science Foundation (NSF)

8:20 to 9:05 am
Plenary Presentation

Town and Country Room

Revolutionary Transitions of GE Technology in NDE Prognostics and Health Monitoring

Ed Hindle, General Electric Aviation

Biography: Mr. Hindle has over 25 years of aerospace experience in materials evaluation and research, military life management, advanced technology program management for the department of defense and engine systems integration. Mr. Hindle currently works in the Advanced Technology and Preliminary Design group at General Electric Aviation in Evendale, Ohio. He manages a group of engineers, which are responsible for development of advanced prognostic technologies to better understand and accurately manage engine system health for commercial and military applications. Currently he is the program manager for the DARPA Engine System Prognosis Program, Propulsion Safety & Affordable Readiness Initiative, Engine Rotor Life Extension Program, Agile Combat Support Programs.

Mr. Hindle has a B.S. in Mechanical Engineering, a Master of Business Administration from the University of Miami and a Master of Divinity from Denver Seminary.

Abstract: A serious operational cost trend threatens the future technical preeminence of the United States DoD. Increasing readiness costs are severely impacting acquisition of new aircraft, which translates to an increase in the average age of the United States Air Force, Navy and Army aircraft fleet. As time marches on, this undesirable trend will become more and more difficult to overcome. It would be unwise to expect congress to increase the defense budget in the near future to overcome this dilemma. Hence, as the current aircraft fleets continue to age this problem will only get worse.

A revolutionary paradigm shift must take place to reverse the aircraft sustainment demand for funding. Prognosis based asset management can go a long way towards reversing the operating cost trend. When applied to aircraft engines, prognosis based asset management may allow the services to reach cost of ownership entitlement as well as achieve significant safety and readiness improvements. This revolutionary change in engine management will employ condition (or state) based component lifing and inspections (verses the current hard time inspections limits). Instead of operating to fixed intervals, the component will dictate when the optimal inspection should occur. In other words, a component level sensor will determine when the engine needs to be inspected. This includes all nondestructive evaluation, borescope activities, component replacement and depot maintenance work.

Current fleet management capability is constrained by uncertainty in the current state of the individual aircraft engines. The ability to sense or measure the damage state of an individual part is limited at best. Further, specific part operational severity is not captured with the current lifing process, hence many components are not operating to their life entitlement because the life is based on fleet weighted average missions.

Within GE Aviation, several recent advances in NDE capability related to turbine engine manufacturing and inspection show high promise. Incorporating novel non-destructive evaluation methods to engine components coupled with signal processing tools will provide insight to the health of a given component. GE Aviation is evaluating break through technology such as digital radiography, phased array ultrasonics and advanced image processing developed by our GE Healthcare business. A revolutionary approach to technology transfer would enable the concurrent development of technologies across several business units using shared resources producing different, yet similar, objectives that benefit each business uniquely. Examples will be shown that highlight past examples of NDE technology and plans for creating turbine engine prognostics and health monitoring applications through the next generation NDE tools.

Thursday 22 March

8:05 to 8:20 am
Funding Agency Talk

Town and Country Room

ONR—Current and Future Programs and Initiatives

Mike Yu, Naval Air Systems Command

8:20 to 9:05 am
Plenary Presentation

Town and Country Room

Smart Structures: The Solution to "Cheaper, Faster, Better" in the Space Industry

Torey Davis, Honeywell Defense and Space

Biography: Torey Davis is a graduate of Arizona State University with a Bachelor of Science in Mechanical Engineering. He is a registered Professional Engineer in the State of Arizona. He has spent his career, over 20 years, developing advanced structures and mechanisms for space and terrestrial based vehicles. He has been recognized by NASA and the United States Department of the Air Force for technical innovation in this area. He has been awarded 16 US patents and published numerous technical papers on the subject of smart structures and structural control. He currently works at Honeywell Defense and Space as a technical manager overseeing the research and development of advanced structures and mechanisms for space vehicles.

Abstract: The Space Industry has been cautiously progressing towards taking advantage of smart materials and structures to develop more capable space vehicles. In recent years space vehicles have incorporated many of the technologies that have been presented at the SPIE Smart Structures & Materials/NDE conference in their infancy. This tendency continues to grow, and there is now beginning to be a realization in the space industry that architecting a space vehicle in a "smart" fashion can actually enable a "cheaper, faster, better" mission development life cycle process. In this presentation, we will show a few examples of past smart structures implementations on space vehicles, and we will explore how future space vehicles could be designed making full use of the technologies currently being developed.

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Smart Structures and Materials *and* NDE for Health Monitoring and Diagnostics

Exhibition Dates
20 - 21 March 2007
Town and Country Resort
& Convention Center
Grand Exhibit Hall

Exhibition Hours
Tuesday, 20 March ..... 10:00 am to 4:00 pm;
6:00 pm to 7:30 pm
(Poster and Exhibit Reception)

Wed., 21 March . . . . . 10:00 am to 4:00 pm

Coffee Breaks and Refreshments
Grand Exhibit Hall
Tuesday/Wed ..... 10:00 am and 3:00 pm

Exhibition/Poster Reception
Grand Exhibit Hall
Tuesday 20 March ..... 6:00 to 7:30 pm
The exhibition hall will be open Tuesday evening in conjunction with the poster session, to allow attendees specific exhibition and poster viewing time during the symposium. Take the opportunity to see the exhibits and talk with company representatives as well as review posters. Refreshments will be served.

Conferences

Conference 6523
Room: California

Monday-Wednesday 19-21 March 2007
Proceedings of SPIE Vol. 6523

Modeling, Signal Processing, and Control

Conference Chair: **Douglas K. Lindner**, Virginia Polytechnic Institute and State Univ.

Cochair: **Michael A. Demetriou**, Worcester Polytechnic Institute

Program Committee: **Mary I. Frecker**, The Pennsylvania State Univ.; **Karolos M. Grigoriadis**, Univ. of Houston; **Scott W. Hansen**, Iowa State Univ.; **Hans Irschik**, Johannes Kepler Univ. Linz (Austria); **Katherine J. Jones**, Rice Univ.; **Jaehwan Kim**, Inha Univ. (South Korea); **Andrew J. Kurdila**, Virginia Polytechnic Institute and State Univ.; **Liviu I. Librescu**, Virginia Polytechnic Institute and State Univ.; **Arnold Lumsdaine**, The Univ. of Tennessee; **S. O. Reza Moheimani**, The Univ. of Newcastle (Australia); **Stefan Seelecke**, North Carolina State Univ.; **Emílio C. N. Silva**, Univ. de São Paulo (Brazil); **Robert E. Skelton**, Univ. of California/San Diego; **Ralph C. Smith**, North Carolina State Univ.; **Wieslaw J. Staszewski**, The Univ. of Sheffield (United Kingdom); **Miao Yu**, Univ. of Maryland/ College Park

6523 continues on page 16

Conference 6524
Room: Town & Country

Monday-Thursday 19-22 March 2007
Proceedings of SPIE Vol. 6524

EAP Actuators and Devices (EAPAD)

Conference Chair: **Yoseph Bar-Cohen**, Jet Propulsion Lab.

Cochair: **Gabor M. Kovacs**, EMPA (Switzerland)

Program Committee: **Ray H. Baughman**, The Univ. of Texas at Dallas; **Václav Bouda**, Czech Technical Univ. in Prague (Czech Republic); **Emilio P. Calius**, Industrial Research Ltd. (New Zealand); **Richard O. Claus**, Virginia Polytechnic Institute and State Univ.; **Pierre-Gilles de Gennes**, École Supérieure de Physique et de Chimie Industrielles (France); **Danilo De Rossi**, Univ. di Pisa (Italy); **Toribio Fernandez-Otero**, Univ. Politécnica de Cartagena (Spain); **Edwin W. H. Jager**, Micromuscle AB (Sweden); **Keiichi Kaneto**, Kyushu Institute of Technology (Japan); **Jaehwan Kim**, Inha Univ. (South Korea); **Kwang J. Kim**, Univ. of Nevada/Reno; **Roy D. Kornbluh**, SRI International; **Wen-Liang Liu**, Industrial Technology Research Institute (Taiwan); **John D. W. Madden**, The Univ. of British Columbia (Canada); **Chris Melhuish**, Univ. of the West of England (United Kingdom); **Jae-Do Nam**, Sungkyunkwan Univ. (South Korea); **Siavouche Nemat-Nasser**, Univ. of California/San Diego; **Yoshihito Osada**, Hokkaido Univ. (Japan); **Qibing Pei**, Univ. of California/Los Angeles; **Subramaniam Radhakrishnan**, National Chemical Lab. (India); **Mohsen Shahinpoor**, Univ. of New Mexico; **Peter Sommer-Larsen**, Risø National Lab. (Denmark); **Ji Su**, NASA Langley Research Ctr.; **Minoru Taya**, Univ. of Washington; **Gordon G. Wallace**, Univ. of Wollongong (Australia); **Thomas Wallmersperger**, Univ. Stuttgart (Germany); **Gary Zaiats**, RAFAEL Armament Development Authority Ltd. (Israel); **Qiming Zhang**, The Pennsylvania State Univ.

6524 continues on page 16

Conference 6525
Room: Royal Palm V

Monday-Thursday 19-22 March 2007
Proceedings of SPIE Vol. 6525

Active and Passive Smart Structures and Integrated Systems

Conference Chair: **Yuji Matsuzaki**, Nagoya Univ. (Japan)

Cochairs: **Mehdi Ahmadian**, Virginia Polytechnic Institute and State Univ.; **Donald J. Leo**, Defense Advanced Research Projects Agency (DARPA)

Program Committee: **Gregory S. Agnes**, Jet Propulsion Lab.; **Eric H. Anderson**, CSA Engineering, Inc.; **Hiroshi Asanuma**, Chiba Univ. (Japan); **Amr M. Baz**, Univ. of Maryland/College Park; **Diann E. Brei**, Univ. of Michigan; **Gregory P. Carman**, Univ. of California/Los Angeles; **Aditi Chattopadhyay**, Arizona State Univ.; **Seung-Bok Choi**, Inha Univ. (South Korea); **William W. Clark**, Univ. of Pittsburgh; **Mohammad H. Elahinia**, Univ. of Toledo; **Alison B. Flatau**, Univ. of Maryland/ College Park; **Ephrahim Garcia**, Cornell Univ.; **Victor Giurgiutiu**, Univ. of South Carolina; **Fernando D. Goncalves**, Lord Corp.; **Faramarz Gordaninejad**, Univ. of Nevada/Reno; **Nakhiah C. S. Goulbourne**, Virginia Polytechnic Institute and State Univ.; **T. Tupper Hyde**, NASA Goddard Space Flight Ctr.; **Daniel J. Inman**, Virginia Polytechnic Institute and State Univ.; **Conor D. Johnson**, CSA Engineering, Inc.; **Seung Jo Kim**, Seoul National Univ. (South Korea); **Jeong-Hoi Koo**, Miami Univ.; **George A. Lesieutre**, The Pennsylvania State Univ.; **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong China); **Arnold Lumsdaine**, The Univ. of Tennessee; **John A. Main**, Defense Advanced Research Projects Agency (DARPA); **Samir A. Nayfeh**, Massachusetts Institute of Technology; **Roger Ohayon**, Conservatoire National des Arts et Métiers (France); **Dale Ruebsamen**, Honeywell, Inc.; **Steve C. Southward**, Virginia Polytechnic Institute and State Univ.; **Roger Stanway**, The Univ. of Sheffield (United Kingdom); **Friedrich K. Straub**, The Boeing Co.; **Jian Q. Sun**, Univ. of Delaware; **Nader Vahdati**, Nanyang Technological Univ. (Singapore); **Kon-Well Wang**, The Pennsylvania State Univ.; **Norman M. Wereley**, Univ. of Maryland/ College Park

6525 continues on page 16

Conference 6526
Room: Golden West

Monday-Thursday 19-22 March 2007
Proceedings of SPIE Vol. 6526

Behavior and Mechanics of Multifunctional and Composite Materials

Conference Chair: **Marcelo J. Dapino**, The Ohio State Univ.

Cochair: **Zoubeida Ounaies**, Texas A&M Univ.

Program Committee: **Hilary Bart-Smith**, Univ. of Virginia; **Abhijit Bhattacharyya**, Univ. of Arkansas/Little Rock; **L. Catherine Brinson**, Northwestern Univ.; **Gregory P. Carman**, Univ. of California/Los Angeles; **Constantin Ciocanel**, Univ. of Toledo; **Christopher P. Henry**, Hughes Research Labs., LLC; **Marc Kamlah**, Forschungszentrum Karlsruhe (Germany); **Ibrahim Karaman**, Texas A&M Univ.; **Dimitris C. Lagoudas**, Texas A&M Univ.; **Chad M. Landis**, Rice Univ.; **Donald J. Leo**, Defense Advanced Research Projects Agency (DARPA); **Christopher S. Lynch**, Georgia Institute of Technology; **Karla M. Mossi**, Virginia Commonwealth Univ.; **Robert C. O'Handley**, Massachusetts Institute of Technology; **Etienne Patoor**, École Nationale Supérieure d'Arts et Métiers (France); **Ralph C. Smith**, North Carolina State Univ.

6526 continues on page 16

Conference 6527
Room: Royal Palm III

Monday-Tuesday 19-20 March 2007
Proceedings of SPIE Vol. 6527

Industrial and Commercial Applications of Smart Structures Technologies

Conference Chair: **L. Porter Davis**, Honeywell, Inc.

Cochairs: **B. K. Henderson**, Air Force Research Lab.; **M. B. McMickell**, Honeywell, Inc.

Program Committee: **Eric H. Anderson**, CSA Engineering, Inc.; **Emil V. Ardelean**, Science Applications International Corp.; **Christian Boller**, The Univ. of Sheffield (United Kingdom); **Peter C. Chen**, Composite Mirror Applications, Inc.; **Johannes K. Dürr**, EADS Deutschland GmbH (Germany); **Kevin M. Farinholt**, Nanoscience, Inc.; **Xiaoyan Gong**, Nitinol Devices and Components; **Ernie Havens**, Cornerstone Research Group, Inc.; **Mark R. Jolly**, Lord Corp.; **Chad H. Joshi**, Energen, Inc.; **Thom Kreider**, Honeywell Technology; **Jayanth N. Kudva**, NextGen Aeronautics, Inc.; **Amrita Kumar**, Acellent Technologies, Inc.; **Douglas K. Lindner**, Virginia Polytechnic Institute and State Univ.; **Ou Ma**, New Mexico State Univ.; **John A. Main**, Defense Advanced Research Projects Agency (DARPA); **Anna-Maria R. McGowan**, NASA Langley Research Ctr.; **Geoffrey P. McKnight**, Hughes Research Labs., LLC; **Marc E. Regelbrugge**, Rhombus Cconsultants Group; **W. Lance Richards**, NASA Dryden Flight Research Ctr.; **Brian P. Sanders**, Air Force Research Lab.; **Janet M. Sater**, Institute for Defense Analyses; **Jerry Schmidt**, Materials Systems, Inc.

6527 continues on page 16

Conference 6528
Room: Royal Palm III

Wednesday-Thursday 21-22 March 2007
Proceedings of SPIE Vol. 6528

Nano-, Micro- and Bio-Sensors and Systems

Conference Chair: **Vijay K. Varadan**, Univ. of Arkansas

Cochair: **Dietmar W. Vogel**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany)

Program Committee: **Pratul K. Ajmera**, Louisiana State Univ.; **Steven W. Arms**, MicroStrain, Inc.; **Joachim F. Baumann**, Siemens AG (Germany); **Bharat Bhushan**, The Ohio State Univ.; **James L. Blackshire**, Air Force Research Lab.; **David L. Carroll**, Wake Forest Univ.; **Jung-Chih Chiao**, The Univ. of Texas at Arlington; **Sang H. Choi**, NASA Langley Research Ctr.; **András Dér**, Biological Research Ctr. (Hungary); **Jürg Dual**, ETH Zürich (Switzerland); **Lukas M. Eng**, Technische Univ. Dresden (Germany); **Cläs-Göran Granqvist, Sr.**, Uppsala Univ. (Sweden); **Peter Heszler, Sr.**, Uppsala Univ. (Sweden); **Michael H. Hoffmann**, Univ. Ulm (Germany); **Laszlo B. Kish**, Texas A&M Univ.; **Nikhil A. Koratkar**, Rensselaer Polytechnic Institute; **Shriram B. Kumar**, Univ. of Arkansas; **Chih-Hao Lee**, National Tsing Hua Univ. (Taiwan); **Eric Lifshin**, SUNY/Univ. at Albany; **Cheng Luo**, Louisiana Tech Univ.; **William H. Marlow**, Texas A&M Univ.; **Conrad Masterson**, Nanotechnology Foundation of Texas, Inc.; **Kathryn M. McGrath**, Univ. of Otago (New Zealand); **Norbert G. Meyendorf**, Univ. of Dayton; **Bernd Michel**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **Y. Eugene Pak**, SAMSUNG Advanced Institute of Technology (South Korea); **Yeonjoon Park**, NASA Langley Research Ctr.; **Yongrae Roh**, Kyungpook National Univ. (South Korea); **Paul B. Ruffin**, U.S. Army Aviation and Missile Research, Development and Engineering Ctr.; **Gabor Schmera**, Space and Naval Warfare Systems Ctr., San Diego; **Ananth Selvarajan**, Indian Institute of Science (India); **Andrei M. Shkel**, Univ. of California/Irvine; **Kyo D. Song**, Norfolk State Univ.; **Ashok Srivastava**, Louisiana State Univ.; **Maria Strømme**, Uppsala Univ. (Sweden); **Joseph A. Turner**, Univ. of Nebraska/Lincoln; **Lode K. Vandamme**, Technische Univ. Eindhoven (Netherlands); **Tian-Bing Xu**, National Institute of Aerospace; **Kazushi Yamanaka**, Tohoku Univ. (Japan); **Kaiming Ye**, Univ. of Arkansas

6528 continues on page 34

Conference 6529
Room: Royal Palm I & II

Monday-Thursday 19-22 March 2007
Proceedings of SPIE Vol. 6529

Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems

Conference Chair: **Masayoshi Tomizuka**, Univ. of California/Berkeley

Cochairs: **Chung-Bang Yun**, Korea Advanced Institute of Science and Technology (South Korea); **Victor Giurgiutiu**, Univ. of South Carolina

Program Committee: **H. Harry Asada**, Massachusetts Institute of Technology; **Amr M. Baz**, Univ. of Maryland/College Park; **Fabio Casciati**, Univ. degli Studi di Pavia (Italy); **C. C. Chang**, The Hong Kong Univ. of Science and Technology (Hong Kong China); **Fu-Kuo Chang**, Stanford Univ.; **Genda Chen**, Univ. of Missouri/Rolla; **Shirley J. Dyke**, Washington Univ.; **Silvia Ferrari**, Duke Univ.; **Alison B. Flatau**, Univ. of Maryland/College Park; **Yozo Fujino**, The Univ. of Tokyo (Japan); **Robert X. Gao**, Univ. of Massachusetts/Amherst; **Steven D. Glaser**, Univ. of California/Berkeley; **Faramarz Gordaninejad**, Univ. of Nevada/Reno; **Xiaoyan Han**, Wayne State Univ.; **B. K. Henderson**, Air Force Research Lab.; **Haiying Huang**, Purdue Univ.; **Jerry Q. Huang**, The Boeing Co.; **Kumar V. Jata**, Air Force Research Lab.; **Jeong-Tae Kim**, Pukyong National Univ. (South Korea); **Ki Soo Kim**, Hoseo Univ. (South Korea); **Jan-Ming Ko**, The Hong Kong Polytechnic Univ. (Hong Kong China); **Francesco Lanza di Scalea**, Univ. of California/San Diego; **Shih-Chi Liu**, National Science Foundation; **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan); **Jerome P. Lynch**, Univ. of Michigan; **Stephen A. Mahin**, Univ. of California/Berkeley; **Eduardo Misawa**, National Science Foundation; **Akira Mita**, Keio Univ. (Japan); **Siavouche Nemat-Nasser**, Univ. of California/San Diego; **Irving J. Oppenheim**, Carnegie Mellon Univ.; **Jinping Ou**, Harbin Institute of Technology (China); **Ser-Tong Quek**, National Univ. of Singapore (Singapore); **Tadanobu Sato**, Waseda Univ. (Japan); **Rahmat A. Shoureshi**, Univ. of Denver; **Andrew W. Smyth**, Columbia Univ.; **Hoon Sohn**, Carnegie Mellon Univ.; **Billie F. Spencer, Jr.**, Univ. of Illinois at Urbana-Champaign; **Tsu-Chin Tsao**, Univ. of California/Los Angeles; **Ming L. Wang**, Univ. of Illinois at Chicago; **Jin Wen**, Drexel Univ.; **Zhishen Wu**, Ibaraki Univ. (Japan); **Youlin Xu**, The Hong Kong Polytechnic Univ. (Hong Kong China); **Hiroyuki Yamanouchi**, Building Research Institute (Japan); **Lily L. Zhou**, Nanjing Univ. of Aeronautics and Astronautics (China)

6529 continues on page 17

Conference 6530
Room: San Diego

Monday-Wednesday 19-21 March 2007
Proceedings of SPIE Vol. 6530

Sensor Systems and Networks: Phenomena, Technology and Applications for NDE and Health Monitoring

Conference Chair: **Kara J. Peters**, North Carolina State Univ.

Cochairs: **Norbert G. Meyendorf**, Univ. of Dayton; **Eric Udd**, Columbia Gorge Research

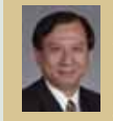
Program Committee: **Farhad Ansari**, Univ. of Illinois at Chicago; **George Y. Baaklini**, NASA Glenn Research Ctr.; **Xiaoyi Bao**, Univ. of Ottawa (Canada); **Axel Berthold**, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); **Bharat Bhushan**, The Ohio State Univ.; **James L. Blackshire**, Air Force Research Lab.; **Richard O. Claus**, Virginia Polytechnic Institute and State Univ.; **Brian Culshaw**, Univ. of Strathclyde (United Kingdom); **Wolfgang Ecke**, Institut für Physikalische Hochtechnologie e.V. (Germany); **Richard D. Finlayson**, Physical Acoustics Corp.; **Gerald U. Gerlach**, Technische Univ. Dresden (Germany); **Neil J. Goldfine**, Jentek Sensors, Inc.; **Joseph Grant**, NASA Marshall Space Flight Ctr.; **Wolfgang R. Habel**, Bundesanstalt für Materialforschung und -prüfung (Germany); **Manfred P. Hentschel**, Bundesanstalt für Materialforschung und -prüfung (Germany); **Daniele Inaudi**, Smartec SA (Switzerland); **Albrecht Jander**, Oregon State Univ.; **Kerop D. Janoyan**, Clarkson Univ.; **YeonWan Koh**, FiberPro, Inc. (South Korea); **David A. Krohn**, Light Wave Venture Consulting, LLC; **Silvio Kruger**, National Research Council Canada (Canada); **Marley Kunzler**, Blue Road Research; **Alexis Méndez**, MCH Engineering LLC; **Bernd Michel**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **Jeff W. Miller**, Micron Optics, Inc.; **Philipp M. Nellen**, EMPA (Switzerland); **Marc Niklès**, Omnisens S.A. (Switzerland); **Stanislave I. Rokhlin**, The Ohio State Univ.; **Jaswinder S. Sandhu**, Santec Systems, Inc.; **Carl Smith**, NVE Corp.; **Holger Speckmann**, Airbus Deutschland GmbH (Germany); **Nobuo Takeda**, The Univ. of Tokyo (Japan); **Roderick C. Tennyson**, Fiber Optic Systems Technology, Inc. (Canada); **Michael D. Todd**, Univ. of California/San Diego; **Zhishen Wu**, Ibaraki Univ. (Japan); **Chung-Bang Yun**, Korea Advanced Institute of Science and Technology (South Korea); **Zhi Zhou**, Harbin Institute of Technology (China)

6530 continues on page 17

Conference 6531
Room: Royal Palm VI

Tuesday-Thursday 20-22 March 2007
Proceedings of SPIE Vol. 6531

Nondestructive Characterization for Composite Materials, Aerospace Engineering, Civil Infrastructure, and Homeland Security



Conference Chair: **H. Felix Wu**, National Institute of Standards and Technology

Cochairs: **Aaron A. Diaz**, Pacific Northwest National Lab.; **Peter J. Shull**, The Pennsylvania State Univ.

Program Committee: **A. Emin Aktan**, Drexel Univ.; **Farhad Ansari**, Univ. of Illinois at Chicago; **George Y. Baaklini**, NASA Glenn Research Ctr.; **Yoseph Bar-Cohen**, Jet Propulsion Lab.; **Fu-Kuo Chang**, Stanford Univ.; **Andrew L. Gyekenyesi**, NASA Glenn Research Ctr.; **Garo K. Kiremidjian**, Sensametrics, Inc.; **James C. Leslie**, Advanced Composite Products and Technology, Inc.; **Richard E. Martin**, NASA Glenn Research Ctr.; **Aftab A. Mufti**, Univ. of Manitoba (Canada); **Kurt Silvers**, Pacific Northwest National Lab.; **Lizhi Sun**, Univ. of California/Irvine; **Bernhard R. Tittmann**, The Pennsylvania State Univ.; **Brian J. Tucker**, Pacific Northwest National Lab.; **Glenn A. Washer**, Univ. of Missouri/Columbia

6531 continues on page 27

Conference 6532
Room: Royal Palm IV

Monday-Thursday 19-22 March 2007
Proceedings of SPIE Vol. 6532

Health Monitoring of Structural and Biological Systems

Conference Chair: **Tribikram Kundu**, The Univ. of Arizona

Cochairs: **Ajit K. Mal**, Univ. of California/Los Angeles; **Kumar V. Jata**, Air Force Research Lab.

Program Committee: **Douglas E. Adams**, Purdue Univ.; **Yoseph Bar-Cohen**, Jet Propulsion Lab.; **Jürgen Bereiter-Hahn**, Johann Wolfgang Goethe-Univ. (Germany); **Fu-Kuo Chang**, Stanford Univ.; **Olivier Giraudo**, ONERA (France); **Victor Giurgiutiu**, Univ. of South Carolina; **Wolfgang Grill**, Univ. Leipzig (Germany); **Shivan Haran**, Arkansas State Univ.; **Sridhar Krishnaswamy**, Northwestern Univ.; **Francesco Lanza di Scalea**, Univ. of California/San Diego; **Shih-Chi Liu**, National Science Foundation; **Jerome P. Lynch**, Univ. of Michigan; **Won-Bae Na**, Pukyong National Univ. (South Korea); **Perngjin F. Pai**, Univ. of Missouri/Columbia; **Paul D. Panetta**, Luna Innovations, Inc.; **Dominique Placko**, Ecole Normale Supérieure de Cachan (France); **Amit Shukla**, Miami Univ.; **Hoon Sohn**, Carnegie Mellon Univ.; **Michael D. Todd**, Univ. of California/San Diego; **Wei-Chih Wang**, Univ. of Washington; **Hwai-Chung Wu**, Wayne State Univ.; **George Zentai**, Varian Medical Systems, Inc.

6532 continues on page 17

Monday 19 March

Conference 6523

SESSION 1
Room: California ..... Mon. 10:30 am to 12:10 pm

Smart Devices I

Chair: **Miao Yu**, Univ. of Maryland/College Park

10:30 am: **Dynamic analysis of a biology-inspired miniature directional microphone,** Z. Chen, M. Yu, Univ. of Maryland/College Park ..... [6523-01]

10:50 am: **Jitter control for an initially stablized tactical rifle,** D. K. Lindner, A. White, Virginia Polytechnic Institute and State Univ.; C. LaVigna, Techno-Sciences Inc.; D. E. Brei, Univ. of Michigan [6523-02]

11:10 am: **Design and quasi-static characterization of SMASH: SMA-actuated stabilizing handgrip,** A. Pathak, D. E. Brei, J. E. Luntz, Univ. of Michigan; C. LaVigna, Techno-Sciences, Inc.. [6523-03]

11:30 am: **Modeling and sensitivity study of the dual-chamber SMART (SMA resetable lift) device,** J. E. Luntz, D. E. Brei, J. Radice, Univ. of Michigan; K. A. Strom, General Motors Corp. .... [6523-04]

11:50 am: **Model identification and controller design of a fish-like robot,** I. Ariyanto, T. Kang, Y. Lee, Konkuk Univ. (South Korea) ..... [6523-05]

Lunch Break ..... 12:10 to 1:30 pm

6523 continues on page 18

Conference 6524

SESSION 1
Room: Town & Country ..... Mon. 10:30 am to 12:10 pm

EAP as Emerging Actuators and Biomimetic Technologies

Chairs: **Yoseph Bar-Cohen**, Jet Propulsion Lab.; **Gabor M. Kovacs**, EMPA (Switzerland)

Keynote

10:30 am: **How fish swim: flexible fin thrusters as an EAP platform,** G. V. Lauder, Harvard Univ. ..... [6524-01]

11:10 am: **Electroactive polymers (EAP) as an enabling tool in biomimetics,** Y. Bar-Cohen, Jet Propulsion Lab. [6524-02]

11:30 am: **A hands-on paradigm for EAP education: undergraduates, pre-college students, and beyond,** X. Tan, D. Kim, E. Goodman, Michigan State Univ.; M. Shahinpoor, Environmental Robots, Inc. ..... [6524-03]

11:50 am: **Benefits and challenges of using ionic polymer metal composites in medical device applications,** C. Yung, N. Bhat, PAVAD Medical, Inc. ..... [6524-04]

Lunch Break ..... 12:10 to 1:30 pm

6524 continues on page 18

Conference 6525

SESSION 1
Room: Royal Palm V ..... Mon. 10:30 to 11:50 am

Energy Harvesting I

Chairs: **William W. Clark**, Univ. of Pittsburgh; **Yi-Chung Shu**, National Taiwan Univ. (Taiwan)

10:30 am: **Harvesting of electrical energy from an backpack with a piezoelectric strap,** H. A. Sodano, J. Granstrom, Michigan Technological Univ.; K. M. Farinholt, NanoSonic, Inc. ..... [6525-01]

10:50 am: **Energy harvesting using optimized piezoelectric microcantilevers,** M. J. Parsons, A. Elalfy, A. Lumsdaine, The Univ. of Tennessee [6525-02]

11:10 am: **Design method for piezoelectric bending generators in energy harvesting systems,** B. Richter, J. Twiefel, T. Hemsel, T. R. Sattel, J. Wallaschek, Univ. Paderborn (Germany) ..... [6525-03]

11:30 am: **On the maximum energy harvesting using a piezoelectric element,** Z. Feng, Univ. of Science and Technology of China (China) ..... [6525-05]

Lunch Break ..... 11:50 am to 1:30 pm

6525 continues on page 18

Conference 6526

SESSION 1
Room: Golden West ..... Mon. 10:30 am to 12:10 pm

Ferroelectrics I

Chairs: **Marcelo J. Dapino**, The Ohio State Univ.; **Pavel M. Chaplya**, Sandia National Labs.

10:30 am: **Mechanics of relaxor ferroelectrics,** C. S. Lynch, Georgia Institute of Technology ..... [6526-01]

10:50 am: **Blocked force and free displacement characterization of PMN-PT stacks,** N. Nersessian, G. Wang, Techno-Sciences Inc.; N. M. Wereley, Univ. of Maryland/College Park ..... [6526-02]

11:10 am: **Simulation of the constitutive behavior of PZT at electromechanical loading,** A. Konstandin, Robert Bosch GmbH (Germany) and Technische Univ. Hamburg-Harburg (Germany); G. Deromelaere, V. Knoblauch, Robert Bosch GmbH (Germany); R. M. McMeeking, Univ. of California/Santa Barbara; G. A. Schneider, Technische Univ. Hamburg-Harburg (Germany) ..... [6526-03]

11:30 am: **Recent progress toward practical flexoelectric piezoelectric composites,** L. E. Cross, W. Zhu, W. Zhu, N. Li, The Pennsylvania State Univ. ..... [6526-04]

11:50 am: **Microstructural modeling of ferroic switching and phase transitions in PZT,** J. Robbins, P. M. Chaplya, Sandia National Labs. ..... [6526-05]

Lunch Break ..... 12:10 to 1:30 pm

6526 continues on page 18

Conference 6527

SESSION 1
Room: Royal Palm III ..... Mon. 10:30 am to 12:10 pm

Space Applications

Chairs: **L. Porter Davis**, Honeywell, Inc.; **Eric H. Anderson**, CSA Engineering, Inc.

10:30 am: **Smart structures product implementation award winners: a review of real-world experience,** E. H. Anderson, CSA Engineering, Inc.; J. M. Sater, Institute for Defense Analyses; E. V. White, The Boeing Co. ..... [6527-01]

10:50 am: **Optical payload isolation using the miniature vibration isolation system (MVIS-II),** M. B. McMickell, T. Kreider, Honeywell Defense and Space Electronic Systems; E. J. Hansen, Air Force Research Lab.; T. Davis, M. Gonzalez, Honeywell Defense and Space Electronic Systems ..... [6527-02]

11:10 am: **Active flatness control of membrane structures using adaptive genetic algorithm,** X. Wang, W. Zheng, Y. Hu, Canadian Space Agency (Canada) ..... [6527-03]

11:30 am: **Isolation, pointing, and suppression (IPS) system for high performance spacecraft,** T. A. Hindle, T. Davis, J. Fischer, Honeywell Defense and Space Electronic Systems ..... [6527-04]

11:50 am: **Cross-track infrared sounder isolation system,** S. Hadden, M. Gonzalez, T. A. Hindle, Honeywell Defense and Space Electronic Systems .. [6527-05]

Lunch Break ..... 12:10 to 1:30 pm

6527 continues on page 18

8:00 to 8:15 am **Welcome Remarks and Awards**

8:15 to 8:30 am ***Funding Agency Talk,* AFOSR - Current and Future Programs and Initiatives**, Victor Giurgiutiu, Air Force Office of Scientific Research (AFOSR)

8:30 to 9:15 **Morphing Wings: From Concept to Reality**, Jayanth N. Kudva, NextGen Aeronautics, Inc.

9:15 to 10:00 **From the Piezo Effectto a New Generation of Fuel Injectors**, Hans Meixner, Siemens AG (Germany)

Monday 19 March

Conference 6529

Conference 6530

Conference 6532

8:00 to 8:15 am **Welcome Remarks and Awards**

8:15 to 8:30 am ***Funding Agency Talk*, AFOSR - Current and Future Programs and Initiatives**, Victor Giurgiutiu, Air Force Office of Scientific Research (AFOSR)

8:30 to 9:15 **Morphing Wings: From Concept to Reality**, Jayanth N. Kudva, NextGen Aeronautics, Inc.

9:15 to 10:00 **From the Piezo Effectto a New Generation of Fuel Injectors**, Hans Meixner, Siemens AG (Germany)

SESSION 1

Room: Royal Palm I ..... Mon. 10:40 am to 12:00 pm

Invited Lectures

Chairs: **Chung-Bang Yun**, Korea Advanced Institute of Science and Technology (South Korea); **Victor Giurgiutiu**, Univ. of South Carolina

10:40 am: **Bio-inspired design of sensing, cognition and actuation: examples in real biology and its transfer to a new man-made sensor system *(Invited Paper)*,** M. Taya, R. Stahlberg, Univ. of Washington ..... [6529-01]

11:20 am: **From photogrammetry, computer vision to structural response measurement *(Invited Paper)*,** C. C. Chang, Hong Kong Univ. of Science and Technology (Hong Kong China) . [6529-02]

Lunch Break ..... 12:00 to 1:30 pm

6529 continues on page 19

SESSION 1

Room: San Diego ..... Mon. 10:30 am to 12:10 pm

Sensor Systems and Packaging for Harsh Environments

Chairs: **Kara J. Peters**, North Carolina State Univ.; **Eric Udd**, Columbia Gorge Research

10:30 am: **Fiber optic grating sensors for structural health monitoring at cryogenic temperatures,** W. Ecke, I. Latka, T. Habisreuther, Institut für Physikalische Hochtechnologie e.V. (Germany); H. Lingertat, Max-Planck-Institut für Plasmaphysik (Germany) ..... [6530-01]

10:50 am: **Extension of fiber optic grating sensor technology toward very high temperatures for structural health monitoring,** E. Udd, Columbia Gorge Research ..... [6530-02]

11:10 am: **FlexPatch: a rugged miniature FBG strain sensor,** S. Ferguson, D. Snyder, T. W. Graver, Micron Optics, Inc.; A. Méndez, MCH Engineering LLC ..... [6530-03]

11:30 am: **Accelerating an integrated FOS system for flight on a small UAV,** W. Kunzler, J. Newman, D. Wilding, R. H. Selfridge, S. M. Schultz, M. J. Wirthlin, Brigham Young Univ. ..... [6530-04]

11:50 am: **Large scale distribution monitoring of FRP-OF based on BOTDR technique for infrastructures,** Z. Zhou, Harbin Institute of Technology (China); J. Ou, Harbin Institute of Technology (China) and Dalian Univ. of Technology (China) ..... [6530-05]

Lunch Break ..... 12:10 to 1:30 pm

6530 continues on page 19

SESSION 1

Room: Royal Palm IV ..... Mon. 10:30 am to 12:10 pm

SHM for Aerospace Applications

Chairs: **Tribikram Kundu**, The Univ. of Arizona; **Wolfgang Grill**, Univ. Leipzig (Germany)

10:30 am: **New development in the real-time ultrasonic imaging system for NDI applications,** Y. Zhou, I. N. Komsky, S. Krishnaswamy, Northwestern Univ. ..... [6532-01]

10:50 am: **An integrated strategy for detection and imaging of damage using a spatially distributed array of piezoelectric sensors,** J. E. Michaels, T. E. Michaels, Georgia Institute of Technology ..... [6532-02]

11:10 am: **Damage detecting and modeling of pre-cracked bolted joints using varied tightening loads and their effects on crack nucleation and propagation under cyclic loading,** C. Coelho, S. Soni, J. Wei, A. Chattopadhyay, P. Peralta, Arizona State Univ. .... [6532-03]

11:30 am: **Detection and quantification of fatigue damage in aircraft structural components,** C. A. Rideout, Positron Systems, Inc. ..... [6532-04]

11:50 am: **Integrated plate and surface acoustic wave sensors for health monitoring,** C. Jen, M. Kobayashi, K. Wu, L. Song, N. Mrad, National Research Council Canada (Canada) ..... [6532-05]

Lunch Break ..... 12:10 to 1:30 pm

6532 continues on page 19

Monday 19 March

Conference 6523

continued

SESSION 2

Room: California ..... Mon. 1:30 to 2:50 pm

Aircraft Wing Design and Control

Chair: **Mary I. Frecker**, The Pennsylvania State Univ.

1:30 pm: **Cellular mechanisms for morphing aircraft wing design,** S. Bharti, M. I. Frecker, G. A. Lesieutre, J. Browne, The Pennsylvania State Univ. .... [6523-06]

1:50 pm: **Energy-based aeroelastic analysis of morphing wings,** R. De Breuker, M. M. Abdalla, Z. Gürdal, Technische Univ. Delft (Netherlands); D. K. Lindner, Virginia Polytechnic Institute and State Univ. ..... [6523-07]

2:10 pm: **Active aeroelastic control using synthetic jet actuators: modeling and simulation,** R. De Breuker, M. M. Abdalla, Z. Gurdal, Technische Univ. Delft (Netherlands); P. Marzocca, K. O'Donnell, Clarkson Univ. ..... [6523-08]

2:30 pm: **Comparison of active flow control devices on bluff body shapes,** S. J. Haack, Univ. of Maryland/College Park; S. Wilkinson, NASA Langley Research Ctr.; A. Flatau, Univ. of Maryland/College Park ..... [6523-09]

Coffee Break ..... 2:50 to 3:30 pm

6523 continues on page 20

Conference 6524

continued

SESSION 2

Room: Town & Country ..... Mon. 1:30 to 3:10 pm

Electronic EAP

Chairs: **Elisabeth Smela**, Univ. of Maryland/College Park; **George V. Lauder**, Harvard Univ.

1:30 pm: **A road to practical dielectric elastomer actuators based robotics and mechatronics: discrete actuation *(Invited Paper)*,** J. Plante, L. Devita, S. Dubowsky, Massachusetts Institute of Technology ..... [6524-05]

2:10 pm: **Robust adaptive control of conducting polymer actuators,** Y. Fang, X. Tan, Michigan State Univ.; G. Alici, Univ. of Wollongong (Australia) ..... [6524-06]

2:30 pm: **Enhanced performance of IPN electroelastomer,** Q. Pei, S. M. Ha, Univ. of California/Los Angeles; R. Pelrine, S. Stanford, SRI International; G. M. Kovacs, EMPA (Switzerland) ..... [6524-07]

2:50 pm: **Electromechanical coupling in cylindrical dielectric elastomer actuators,** M. T. Wissler, EMPA (Switzerland); E. Mazza, ETH Zürich (Switzerland); G. M. Kovacs, EMPA (Switzerland) ..... [6524-08]

Coffee Break ..... 3:10 to 4:30 pm

EAP-in-Action

6524 continues on page 22

Conference 6525

continued

SESSION 2

Room: Royal Palm V ..... Mon. 1:30 to 2:30 pm

Energy Harvesting II

Chairs: **Arnold Lumsdaine**, The Univ. of Tennessee; **Jeong-Hoi Koo**, Miami Univ.

1:30 pm: **Energy harvesting with PMN-PT for implantable medical devices,** C. Mo, SangJu National Univ. (South Korea); L. J. Radziemski, Piezo Energy Technologies LLC; W. W. Clark, Univ. of Pittsburgh ..... [6525-06]

1:50 pm: **Adaptive vibration energy harvesting,** S. Behrens, J. K. Ward, Commonwealth Scientific and Industrial Research Organisation (Australia)[6525-07]

2:10 pm: **Optimal AC-DC energy conversion efficiency of a piezoelectric energy harvester,** Y. Shu, I. Lien, National Taiwan Univ. (Taiwan) ..... [6525-08]

6525 continues on page 20

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Conference 6526

continued

SESSION 2

Room: Golden West ..... Mon. 1:30 to 3:10 pm

Ferroelectrics II

Chairs: **Chad M. Landis**, Rice Univ.; **Stewart Sherrit**, Jet Propulsion Lab.

1:30 pm: **Analytical model for the strain-field and polarization-field hysteresis curves for ferroic materials,** S. Sherrit, Jet Propulsion Lab. ..... [6526-06]

1:50 pm: **Fully coupled finite element modeling of piezothermoelastic materials,** M. S. Senousy, N. Rajapakse, M. S. Gadala, The Univ. of British Columbia (Canada) ..... [6526-07]

2:10 pm: **Vector potential formulation for the 3D finite element analysis of nonlinear electromechanical problems,** A. S. Semenov, St.-Petersburg State Polytechnical Univ. (Russia); A. C. Liskowsky, H. Balke, Technische Univ. Dresden (Germany) ..... [6526-08]

2:30 pm: **Interaction of defects with domain walls in ferroelectric materials,** D. G. Schrade, B. X. Xu, R. Mueller, D. Gross, Technische Univ. Darmstadt (Germany) ..... [6526-09]

2:50 pm: **A thermodynamic consistent material model for hysteresis effects,** S. O. Klinkel, W. Wagner, Univ. Karlsruhe (Germany) ..... [6526-10]

Coffee Break ..... 3:10 to 3:40 pm

6526 continues on page 20

Conference 6527

continued

SESSION 2

Room: Royal Palm III ..... Mon. 1:30 to 3:10 pm

Structural Health Monitoring Applications

Chairs: **B. K. Henderson**, Air Force Research Lab.; **Christian Boller**, The Univ. of Sheffield (United Kingdom)

1:30 pm: **Reflexive aero-structures: increased vehicle survivability,** T. W. Margraf, C. D. Hemmelgarn, T. J. Barnell, Cornerstone Research Group, Inc. ..... [6527-06]

1:50 pm: **Design of a robust SHM system for composite structures,** S. J. Beard, C. Liu, Acellent Technologies, Inc.; F. Chang, Stanford Univ. ..... [6527-07]

2:10 pm: **Detection of crack initiation and propagation in ceramic composites using piezoelectric acoustic sensors,** A. Ghoshal, United Technologies Research Ctr.; H. S. Kim, Inha Univ. (South Korea) ..... [6527-08]

2:30 pm: **Impact monitoring of the aircraft composite structure,** T. Ogisu, N. Nakamura, Fuji Heavy Industries, Ltd.; Y. Okabe, N. Takeda, The Univ. of Tokyo (Japan); T. Sakurai, R&D Institute of Metals and Composites for Future Industries (Japan) ..... [6527-09]

2:50 pm: **Structural health monitoring potential determination based on maintenance process analysis,** C. Boller, H. Kapoor, M. W. T. Goh, The Univ. of Sheffield (United Kingdom) ..... [6527-10]

Coffee Break ..... 3:10 to 3:40 pm

6527 continues on page 20

Monday 19 March

Conference 6529

Session 2 and 4 run concurrently

SESSION 2

Room: Royal Palm I ..... Mon. 1:30 to 2:50 pm

Piezoelectric and Integrated Sensors I

Chairs: **Yunfeng Zhang**, Lehigh Univ.; **Jiong Tang**, Univ. of Connecticut

1:30 pm: **Piezoelectric paint sensor for ultrasonic NDE,** Y. Zhang, X. Li, Lehigh Univ. ..... [6529-03]

1:50 pm: **Enhancement of a unimorph actuator performance implementing the nonlinear characteristics of piezoceramic wafer (3203HD, CTS),** Q. V. Nguyen, H. C. Park, N. Goo, Konkuk Univ. (South Korea) ..... [6529-04]

2:10 pm: **Robust structural damage detection using piezoelectric actuator and Lamb wave approach,** J. Tang, Univ. of Connecticut ..... [6529-05]

2:30 pm: **Sensing region of PZT transducers bonded to concrete,** Y. Hu, Y. Yang, Nanyang Technological Univ. (Singapore) ..... [6529-06]

Coffee Break ..... 2:50 to 3:30 pm

SESSION 4

Room: Royal Palm II ..... Mon. 1:30 to 2:50 pm

Novel Sensors I

Chairs: **Ming L. Wang**, Univ. of Illinois/Chicago; **Zhihong Xu**, Univ. of Illinois/Chicago

1:30 pm: **Integrating broadband high-fidelity acoustic emission sensors and array processing to study drying shrinkage cracking in concrete,** G. C. McLaskey, S. D. Glaser, Univ. of California/Berkeley; C. U. Grosse, Univ. Stuttgart (Germany) ..... [6529-11]

1:50 pm: **The self-sensing ability of carbon fiber smart concrete,** Z. Xu, Nanjing Univ. of Science and Technology (China) ..... [6529-12]

2:10 pm: **Microfabrication of a wall shear-stress sensor using side-implanted piezoresistive tethers,** Y. Li, T. Nishida, D. Arnold, M. Sheplak, Univ. of Florida ..... [6529-13]

2:30 pm: **Subsurface sampler and sensors platform using the Ultrasonic/sonic driller/corer (USDC),** Y. Bar-Cohen, S. Sherrit, X. Bao, M. Badescu, J. B. Aldrich, Z. Chang, Jet Propulsion Lab. ..... [6529-18]

Coffee Break ..... 2:50 to 3:30 pm

6529 continues on page 21

Conference 6530

continued

SESSION 2

Room: San Diego ..... Mon. 1:30 to 3:10 pm

Sensor Networks for NDE Imaging

Chairs: **Norbert G. Meyendorf**, Univ. of Dayton; **Axel Berthold**, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany)

1:30 pm: **X-ray detectors for NDE applications,** A. Berthold, M. Kroening, Fraunhofer-Institut fur Zerstorungsfreie Prufverfahren (Germany); T. Baumbach, Forschungszentrum Karlsruhe (Germany); R. G. Melkadze, T. M. Lezhneva, L. B. Khvedelidze, G. D. Kalandadze, Tbilisi State Univ. (Georgia) ..... [6530-06]

1:50 pm: **Emission of multiple types of radiation using a miniature ferroelectric-based single source,** Y. Bar-Cohen, S. Lih, X. Bao, S. Sherrit, M. Badescu, Jet Propulsion Lab. ..... [6530-07]

2:10 pm: **Ultrasonic 3D imaging system for the automated application in milling machines,** R. Schmitt, P. H. Hafner, RWTH Aachen (Germany) ..... [6530-08]

2:30 pm: **Process monitoring system for laser transmission welding of plastics using direct visualisation of the weld seam,** D. Herzog, M. Fargas, O. Meier, A. von Busse, Laser Zentrum Hannover e.V. (Germany) ..... [6530-09]

2:50 pm: **Nondestructive testing of ferroelectrics by thermal wave methods,** G. U. Gerlach, G. Suchaneck, Technische Univ. Dresden (Germany); A. Movchikova, O. Malyshkina, Tver State Univ. (Russia) ..... [6530-10]

Coffee Break ..... 3:10 to 3:40 pm

6530 continues on page 21

Conference 6532

continued

SESSION 2

Room: Royal Palm IV ..... Mon. 1:30 to 3:10 pm

Guided Waves for SHM I

Chairs: **Francesco Lanza di Scalea**, Univ. of California/San Diego; **Hoon Sohn**, Carnegie Mellon Univ.

1:30 pm: **Ultrasonic guided waves for fatigue crack detection in multi-layered metallic structures,** E. Lindgren, K. V. Jata, Air Force Research Lab.; J. C. Aldrin, Computational Tools; J. Knopp, Air Force Research Lab. ..... [6532-06]

1:50 pm: **Impact of ultrasonic guided wave transducer design on structural health monitoring of composite structures,** H. Gao, J. L. Rose, The Pennsylvania State Univ. ..... [6532-07]

2:10 pm: **Instantaneous crack detection under changing operational and environmental variations,** S. B. Kim, H. Sohn, Carnegie Mellon Univ. ..... [6532-08]

2:30 pm: **Sensitivity limitations for guided wave structural health monitoring,** P. D. Wilcox, A. J. Croxford, G. Konstantinidis, B. W. Drinkwater, Univ. of Bristol (United Kingdom) ..... [6532-09]

2:50 pm: **On piezoelectric Lamb wave-based structural health monitoring using instantaneous baseline measurements,** S. R. Anton, Virginia Polytechnic Institute and State Univ.; G. Park, C. R. Farrar, Los Alamos National Lab.; D. J. Inman, Virginia Polytechnic Institute and State Univ. ..... [6532-10]

Coffee Break ..... 3:10 to 3:40 pm

6532 continues on page 21

Monday 19 March

Conference 6523

continued

SESSION 3

Room: California ..... Mon. 3:30 to 5:10 pm

Smart Devices II

Chair: **Emílio C. N. Silva**, Escola Politécnica da Univ. de São Paulo (Brazil)

3:30 pm: **Extremum-seeking control of ultrasonic/sonic driller/corer using frequency and voltage modulation,** J. B. Aldrich, S. Sherrit, M. Badescu, X. Bao, Y. Bar-Cohen, Z. Chang, C. Jones, Jet Propulsion Lab. ..... [6523-10]

3:50 pm: **Piezoactuator design considering optimum placement of functionally graded piezoceramics,** R. C. Carbonari, E. C. N. Silva, Escola Politécnica da Univ. de São Paulo (Brazil); G. H. Paulino, Univ. of Illinois at Urbana-Champaign; S. Nishiwaki, Kyoto Univ. (Japan) ..... [6523-11]

4:10 pm: **Control modeling of LIPCA using miniaturized piezoelectric actuator driver,** T. Kang, Konkuk Univ. (South Korea); I. Kang, Korea Institute of Industrial Technology (South Korea); M. Song, K. Yoon, S. Lee, Konkuk Univ. (South Korea) ..... [6523-12]

4:30 pm: **Estimating the control capacity of the squeeze mode MR damper with multi-electro-magnetic system,** G. Heo, Konyang Univ. (South Korea); J. Jeon, Chungnam National Univ. (South Korea); G. Lee, J. Lee, D. Lee, Konyang Univ. (South Korea) ..... [6523-14]

6523 continues on page 22

EAP-in-Action Session and Arm Wrestling Challenge Contest

Town and Country Room

Eap-in-Action Session

This Session is intended to turn the spotlight on Electroactive Polymers (EAP) materials and their applications as well as increase the recognition of their potential. It offers a forum of interaction between the technology developers and potential users as well as "hands-on" experience with this emerging technology. The attendees are given a great opportunity to see the capability of state-of-the-art of EAP as potential actuators-of-choice. This year, we are going to have six research and industry presenters demonstrating their latest EAP actuators and devices. The highlight of these demos includes a large blimp that will fly indoor and steered by EAP-actuated controlled surfaces. Also, new commercial EAP actuated prototypes will be shown including loudspeaker and generator powering a wireless communication device. The affiliation of the presenters includes Artificial Muscle, Inc.; EMPA - Materials Science & Technology, Switzerland; Hyper Drive Corporation, Japan; Intelligent Materials for Prosthetics & Automation, Ras Labs, L.L.C.; SRI International; and University of Pisa, Research Centre "E. Piaggio", Italy.

Preliminary EAP Demonstrations

Silvain Michel and Gabor Kovacs, Empa (Switzerlang) Materials Science & Technology
Demonstrating: A large EAP-Blimp performing indoor flying demonstration using controlled surfaces

Federico Carpi, Univ. of Pisa (Italy), Research Centre "E. Piaggio"
Demonstrating: Contractile folded dielectric elastomer actuators; Buckling dielectric elastomer actuators

Roy Kornbluh, SRI International
Demonstrating: An EAP generator

Seiki Chiba, SRI International
Demonstrating: Extending applications of dielectric elastomer artificial muscle

Lenore Rasmussen, Ras Labs, L.L.C. Intelligent Materials for Prosthetics & Automation
Demonstrating: Electroactive Polymer Materials: Beauty in Motion

Charlie Duncheon, Artificial Muscle, Inc.
Demonstrating: The first high volume standard commercial product - DLP95 lens positioner; Standard Universal Muscle Actuator platform; UMA based prototype products (including proportional valve)

More information about the EAP-in-Action Session can be found at: http://ndeaa.jpl.nasa.gov/nasa-nde/lommas/eap/EAPIA/EAP-in-Action-Demos-2007.htm

Conference 6525

continued

SESSION 3

Room: Royal Palm V ..... Mon. 2:30 to 5:00 pm

Magnet-Rheological Systems

Chairs: **Faramarz Gordaninejad**, Univ. of Nevada/Reno; **Andrew N. Vavreck**, The Pennsylvania State Univ.

2:30 pm: **Agglomeration of magnetorheological fluid mass to an immersed vibrating electromagnet,** A. N. Vavreck, J. Black, The Pennsylvania State Univ. ..... [6525-09]

2:50 pm: **Alternative power source for magneto-rheological dampers,** J. Koo, E. Ritchie, Miami Univ.; S. Cho, The Univ. of Western Ontario (Canada) ..... [6525-10]

Coffee Break ..... 3:10 to 3:40 pm

3:40 pm: **Study of a magneto-rheological grease (MRG) clutch,** F. Gordaninejad, B. M. Kavlicoglu, X. Wang, Univ. of Nevada/Reno ..... [6525-11]

4:00 pm: **Behavior of magneto-rheological grease (MRG),** H. Sahin, F. Gordaninejad, X. Wang, Univ. of Nevada/Reno ..... [6525-12]

4:20 pm: **On the design of a combined squeeze-flow mode magnetorheological fluid mount,** C. Ciocanel, T. M. Nguyen, M. H. Elahinia, N. Naganathan, The Univ. of Toledo ..... [6525-13]

4:40 pm: **Structural optimization of clutch activated by magnetorheological fluid,** Y. Liu, Harbin Institute of Technology (China) ..... [6525-15]

6525 continues on page 22

Conference 6526

continued

SESSION 3

Room: Golden West ..... Mon. 3:40 to 5:40 pm

Ferroelectrics III

Chairs: **Christopher S. Lynch**, Georgia Institute of Technology; **Etienne Patoor**, École Nationale Supérieure d'Arts et Métiers (France)

3:40 pm: **Finite element simulation of ferroelectrics based on a micromechanical approach,** M. Elhadrouz, E. Patoor, École Nationale Supérieure d'Arts et Métiers (France) ..... [6526-11]

4:00 pm: **Evolution of elastic, dielectric, and piezoelectric coefficients of PZT under electro-mechanical loading,** Q. Liu, Univ. of Cambridge (United Kingdom); J. E. Huber, Univ. of Oxford (United Kingdom) ..... [6526-13]

4:20 pm: **Tensile and compressive stress dependency of the transverse (e31,f) piezoelectric coefficient of PZT thin films for MEMS devices,** K. Prume, aixACCT Systems GmbH (Germany); P. Muralt, École Polytechnique Fédérale de Lausanne (Switzerland); T. Schmitz-Kempen, S. Tiedke, aixACCT Systems GmbH (Germany) ..... [6526-14]

4:40 pm: **Dynamic thermo-electro-mechanical performance of piezoelectric stack actuators,** M. S. Senousy, F. X. Li, The Univ. of British Columbia (Canada); D. Mumford, Westport Innovations Inc. (Canada); M. S. Gadala, N. Rajapakse, The Univ. of British Columbia (Canada) ..... [6526-15]

5:00 pm: **Studies on ferroelastic time-dependent domain switching effects of PZT ceramics,** A. Menzel, Univ. Siegen (Germany); A. Arockiarajan, S. M. Sivakumar, Indian Institute of Technology (India) ..... [6526-16]

5:20 pm: **Study about possibilities for direct integration of piezo-fibers in sheet metal,** W. Drossel, R. Neugebauer, B. Kranz, Fraunhofer-Institut für Werkzeugmaschinen und Umformtechnik (Germany) ..... [6526-17]

6526 continues on page 22

Conference 6527

continued

SESSION 3

Room: Royal Palm III ..... Mon. 3:40 to 5:40 pm

Mechanisms and Sensing Applications

Chairs: **M. B. McMickell**, Honeywell Defense and Space Electronic Systems; **Marc E. Regelbrugge**, Rhombus Cconsultants Group

3:40 pm: **Smart structures technologies for parallel kinematics in handling and assembly,** R. Keimer, S. Algermissen, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); N. Pavlovic, C. Budde, Technische Univ. Braunschweig (Germany) ..... [6527-11]

4:00 pm: **Ultralight dust wiper mechanism for operation in Mars,** D. Fernandez, Univ. Carlos III de Madrid (Spain); R. Cabas, Arquimea Ingenieria S.L. (Spain); L. Moreno, Univ. Carlos III de Madrid (Spain) ..... [6527-12]

4:20 pm: **Amplification in micropositioning using a hydraulic booster,** S. Valadkhan, A. Khajepour, K. Morris, Univ. of Waterloo (Canada) ..... [6527-13]

4:40 pm: **Piezoelectric control of a machine tool with parallel kinematics,** C. Rudolf, J. Wauer, C. Munzinger, M. Weis, Univ. Karlsruhe (Germany) ..... [6527-15]

5:00 pm: **Kinetic ceramics piezoelectric hydraulic pump (PHP),** C. H. O'Neill, J. Burchfield, Kinetic Ceramics, Inc.[6527-17]

5:20 pm: **Downhole fiber optic real-time casing monitor,** B. A. Childers, Luna Energy; F. Rambow, D. Dria, M. Shuck, Shell Exploration & Production Co.; S. H. Poland, Luna Energy ..... [6527-35]

6527 continues on page 23

Monday 19 March

Conference 6529

Session 3 and 5 run concurrently

SESSION 3

Room: Royal Palm I ..... Mon. 3:30 to 4:50 pm

Piezoelectric and Integrated Sensors II

Chairs: **Henrique L. Reis**, Univ. of Illinois at Urbana-Champaign; **Rais Ahmad**, The Univ. of Arizona

3:30 pm: **Monitoring the setting times and strength gain of mortar using one-sided ultrasonic guided wave approach,** H. L. Reis, J. L. Borgerson, Univ. of Illinois at Urbana-Champaign ..... [6529-07]

3:50 pm: **A computational method for materials selection in hybrid actuation systems,** B. J. Nickless, National Institute of Aerospace; J. Su, NASA Langley Research Ctr.; T. Xu, J. E. Hubbard, Jr., National Institute of Aerospace .. [6529-08]

4:10 pm: **Studies on effects of thermal variation on guided-wave propagation for structural health monitoring,** A. Raghavan, C. E. S. Cesnik, Univ. of Michigan ..... [6529-09]

4:30 pm: **Estimation of adhesive bond strength in laminated safey glass,** H. L. Reis, S. Huo, Univ. of Illinois at Urbana-Champaign ..... [6529-10]

SESSION 5

Room: Royal Palm II ..... Mon. 3:30 to 5:50 pm

Novel Sensors II

Chairs: **Douglas A. Boehm**, Univ. at Buffalo; **David J. Griffiths**, Virginia Polytechnic Institute and State Univ.

3:30 pm: **A microfluidic biosensor for bacteria detection and identification,** D. A. Boehm, P. Gottlieb, S. Z. Hua, Univ. at Buffalo ..... [6529-15]

3:50 pm: **Ferroelectric thin-film active sensor arrays for structural health monitoring,** B. Lin, Univ. of South Carolina; A. S. Bhalla, The Pennsylvania State Univ.; C. Chen, The Univ. of Texas at San Antonio; V. Giurgiutiu, Univ. of South Carolina; J. Jiang, The Univ. of Texas at Arlington; R. Guo, The Pennsylvania State Univ. ..... [6529-16]

4:10 pm: **Development of a small reusable space release device using SMAs,** X. Yan, K. Zhang, Beijing Univ. of Aeronautics and Astronautics (China) ..... [6529-17]

4:30 pm: **Tire tread deformation sensor and energy harvester development for "smart tire" applications,** K. S. Moon, San Diego State Univ.; H. Liang, J. Yi, Texas A&M Univ. ..... [6529-14]

4:50 pm: **Development of ionic polymer transducers as flow shear stress sensors: effects of electrode architecture,** D. J. Griffiths, J. Dominic, B. J. Akle, P. Vlachos, D. Leo, Virginia Polytechnic Institute and State Univ. ..... [6529-19]

5:10 pm: **Surface stress sensors for detection of chemical and biological species,** P. Shrotriya, K. Kang, J. Marquardt, Iowa State Univ. ..... [6529-20]

5:30 pm: **Dynamic analysis of highway bridges with seismic restrainers by using shape memory alloy,** A. Guo, H. Li, Harbin Institute of Technology (China) ..... [6529-21]

6529 continues on page 23

Conference 6530

continued

SESSION 3

Room: San Diego ..... Mon. 3:40 to 6:00 pm

New Sensing Principles

Chairs: **Eric Udd**, Columbia Gorge Research; **Kara J. Peters**, North Carolina State Univ.

3:40 pm: **New sensor principle based on Barkhausen noise,** J. Schreiber, N. G. Meyendorf, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany) ..... [6530-11]

4:00 pm: **Structure-integrated fiber-optic sensors for reliable static and dynamic analysis of concrete foundation piles,** M. Schallert, W. R. Habel, Bundesanstalt für Materialforschung und -prüfung (Germany); J. Stahlmann, Technical Univ. Braunschweig (Germany) ..... [6530-12]

4:20 pm: **Behavior of intrinsic polymer optical fiber sensor for large-strain applications,** S. Kiesel, K. J. Peters, M. Kowalsky, T. Hassan, North Carolina State Univ. ..... [6530-13]

4:40 pm: **Side-polished and tilted fiber Bragg grating sensors for structural health monitoring applications,** C. Chan, G. A. Ferrier, D. J. Thomson, Univ. of Manitoba (Canada); C. Chen, J. Albert, Carleton Univ. (Canada); A. Vincelette, P. Lefebvre, LxSix Photonics Inc. (Canada) ..... [6530-14]

5:00 pm: **Nondestructive evaluation and quality control of surface treatments,** C. A. Rideout, S. Ritchie, Positron Systems, Inc. ..... [6530-15]

5:20 pm: **Development of a wireless bridge monitoring system for condition assessment using hybrid techniques,** M. J. Whelan, M. P. Fuchs, M. V. Gangone, K. D. Janoyan, Clarkson Univ. ..... [6530-16]

5:40 pm: **A study of implantable power haversting transducers,** B. Lee, B. Shih, J. He, W. Shih, W. Wu, National Taiwan Univ. (Taiwan) ..... [6530-17]

6530 continues on page 23

Conference 6532

continued

SESSION 3

Room: Royal Palm IV ..... Mon. 3:40 to 5:40 pm

Guided Waves for SHM II

Chairs: **Hoon Sohn**, Carnegie Mellon Univ.; **Francesco Lanza di Scalea**, Univ. of California/San Diego

3:40 pm: **Active sensing-based structural health monitoring using pattern recognition techniques,** S. Park, C. Yun, Korea Advanced Institute of Science and Technology (South Korea); D. J. Inman, Virginia Polytechnic Institute and State Univ. ..... [6532-11]

4:00 pm: **SAFE modeling of elastic waves in axis-symmetric waveguides,** I. Bartoli, Univ. of California/San Diego; A. Marzani, Univ. degli Studi di Bologna (Italy); F. Lanza di Scalea, Univ. of California/San Diego; P. Rizzo, Univ. of Pittsburgh; E. Viola, Univ. degli Studi di Bologna (Italy) ..... [6532-12]

4:20 pm: **Modal decomposition of double-mode Lamb waves with attenuation,** K. Luangvilai, L. J. Jacobs, J. Qu, Georgia Institute of Technology ..... [6532-13]

4:40 pm: **Electro-mechanical analogies for modeling the structural impedance response,** A. N. Zagrai, New Mexico Institute of Mining and Technology ..... [6532-14]

5:00 pm: **Lamb wave phased array beam steering in composite plates,** F. Yan, J. L. Rose, The Pennsylvania State Univ. ..... [6532-15]

5:20 pm: **Simultaneous multipoint acousto-ultrasonic sensing based on fiber wave bragg grating sensors,** J. Lee, J. Takatsubo, H. Tsuda, National Institute of Advanced Industrial Science and Technology (Japan) ..... [6532-16]

6532 continues on page 23

Tuesday 20 March

Conference 6523

continued

SESSION 4

Room: California ..... Tues. 9:20 to 10:00 am

Control of Systems with Hysteresis

Chair: **Kirsten Morris**, Univ. of Waterloo (Canada)

9:20 am: **Passivity-based control of magnetostrictive materials,** S. Valadkhan, K. Morris, A. Khajepour, Univ. of Waterloo (Canada) ..... [6523-17]

9:40 am: **Modeling and identification of the hysteretic dynamics of a MR actuator for its application to semiactive control of flexible structures,** N. Luo, M. Zapateiro, Univ. of Girona (Spain) ..... [6523-18]

Coffee Break ..... 10:00 to 10:30 am

6523 continues on page 24

Conference 6524

continued

SESSION 3

Room: Town & Country ..... Tues. 9:00 to 10:00 am

Ionic EAP I

Chairs: **John D. W. Madden**, The Univ. of British Columbia (Canada); **Minoru Taya**, Univ. of Washington

9:00 am: **Can we overcome the relaxation of ionic polymer-metal composite?,** D. Kim, K. J. Kim, Univ. of Nevada/Reno ..... [6524-09]

9:20 am: **Finite element simulations of the bending of the IPMC sheet,** D. Pugal, Univ. of Nevada/Reno and Tartu Ülikool (Estonia); H. Kasemägi, M. Kruusmaa, A. Aabloo, Tartu Ülikool (Estonia); K. J. Kim, Univ. of Nevada/Reno ..... [6524-67]

9:40 am: **Effect of charge redistribution on dynamic actuation of ionic polymer-metal composites,** L. Zhang, Y. Yang, Nanyang Technological Univ. (Singapore) ..... [6524-11]

Coffee Break ..... 10:00 to 10:30 am

Commemoration of Alberto Mazzoldi

6524 continues on page 24

Conference 6525

Session 4 and 8 run concurrently

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* DARPA - Current and Future Programs and Initiatives**, Don Leo, Defense Advanced Research Projects Agency (DARPA)

8:20 to 9:05 *Plenary Talk* **Piezoelectric Actuators - from IT/Robotics to Ecological/Energy**, Kenji Uchino, The Pennsylvania State Univ.

SESSION 4

Room: Royal Palm V ..... Tues. 9:00 to 10:00 am

Smart Aerospace Systems

Chairs: **Friedrich K. Straub**, The Boeing Co.; **Ephrahim Garcia**, Cornell Univ.

9:00 am: **Rapid manufacturing of symbiotic structures to significantly enhance space missions,** A. D. Williams, B. J. Arritt, Air Force Research Lab.; M. F. Diaz-Aguado, The Univ. of Texas at Austin ..... [6525-16]

9:20 am: **Hybrid acoustically layered foil (half) foam for improved low-frequency acoustic mitigation for launch fairings,** A. D. Williams, B. K. Henderson, Air Force Research Lab.; E. V. Ardelean, Science Applications International Corp.; D. Domme, Virginia Polytechnic Institute and State Univ. ..... [6525-17]

9:40 am: **Development of a SMA hybrid composite jet engine chevron concept,** T. L. Turner, R. H. Cabell, R. J. Cano, R. J. Silcox, NASA Langley Research Ctr. ..... [6525-18]

Coffee Break ..... 10:00 to 10:30 am

SESSION 8

Room: Royal Palm VI ..... Tues. 9:00 to 10:00 am

Damping and Isolation I

Chairs: **Wei-Hsin Liao**, The Chinese Univ. of Hong Kong (Hong Kong China); **Dimitris C. Lagoudas**, Texas A&M Univ.

9:00 am: **Nonlinear dynamics and chaos of a SMA passive vibration isolation and damping device,** L. G. Machado, D. C. Lagoudas, Texas A&M Univ. ..... [6525-34]

9:20 am: **On semi-active enhancement of the dissipation provided by piezoelectric films,** U. A. Korde, M. A. Wickersham, L. Kjerengtroen, South Dakota School of Mines and Technology; C. H. M. Jenkins, Montana State Univ. ..... [6525-35]

9:40 am: **Generation of quasi-resonance by variable damping,** D. Iba, A. Masuda, A. Sone, Kyoto Institute of Technology (Japan) ..... [6525-36]

Coffee Break ..... 10:00 to 10:30 am

6525 continues on page 24

Conference 6526

continued

SESSION 4

Room: Golden West ..... Tues. 9:00 to 10:00 am

Ferroelectrics IV

Chairs: **Abhijit Bhattacharyya**, Univ. of Arkansas/Little Rock; **Karla M. Mossi**, Virginia Commonwealth Univ.

9:00 am: **Studying the effects of temperature on energy harvesting using pre-stressed actuators,** P. Mane, K. M. Mossi, Virginia Commonwealth Univ. ..... [6526-18]

9:20 am: **Energy conversion in piezoelectric superlattices,** Y. Chou, M. Yang, National Taiwan Univ. (Taiwan) ..... [6526-19]

9:40 am: **Switching characteristics of (Bi0.5Na0.5)TiO3-BaTiO3-(Bi0.5K0.5)TiO3 lead-free ferroelectric ceramics,** J. Shieh, K. Wu, C. Chen, National Taiwan Univ. (Taiwan) ... [6526-20]

Coffee Break ..... 10:00 to 10:30 am

6526 continues on page 24

Tuesday 20 March

Conference 6527

continued

SESSION 4

Room: Royal Palm III ..... Tues. 9:00 to 10:00 am

Aircraft Applications

Chairs: **Jayanth N. Kudva**, NextGen Aeronautics, Inc.; **Brian P. Sanders**, Air Force Research Lab.

9:00 am: **Approaching morphing wing concepts on the basis of micro aerial vehicles,** C. Boller, C. M. Kuo, N. Qin, The Univ. of Sheffield (United Kingdom) ..... [6527-18]

9:20 am: **Shape morphing CMC skin for hypersonic applications,** S. L. dos Santos e Lucato, D. B. Marshall, O. H. Sudre, Rockwell Scientific Co., LLC ..... [6527-19]

9:40 am: **Application of self-repair to composite airplane components,** C. M. Dry, Natural Process Design, Inc. ..... [6527-20]

Coffee Break ..... 10:00 to 10:30 am

6527 continues on page 25

Conference 6529

Session 7 and 11 run concurrently

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* DARPA - Current and Future Programs and Initiatives**, Don Leo, Defense Advanced Research Projects Agency (DARPA)

8:20 to 9:05 *Plenary Talk* **Piezoelectric Actuators - from IT/Robotics to Ecological/Energy**, Kenji Uchino, The Pennsylvania State Univ.

SESSION 6

Room: Royal Palm I ..... Tues. 9:20 to 10:00 am

Monitoring Systems

Chairs: **Jina Kim**, Virginia Polytechnic Institute and State Univ.; **Amr M. Baz**, Univ. of Maryland/College Park

9:20 am: **A system-on-board approach for impedance-based structural health monitoring,** J. Kim, B. L. Grisso, D. S. Ha, D. J. Inman, Virginia Polytechnic Institute and State Univ. ..... [6529-22]

9:40 am: **Remote control of a morphing model aircraft with distributed sensors,** A. M. Baz, J. Smoker, Univ. of Maryland/College Park ..... [6529-23]

Coffee Break ..... 10:00 to 10:30 am

SESSION 10

Room: Royal Palm II ..... Tues. 9:00 to 10:00 am

Corrosion Detection

Chairs: **John S. Popovics**, Univ. of Illinois at Urbana-Champaign; **Chin-Hsiung Loh**, National Taiwan Univ. (Taiwan)

9:00 am: **Encoding sensing transduction mechanisms in SWNT thin films for strain and corrosion monitoring,** K. J. Loh, J. P. Lynch, Univ. of Michigan ..... [6529-41]

9:20 am: **A magnetic sensing approach to characterize corrosion in reinforced concrete,** J. S. Popovics, Univ. of Illinois at Urbana-Champaign ..... [6529-42]

9:40 am: **Estimation of general corrosion damage to steel reinforced mortar using high-frequency guided mechanical waves,** H. L. Reis, B. L. Ervin, J. T. Bernhard, D. A. Kuchma, Univ. of Illinois at Urbana-Champaign ..... [6529-43]

Coffee Break ..... 10:00 to 10:30 am

6529 continues on page 25

Conference 6530

continued

SESSION 4

Room: San Diego ..... Tues. 9:00 to 10:00 am

Sensing of Guided Waves I

Chairs: **James L. Blackshire**, Air Force Research Lab.; **Mannur J. Sundaresan**, North Carolina A&T State Univ.

9:00 am: **Effect of adhesive properties on elastic wave generation by bonded sensors,** S. A. Martin, NDE Computational Consultants; J. L. Blackshire, Air Force Research Lab. ..... [6530-18]

9:20 am: **Structural health monitoring in fuselage lap joints,** M. J. Sundaresan, North Carolina A&T State Univ. .. [6530-19]

9:40 am: **Disbonding effects on elastic wave generation and reception by bonded piezoelectric sensor systems,** J. L. Blackshire, Air Force Research Lab.; S. A. Martin, NDE Computational Consultants; J. K. Na, Univ. of Dayton Research Institute ..... [6530-20]

Coffee Break ..... 10:00 to 10:30 am

6530 continues on page 25

Conference 6532

continued

SESSION 4

Room: Royal Palm IV ..... Tues. 9:00 to 10:00 am

Guided Waves for SHM of Pipes and Rods

Chairs: **Victor Giurgiutiu**, Univ. of South Carolina; **Paul D. Panetta**, Luna Innovations, Inc.

9:00 am: **Guided wave based structural health monitoring of piping systems,** F. Schubert, B. B. F. Frankenstein, K. Froehlich, M. Kuettner, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); R. Petricevic, Neue Materialien Würzburg GmbH (Germany) ..... [6532-17]

9:20 am: **Parametric studies on attenuation of cylindrical guided-waves,** W. Na, J. Kim, D. Hong, Pukyong National Univ. (South Korea) ..... [6532-18]

9:40 am: **Optimization of the magnetic field for wide-band EMATs to increase the efficiency of the excitation and detection of guided ultrasonic waves traveling on metallic rods,** E. Twerdowski, W. Grill, Univ. Leipzig (Germany) ..... [6532-19]

Coffee Break ..... 10:00 to 10:30 am

6532 continues on page 25

Tuesday 20 March

Conference 6523

continued

SESSION 5

Room: California ..... Tues. 10:30 am to 12:10 pm

Robust Control

Chair: **Michael A. Demetriou**, Worcester Polytechnic Institute

10:30 am: **Active fault tolerant control of a flexible beam,** Y. Bai, K. M. Grigoriadis, G. Song, Univ. of Houston ..... [6523-19]

10:50 am: **An [infinity] upper bound approach for control of collocated structural systems,** M. Meisami-Azad, J. Mohammadpour, Univ. of Houston ..... [6523-20]

11:10 am: **Control and integrated design of smart material systems using analytical upper bound methods,** K. M. Grigoriadis, Univ. of Houston; M. A. Demetriou, Worcester Polytechnic Institute ..... [6523-21]

11:30 am: **Utilizing spatial robustness measures for the optimization of a PZT-actuated flexible beam,** M. A. Demetriou, Worcester Polytechnic Institute; K. M. Grigoriadis, Univ. of Houston ..... [6523-22]

11:50 am: **Active vibration control of piezoactuated structures using fast output sampling based sliding mode control,** M. Umapathy, A. Girija, G. Uma, National Institute of Technology/ Tiruchirappalli (India); B. Bandopadhyay, Indian Institute of Technology (India) ..... [6523-23]

Lunch/Exhibition Break . 12:10 to 2:00 pm

6523 continues on page 26

Conference 6524

continued

SESSION 4

Room: Town & Country ..... Tues. 10:40 am to 12:10 pm

Memorial Honoring of Alberto Mazzoldi

Chairs: **Danilo De Rossi**, Univ. degli Studi di Pisa (Italy); **Ray H. Baughman**, The Univ. of Texas at Dallas

10:40 am: **Contractile folded dielectric elastomer actuators *(Invited Paper),*** F. Carpi, F. Lorussi, D. De Rossi, Univ. degli Studi di Pisa (Italy) ..... [6524-12]

11:10 am: **Conducting polymer actuators: rate limits,** J. D. W. Madden, M. Cole, M. R. Warren, C. Michal, C. Tso, The Univ. of British Columbia (Canada) ..... [6524-13]

11:30 am: **From electrical to fuel-powered artificial muscles,** M. Kozlov, The Univ. of Texas at Dallas; J. Oh, The Univ. of Texas at Dallas and Pusan National Univ. (South Korea); T. Mirfakhrai, The Univ. of British Columbia (Canada); V. H. Ebron, Z. Yang, D. J. Seyer, H. Xie, J. Razal, L. J. Hall, M. Zhang, S. Fang, J. P. Ferraris, A. G. MacDiarmid, The Univ. of Texas at Dallas; J. D. W. Madden, The Univ. of British Columbia (Canada); R. H. Baughman, The Univ. of Texas at Dallas ..... [6524-14]

11:50 am: **Integrated cell-based sensors utilizing conjugated polymer actuators,** E. Smela, P. Abshire, Univ. of Maryland/ College Park ..... [6524-15]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6524 continues on page 26

Conference 6525

Session 5 and 9 run concurrently

SESSION 5

Room: Royal Palm V ..... Tues. 10:30 am to 12:10 pm

Biology-Inspired and Related Systems I

Chairs: **Daniel J. Inman**, Virginia Polytechnic Institute and State Univ.; **Ronald M. Barrett**, The Univ. of Kansas

10:30 am: **Ornithopter flight stabilization,** J. M. Dietl, E. Garcia, Cornell Univ. ..... [6525-19]

10:50 am: **Evolutionary flight and enabling smart actuator devices,** J. Manzo, E. Garcia, Cornell Univ. ..... [6525-20]

11:10 am: **Post-buckled precompressed (PBP) subsonic microflight control actuators and surfaces,** R. M. Barrett, R. Vos, The Univ. of Kansas; R. De Breuker, P. Tiso, Technische Univ. Delft (Netherlands) ..... [6525-21]

11:30 am: **Insect cyborgs: a new frontier in flight control systems,** T. Reissman, E. Garcia, Cornell Univ. ..... [6525-22]

11:50 am: **Perching aerodynamics and trajectory optimization,** A. M. Wickenheiser, E. Garcia, Cornell Univ. ..... [6525-23]

SESSION 9

Room: Royal Palm VI ..... Tues. 10:30 am to 12:10 pm

Damping and Isolation II

Chair: **Mehdi Ahmadian**, Virginia Polytechnic Institute and State Univ.

10:30 am: **On the effect of electrical uncertainties on resonant piezoelectric shunting,** M. Porfiri, Polytechnic Univ.; U. Andreaus, Univ. degli Studi di Roma (Italy) ..... [6525-37]

10:50 am: **Optimal piezoelectric switching shunts for vibration damping,** M. Neubauer, Leibniz Univ. Hannover (Germany); R. Oleskiewicz, Politechnika Koszalińska (Poland) ..... [6525-38]

11:10 am: **Shear thickening fluids as a tunable damping element: experimental results and modeling,** C. Fischer, École Polytechnique Fédérale de Lausanne (Switzerland); A. Bennani, Univ. de Claude Bernard Lyon I (France); P. Bourban, V. J. Michaud, C. J. G. Plummer, École Polytechnique Fédérale de Lausanne (Switzerland); E. Jacquelin, Univ. de Claude Bernard Lyon I (France); J. E. Månson, École Polytechnique Fédérale de Lausanne (Switzerland) ..... [6525-39]

11:30 am: **A numerical model for the prediction of the stiffness of a homogeneous electrostatically tunable multilayer beam,** A. E. Bergamini, R. E. Christen, M. Motavalli, EMPA (Switzerland) ..... [6525-40]

11:50 am: **Passive damping with magnetostrictive composite (autonomous materials),** J. R. Maly, J. C. Goodding, CSA Engineering, Inc.; G. P. Carman, C. A. Kerrigan, Univ. of California/Los Angeles; K. K. Ho, Fortis Technologies, Inc. ..... [6525-41]

Lunch/Exhibition Break ..... 12:10 to 1:30 pm

6525 continues on page 26

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Conference 6526

continued

SESSION 5

Room: Golden West ..... Tues. 10:30 am to 12:10 pm

Ferroelectrics V

Chairs: **Karla M. Mossi**, Virginia Commonwealth Univ.; **Zoubeida Ounaies**, Texas A&M Univ.

10:30 am: **Nonlinear electric reaction arising in dry bone subjected to 3-point bending,** G. Murasawa, Yamagata Univ. (Japan); H. Cho, Aoyama Gakuin Univ. (Japan); K. Ogawa, Kanazawa Univ. (Japan) ..... [6526-21]

10:50 am: **An experimental study of improving performance for unimorph piezoelectric actuator performance subjected to external loading,** N. Nguyen, K. Yoon, Konkuk Univ. (South Korea) ..... [6526-22]

11:10 am: **Life-span investigations of piezoceramic patch sensors,** M. M. Gall, B. Thielicke, Fraunhofer-Instituts für Werkstoffmechanik IWM (Germany) ..... [6526-23]

11:30 am: **Poly(vinylidene fluoride)/zinc oxide smart composite film for micro-air vehicle (MAV) morphing wing skin,** E. Ogut, Sabanci Univ. (Turkey); O. S. Yordem, Univ. of Massachusetts; M. Gulleroglu, Y. Menceloglu, M. Papila, Sabanci Univ. (Turkey) ..... [6526-24]

11:50 am: **Development of multilayer actuators with piezoelectric single crystals for an implantable hearing aid,** Y. Roh, I. Yun, Kyungpook National Univ. (South Korea) ..... [6526-25]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6526 continues on page 26

Tuesday 20 March

Conference 6527

continued

SESSION 5

Room: Royal Palm III ..... Tues. 10:30 am to 12:10 pm

Biological and Medical Applications

Chairs: **Ernie Havens**, Cornerstone Research Group, Inc.; **Ou Ma**, New Mexico State Univ.

10:30 am: **Development of PACS digital pump and implications for other industries,** M. Banister, S. Vohnout, Medipacs, LLC ..... [6527-21]

10:50 am: **A magnetorheological fluid-based controllable active knee brace,** J. L. Zite, F. Ahmadkhanlou, G. N. Washington, The Ohio State Univ. ..... [6527-22]

11:10 am: **Water cooling system using a piezoelectrically actuated flow pump inside a headlight system for medical applications,** R. F. Pires, P. H. Nakasone, Escola Politécnica da Univ. de São Paulo (Brazil); C. R. de Lima, INOVEO Automação de Sistemas (Brazil); E. C. N. Silva, Escola Politécnica da Univ. de São Paulo (Brazil) ..... [6527-23]

11:30 am: **Smart colonoscope with 3D shape detection capability,** L. Zhang, New Mexico State Univ.; J. Qian, Shanghai Univ. (China) ..... [6527-24]

11:50 am: **Bio-inspired flapping actuators based on concept of ferromagnetic shape memory alloy composite and hybrid mechanism,** R. Liang, M. Taya, Univ. of Washington; D. Chung, Korea Univ. of Technology and Education (South Korea) ..... [6527-25]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6527 continues on page 26

Conference 6529

Session 7 and 11 run concurrently

SESSION 7

Room: Royal Palm I ..... Tues. 10:30 am to 12:10 pm

Ultrasonics for SHM

Chairs: **Howard M. Matt**, Univ. of California/San Diego; **Mircea Badescu**, Jet Propulsion Lab.

10:30 am: **Enhanced passive and active damage detection by directional guided-wave piezocomposite transducers,** H. M. Matt, I. Bartoli, S. Salamone, F. Lanza di Scalea, Univ. of California/San Diego; P. Rizzo, Univ. of Pittsburgh ..... [6529-24]

10:50 am: **Lamb waves time-reversal method using frequency tuning technique for structural health monitoring,** B. Xu, V. Giurgiutiu, Univ. of South Carolina ..... [6529-25]

11:10 am: **Ultrasonic/sonic driller/corer as a hammer-rotary drill,** M. Badescu, Jet Propulsion Lab.; S. Kassab, Purdue Univ.; S. Sherrit, J. Aldrich, X. Bao, Y. Bar-Cohen, Z. Chang, Jet Propulsion Lab. ... [6529-26]

11:30 am: **Characterization of fiber Bragg gratings for multi-parameters sensing,** N. Mrad, Ministry of National Defence (Canada); A. Leshka, J. Albert, Carleton Univ. (Canada); G. Z. Xiao, National Research Council Canada (Canada) ..... [6529-27]

11:50 am: **Miniaturized sensors for intelligent system fault detection and diagnosis,** I. Kao, Stony Brook Univ. ..... [6529-28]

Lunch/Exhibition Break . 12:30 to 1:30 pm

SESSION 11

Room: Royal Palm II ..... Tues. 10:30 am to 12:30 pm

SHM for Civil Structures

Chairs: **Chin-An Tan**, Wayne State Univ.; **Jan-Ming Ko**, The Hong Kong Polytechnic Univ. (Hong Kong China)

10:30 am: **Semi-active flutter control of a high-aspect-ratio wing using multiple MR dampers,** J. Hu, L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China) ..... [6529-44]

10:50 am: **A video-assisted approach for health monitoring,** C. Tan, D. Ashebo, Wayne State Univ.; M. Feng, Y. Fukuda, Univ. of California/Irvine ..... [6529-45]

11:10 am: **Developing hybrid structural health monitoring via integrated global sensing and local infrared imaging,** H. T. Yang, Univ. of California/Santa Barbara; D. T. Ma, Univ. of Hawaii at Manoa; Q. He, X. Han, Wayne State Univ. ..... [6529-46]

11:30 am: **Application of XML database to autonomous configuration control and data transfer for sensor networks in buildings,** M. Shoji, A. Mita, Keio Univ. (Japan) ..... [6529-47]

11:50 am: **Scheduling of intelligent sensor and actuator network in flexible structures,** M. A. Demetriou, R. Potami, Worcester Polytechnic Institute . [6529-48]

12:10 pm: **A study of train intelligent measurement system using acceleration of train,** Y. Fujino, The Univ. of Tokyo (Japan); H. Ishii, Yokogawa Bridge Co. (Japan); Y. Mizuno, The Univ. of Tokyo (Japan); K. Kaito, The Univ. of Kyoto (Japan) ..... [6529-49]

Lunch/Exhibition Break . 12:30 to 1:30 pm

6529 continues on page 27

Conference 6530

continued

SESSION 5

Room: San Diego ..... Tues. 10:30 am to 12:10 pm

Applications of Sensor Systems to SHM I

Chairs: **Alexis Méndez**, MCH Engineering LLC; **Nobuo Takeda**, The Univ. of Tokyo (Japan)

10:30 am: **Demonstration of an instrumented patch,** M. J. Martinez, D. Backman, G. Renaud, National Research Council Canada (Canada) ..... [6530-21]

10:50 am: **Advanced disbond monitoring strategy in composites bonded repairs,** N. Mrad, Ministry of National Defence (Canada); G. Renaud, G. Z. Xiao, National Research Council Canada (Canada) ..... [6530-22]

11:10 am: **Small-diameter optical fiber and high-speed wavelength interrogator for FBG/PZT hybrid sensing system,** S. Komatsuzaki, S. Kojima, A. Hongo, Hitachi Cable, Ltd. (Japan); N. Takeda, The Univ. of Tokyo (Japan); T. Sakurai, R&D Institute of Metals and Composites for Future Industries (Japan) ..... [6530-23]

11:30 am: **Guided wave diagnosis in composite grid structure with embedded FBG sensors,** M. Amano, T. Arai, N. Takeda, The Univ. of Tokyo (Japan) ..... [6530-24]

11:50 am: **Quantification of impact damage in CMC thermal protection systems using thin-film piezoelectric sensors,** S. J. M. Kuhr, Univ. of Dayton Research Institute; J. L. Blackshire, K. V. Jata, Air Force Research Lab. ... [6530-25]

Lunch/Exhibition Break . 12:10 to 1:40 pm

6530 continues on page 27

Conference 6532

continued

SESSION 5

Room: Royal Palm IV ..... Tues. 10:30 am to 12:10 pm

Guided Waves for SHM III

Chairs: **Francesco Lanza di Scalea**, Univ. of California/San Diego; **Won-Bae Na**, Pukyong National Univ. (South Korea)

10:30 am: **Ultrasonic magnetostrictive transducers for guided ultrasonic waves in thin wires,** M. M. Kropf, B. R. Tittmann, The Pennsylvania State Univ. .... [6532-20]

10:50 am: **An improved technique for locating the point of impact from the acoustic emission data,** T. Kundu, S. Das, The Univ. of Arizona; K. V. Jata, Air Force Research Lab. ..... [6532-73]

11:10 am: **Analytical and experimental evaluation of piezoelectric wafer active sensors performances for Lamb waves based structural health monitoring in composite laminates,** B. S. Giola, Univ. of South Carolina; N. Chrysochoidis, Univ. of Patras (Greece); V. Giurgiutiu, Univ. of South Carolina; D. A. Saravanos, Univ. of Patras (Greece) ..... [6532-22]

11:30 am: **Sensitivity comparisons of layered Rayleigh wave and Love wave acoustic devices,** M. K. Pedrick, B. R. Tittmann, The Pennsylvania State Univ. ..... [6532-23]

11:50 am: **Application of Gabor transform on cylindrical guided waves to detect defects in underground pipes,** R. Ahmad, S. Banerjee, T. Kundu, The Univ. of Arizona ..... [6532-24]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6532 continues on page 27

Tuesday 20 March

Conference 6523

continued

SESSION 6

Room: California ..... Tues. 2:00 to 2:40 pm

Control Theory

Chair: **Scott W. Hansen**, Iowa State Univ.

2:00 pm: **Controllability of a multilayer Rao-Nakra beam with minimal number of boundary controls,** S. W. Hansen, Iowa State Univ. ..... [6523-25]

2:20 pm: **Adaptive active control of noise transmission in a strut system,** C. Liao, Univ. of Maryland/College Park; D. R. Mahapatra, Wilfrid Laurier Univ. (Canada); B. Balachandran, Univ. of Maryland/College Park ..... [6523-26]

Coffee Break ..... 2:40 to 3:30 pm

6523 continues on page 28

Conference 6524

continued

SESSION 5

Room: Town & Country ..... Tues. 1:30 to 3:10 pm

New and Other EAP I

Chairs: **Siavouche Nemat-Nasser**, Univ. of California/San Diego; **Qibing Pei**, Univ. of California/Los Angeles

1:30 pm: **Towards artificial molecular motor-based electroactive/photoactive biomimetic muscles *(Invited Paper)*,** T. J. Huang, The Pennsylvania State Univ. ..... [6524-16]

2:10 pm: **Description and characterization of an electroactive polymer synthetic jet actuator,** G. A. Slipher, J. E. Hubbard, Jr., Univ. of Maryland/College Park ..... [6524-17]

2:30 pm: **Linear artificial muscle actuator based on synthetic elastomer,** N. H. Chuc, K. M. Jung, J. K. Park, J. C. Koo, J. Nam, Y. K. Lee, H. Choi, Sungkyunkwan Univ. (South Korea) ..... [6524-18]

2:50 pm: **Investigation of electronechanical coupling and visco-elastic behavior of cellulose-based electro-active paper actuator,** C. Yang, Andong National Univ. (South Korea) and Inha Univ. (South Korea); L. Zhao, Y. Li, H. S. Kim, J. Kim, Inha Univ. (South Korea) ..... [6524-19]

Coffee Break ..... 3:10 to 3:40 pm

6524 continues on page 28

Conference 6525

continued

SESSION 6

Room: Royal Palm V ..... Tues. 1:30 to 3:10 pm

Biology-Inspired and Related Systems II

Chairs: **Alison B. Flatau**, Univ. of Maryland/College Park; **Hoon Cheol Park**, Konkuk Univ. (South Korea)

1:30 pm: **Chemo-electrical energy conversion of adenosine triphosphate,** V. B. Sundaresan, S. A. Sarles, D. J. Leo, Virginia Polytechnic Institute and State Univ. ..... [6525-24]

1:50 pm: **Force control of an electrorheological haptic device in virtual environment,** S. Choi, Y. Han, Inha Univ. (South Korea) ..... [6525-25]

2:10 pm: **Experiment and parametric study of an improved biomimetic robot fish actuated by piezoelectric actuators,** H. C. Park, S. Heo, N. Goo, T. Wiguna, Konkuk Univ. (South Korea) ..... [6525-26]

2:30 pm: **Design and development of a snake-like flexible robot,** R. M. John, J. M. Roshy, National Institute of Technology/Tiruchirappalli (India) ..... [6525-27]

2:50 pm: **A small and fast piezo-actuated hexapod robot,** S. Lee, A. Yumaryanto, J. An, Konkuk Univ. (South Korea) ..... [6525-28]

Coffee Break ..... 3:10 to 3:40 pm

6525 continues on page 28

Conference 6526

continued

SESSION 6

Room: Golden West ..... Tues. 1:30 to 3:10 pm

Magnetic Field-Based Multifunctional Composites

Chairs: **Christopher P. Henry**, Hughes Research Labs., LLC; **JiangYu Li**, Univ. of Washington

1:30 pm: **Magneto-elastic modeling of compostites with chain-structured magnetostrictive particles,** H. M. Yin, Univ. of Illinois at Urbana-Champaign; L. Sun, Univ. of California/Irvine .... [6526-26]

1:50 pm: **Giant magnetoelectric coupling effect in MPLC system,** C. Chang, G. P. Carman, Univ. of California/Los Angeles ..... [6526-27]

2:10 pm: **An investigation on granular-nanocomposite-based giant magnetoresistance (GMR) sensor,** Z. Guo, Univ. of California/Los Angeles; S. Wei, Louisiana State Univ.; S. S. Park, Univ. of California/Los Angeles; M. Moldovan, A. Karki, D. P. Young, Louisiana State Univ.; H. T. Hahn, Univ. of California/Los Angeles ..... [6526-28]

2:30 pm: **Generalized energy model for the behavior of magneto-electric composites,** J. Atulasimha, Univ. of Maryland/College Park; G. Akhras, Royal Military College of Canada (Canada); A. B. Flatau, Univ. of Maryland/College Park ..... [6526-29]

2:50 pm: **Magnetoelectric Green's functions and inclusion problems in a uniaxial multiferroic material,** J. Li, L. Li, Univ. of Washington ..... [6526-30]

Coffee Break ..... 3:10 to 3:40 pm

6526 continues on page 28

Conference 6527

continued

SESSION 6

Room: Royal Palm III ..... Tues. 1:30 to 3:10 pm

Automotive Applications

Chairs: **Anna-Maria R. McGowan**, NASA Langley Research Ctr.; **Janet M. Sater**, Institute for Defense Analyses

1:30 pm: **Smart structural components by the integration of sensor/actuator modules in die castings,** V. Braeutigam, C. Koerner, R. F. Singer, Univ. of Erlangen (Germany) ..... [6527-26]

1:50 pm: **The analysis of pulse driven multilayer piezoelectric actuators for diesel fuel injection,** Y. Kalish, Detroit Diesel Corp.; N. Henein, Wayne State Univ. [6527-27]

2:10 pm: **General Motors and the Univ. of Michigan Smart Materials and Structures Collaborative Research Lab.,** N. L. Johnson, General Motors Corp.; D. E. Brei, Univ. of Michigan ..... [6527-28]

2:30 pm: **Feasibility study of the dual-chamber SMART (SMA resetable lift) device,** J. E. Luntz, D. E. Brei, J. Radice, Univ. of Michigan; N. L. Johnson, A. L. Browne, K. A. Strom, General Motors Corp. ..... [6527-29]

2:50 pm: **Damping of vibrations with active carbon fiber structures,** R. Neugebauer, H. Roscher, H. Kunze, M. Riedel, Fraunhofer-Institut für Werkzeugmaschinen und Umformtechnik (Germany) ..... [6527-30]

Coffee Break ..... 3:10 to 3:40 pm

6527 continues on page 28

Tuesday 20 March

Conference 6529

Session 8 and 12 run concurrently

SESSION 8

Room: Royal Palm I ..... Tues. 1:30 to 3:10 pm

Modeling and Design of Smart Systems I

Chairs: **Philip W. Loveday**, Council for Scientific and Industrial Research (South Africa); **Steven A. Martin**, Consultant

1:30 pm: **Time domain simulation of piezoelectric excitation of guided waves in rails using waveguide finite elements,** P. W. Loveday, C. S. Long, Council for Scientific and Industrial Research (South Africa) ..... [6529-29]

1:50 pm: **FEM modeling of guided wave behavior in integrally stiffened plate structures,** S. A. Martin, NDE Computational Consultants; K. V. Jata, Air Force Research Lab. ..... [6529-30]

2:10 pm: **Sensing rich drive trains for modern mechatronic systems,** M. Tomizuka, Univ. of California/ Berkeley ..... [6529-31]

2:30 pm: **Fabrication and evaluation of hybrid glass/plastic optical fiber sensors for large strain measurement,** H. Huang, The Univ. of Texas at Arlington ..... [6529-32]

2:50 pm: **Fabrication and evaluation of a LPFG-based whitelight interferometric distance sensor,** H. Huang, The Univ. of Texas at Arlington ..... [6529-33]

Coffee Break ..... 3:10 to 3:40 pm

SESSION 12

Room: Royal Palm II ..... Tues. 1:30 to 3:10 pm

Data-Driven Techniques for SHM I

Chairs: **Jerome P. Lynch**, Univ. of Michigan; **Jin-Song Pei**, Univ. of Oklahoma

1:30 pm: **Reliable data management in a low-cost wireless structural sensing network,** Y. Wang, Stanford Univ.; J. P. Lynch, Univ. of Michigan; K. H. Law, Stanford Univ. ..... [6529-50]

1:50 pm: **Non-target image technique for spatial-temporal structural responses measurement,** C. C. Chang, Y. Ji, Hong Kong Univ. of Science and Technology (Hong Kong China) ..... [6529-51]

2:10 pm: **Flexibility-based structural damage identification using Gauss-Newton method,** C. Bilei, S. Nagarajaiah, Rice Univ. ..... [6529-52]

2:30 pm: **The slow-flow method of identification in nonlinear structural dynamics,** G. Kerschen, Univ. de Liège (Belgium); A. F. Vakakis, National Technical Univ. of Athens (Greece); Y. S. Lee, M. McFarland, L. A. Bergman, Univ. of Illinois at Urbana-Champaign ..... [6529-53]

2:50 pm: **Application of pattern recognition techniques to identify damage in different test specimens,** M. Gul, Univ. of Central Florida; F. N. Catbas, Drexel Univ.; M. Georgiopoulos, Univ. of Central Florida ..... [6529-54]

Coffee Break ..... 3:10 to 3:40 pm

6529 continues on page 29

Conference 6530

continued

SESSION 6

Room: San Diego ..... Tues. 1:40 to 3:00 pm

Applications of Sensor Systems to SHM II

Chairs: **Wolfgang Ecke**, Institut für Physikalische Hochtechnologie e.V. (Germany); **Zhi Zhou**, Harbin Institute of Technology (China)

1:40 pm: **Performance monitoring of a single-span integral-abutment bridge using a dense wireless sensor network,** M. V. Gangone, M. J. Whelan, M. P. Fuchs, K. D. Janoyan, Clarkson Univ. ... [6530-26]

2:00 pm: **Real-time wireless sensing with spatiotemporal tracking,** M. J. Whelan, K. D. Janoyan, Clarkson Univ. ..... [6530-27]

2:20 pm: **Multiple damage identification on a wind turbine blade using a structural neural system,** G. R. Kirikera, Northwestern Univ.; M. J. Schulz, Univ. of Cincinnati; M. J. Sundaresan, North Carolina A&T State Univ. ..... [6530-29]

2:40 pm: **The application of ultrasonic phased array technology to offshore platform structures inspection,** S. Baohua, Harbin Institute of Technology ..... [6530-30]

Coffee Break ..... 3:00 to 3:40 pm

6530 continues on page 29

Conference 6531

SESSION 1

Room: Royal Palm VI ..... Tues. 1:30 to 2:50 pm

Nondestructive Detection in Structural and Mechanical Systems

Chairs: **Bernhard R. Tittmann**, The Pennsylvania State Univ.; **Ming L. Wang**, Univ. of Illinois/Chicago

1:30 pm: **Damage assessment of composite laminate by using a fiber optic AE sensor based on fused-tapered coupler,** J. Leng, J. Hao, Harbin Institute of Technology (China) ..... [6531-01]

1:50 pm: **Sensing damage in an inaccessible area of a structure using frequency response functions,** X. Hou, S. Quek, National Univ. of Singapore (Singapore) ..... [6531-02]

2:10 pm: **An innovative MEMS microphone sensing array for structural health monitoring,** G. Feng, National Chung Cheng Univ. (Taiwan); H. Chung, Garnetex Corp. ..... [6531-04]

2:30 pm: **Soft matter acoustics,** A. Kamanyi, Jr., Univ. Leipzig (Germany); W. Ngwa, Univ. of Central Florida; W. Grill, Univ. Leipzig (Germany); T. Kundu, The Univ. of Arizona ..... [6531-05]

Coffee Break ..... 2:50 to 3:40 pm

6531 continues on page 29

Conference 6532

continued

SESSION 6

Room: Royal Palm IV ..... Tues. 1:30 to 3:10 pm

Damage Detection

Chairs: **Wolfgang Grill**, Univ. Leipzig (Germany); **Kumar V. Jata**, Air Force Research Lab.

1:30 pm: **Application of Hilbert-Huang transformation for detection of damage in concrete,** H. Wu, Wayne State Univ.; F. Pai, Univ. of Missouri/Columbia . [6532-25]

1:50 pm: **An improved DPSM technique for modelling ultrasonic fields in cracked solids,** S. Banerjee, T. Kundu, The Univ. of Arizona; D. Placko, École Normale Supérieure de Cachan (France) ..... [6532-26]

2:10 pm: **Advanced signal processing for structural identification: experiment studies,** J. Zhang, Kyoto Univ. (Japan) ..... [6532-27]

2:30 pm: **Analysis of bearing vibration signatures using empirical mode decomposition and Hilbert-Huang transform,** S. Haran, M. A. Davidson, Arkansas State Univ.; L. W. Salvino, Naval Surface Warfare Ctr. ..... [6532-28]

2:50 pm: **Application of information fusion and Shannon entropy in structural damage detection,** Y. Bao, H. Li, Harbin Institute of Technology (China) ..... [6532-29]

Coffee Break ..... 3:10 to 3:40 pm

6532 continues on page 29

Tuesday 20 March

Conference 6523

continued

SESSION 7

Room: California ..... Tues. 3:30 to 5:10 pm

Identification of Complex Structures

Chair: **Maurizio Porfiri**, Polytechnic Univ.

3:30 pm: **High-speed parameter estimation algorithms for nonlinear smart materials,** J. M. Ernstberger, R. C. Smith, North Carolina State Univ.[6523-28]

3:50 pm: **Tracking of transient displacements of plates with support excitations,** H. Irschik, M. Krommer, M. Nader, Johannes Kepler Univ. Linz (Austria) ..... [6523-29]

4:10 pm: **On the identification of modal couplings and inherent capacitances of piezoelectric structures,** C. Maurini, Univ. Pierre et Marie Curie (France); M. Porfiri, Polytechnic Univ.; J. Pouget, Univ. Pierre et Marie Curie (France) ..... [6523-30]

4:30 pm: **Anomaly identification in complex structures using model free data statistical analysis,** D. Posenato, Smartec SA (Switzerland); F. Lanata, Univ. degli Studi di Genova (Italy) ..... [6523-31]

4:50 pm: **Parameter estimation in active laminated plate structures,** C. M. Mota Soares, Instituto Superior Técnico (Portugal); A. L. Araujo, Institute Politecnico de Braganca (Portugal); J. Herskovits, Univ. Federal do Rio de Janeiro (Brazil) ..... [6523-32]

6523 continues on page 34

Conference 6524

continued

SESSION 6

Room: Town & Country ..... Tues. 3:40 to 5:20 pm

New and Other EAP II

Chairs: **Jae-Do Nam**, Sungkyunkwan Univ. (South Korea); **Qibing Pei**, Univ. of California/Los Angeles

3:40 pm: **Attempting a classification for electrical polymeric actuators *(Invited Paper),*** T. Fernandez-Otero, J. López-Cascales, A. J. Fernández Romero, Univ. Politécnica de Cartagena (Spain) ..... [6524-20]

4:20 pm: **Epoxy hydrogels as sensors and actuators,** P. D. Calvert, P. Patra, D. Duggal, Univ. of Massachusetts [6524-21]

4:40 pm: **New electrode materials for dielectric elastomer actuators,** Q. Pei, Univ. of California/Los Angeles .. [6524-22]

5:00 pm: **Large response photo-activated polymer gel actuator,** M. Banister, Medipacs, LLC ..... [6524-23]

6524 continues on page 34

Conference 6525

continued

SESSION 7

Room: Royal Palm V ..... Tues. 3:40 to 5:00 pm

Shape Memory Materials and Applications

Chairs: **Farhan Gandhi**, The Pennsylvania State Univ.; **Fred van Keulen**, Technische Univ. Delft (Netherlands)

3:40 pm: **Effects of processing parameters on the shape memory effect of a porous shape memory polymer,** S. L. Simkevitz, H. E. Naguib, Univ. of Toronto (Canada) ..... [6525-29]

4:00 pm: **Microscale damping using thin film NiTi,** C. A. Kerrigan, G. P. Carman, Univ. of California/Los Angeles .. [6525-30]

4:20 pm: **Design optimization of shape memory alloy active structures using the R-phase transformation,** M. Langelaar, F. van Keulen, Technische Univ. Delft (Netherlands) ..... [6525-31]

4:40 pm: **Dynamic behavior of a pseudoelastic vibration absorber,** T. C. Elias, E. P. da Silva, Univ. de Brasília (Brazil) ..... [6525-33]

6525 continues on page 34

Conference 6526

continued

SESSION 7

Room: Golden West ..... Tues. 3:40 to 6:00 pm

Multifuncional Polymers

Chairs: **L. Catherine Brinson**, Northwestern Univ.; **Lisa M. Weiland**, Univ. of Pittsburgh

3:40 pm: **Effect of crosslinking on the shape recovery of shape memory polymer networks,** E. Wornyo, K. A. Gall, F. Yang, W. P. King, Georgia Institute of Technology ..... [6526-31]

4:00 pm: **Strain recovery characterization of a shape memory polymer,** X. Wu, Wayne State Univ.; J. R. Mabesa, Jr., U.S. Army Tank-Automotive Research, Developmentand Engineering Ctr. ..... [6526-32]

4:20 pm: **Improving RIS theory for application to mechanical properties prediction,** F. Gao, L. M. Weiland, Univ. of Pittsburgh ..... [6526-33]

4:40 pm: **Study on electrical conductivity and dielectric properties of doped polyaniline,** S. Chen, North Carolina A&T State Univ. ..... [6526-34]

5:00 pm: **Evaluating the mechanical integrity of bilayer lipid membranes using a high-precision pressurization system,** D. Hopkinson, Virginia Polytechnic Institute and State Univ.; D. J. Leo, DARPA ..... [6526-35]

5:20 pm: **Electrochemical flux and mechanical back-relaxation in ionic polymer transducers,** B. J. Akle, Virginia Polytechnic Institute and State Univ.; T. Wallmersperger, Univ. Stuttgart (Germany); D. J. Leo, DARPA; B. H. Kröplin, Univ. Stuttgart (Germany) ..... [6526-36]

5:40 pm: **Self-repairing of composites for increased durability and vulnerability reduction in vehicles,** C. M. Dry, Natural Process Design, Inc. ..... [6526-37]

6526 continues on page 34

Conference 6527

continued

SESSION 7

Room: Royal Palm III ..... Tues. 3:40 to 5:00 pm

Energy Harvesting and Absorption Applications

Chairs: **Douglas K. Lindner**, Virginia Polytechnic Institute and State Univ.; **Xiaoyan Gong**, Nitinol Devices and Components

3:40 pm: **Novel impact-based peak-energy locking piezoelectric generators for munitions,** J. S. Rastegar, R. Murray, Omnitek Partners, LLC; C. M. Pereira, H. Nguyen, U.S. Army Armament Research, Development and Engineering Ctr. ..... [6527-31]

4:00 pm: **Novel piezoelectric energy-harvesting power sources for gun-fired munitions,** J. S. Rastegar, R. Murray, Omnitek Partners, LLC; C. M. Pereira, H. Nguyen, U.S. Army Armament Research, Development and Engineering Ctr. ..... [6527-32]

4:20 pm: **Novel vibration-based electrical energy generators for low and variable speed turbo-machinery,** J. S. Rastegar, R. Murray, Omnitek Partners, LLC ..... [6527-33]

4:40 pm: **Shock load mitigation using magnetorheological energy absorber with bifold valves,** M. Mao, W. Hu, N. M. Wereley, Univ. of Maryland/College Park; A. L. Browne, J. C. Ulicny, General Motors Corp. ..... [6527-34]

Tuesday 20 March

Conference 6529

Session 9 and 13 run concurrently

SESSION 9

Room: Royal Palm I ..... Tues. 3:40 to 5:40 pm

Novel Sensors III

Chairs: **Irving J. Oppenheim**, Carnegie Mellon Univ.; **Niell G. Elvin**, Michigan State Univ.

3:40 pm: **Development of a MEMS acoustic emission sensor system,** I. J. Oppenheim, D. W. Greve, W. Wu, Carnegie Mellon Univ. ..... [6529-34]

4:00 pm: **A wire-guided transducer for acoustic emission sensing,** I. J. Oppenheim, D. W. Greve, I. T. Neill, Carnegie Mellon Univ. ..... [6529-35]

4:20 pm: **A sub-microwatt self-powered fatigue sensor operating,** N. G. Elvin, N. Lajnef, S. Chakrabartty, Michigan State Univ.; A. Elvin, Univ. of the Witwatersrand (South Africa) ..... [6529-36]

4:40 pm: **A linear peristaltic MRF/foam actuator,** C. H. M. Jenkins, J. J. Larsen, Montana State Univ.; U. A. Korde, South Dakota School of Mines and Technology ..... [6529-37]

5:00 pm: **Dynamic deformation sensing and electrical stiffness tuning in ferromagnetic shape memory Ni-Mn-Ga,** N. N. Sarawate, M. J. Dapino, The Ohio State Univ. ..... [6529-39]

5:20 pm: **Co-located fiber-optic temperature sensor and extensometer for high temperature strain measurements,** S. M. Klute, R. S. Fielder, Luna Innovations, Inc. ..... [6529-40]

SESSION 13

Room: Royal Palm II ..... Tues. 3:40 to 5:40 pm

Data-Driven Techniques for SHM II

Chairs: **Jerome P. Lynch**, Univ. of Michigan; **Jin-Song Pei**, Univ. of Oklahoma

3:40 pm: **Integrated structural health monitoring system with interactively retrieved sensor data,** Y. Zhang, J. Li, Lehigh Univ. ..... [6529-55]

4:00 pm: **Real-time condition assessment of the Bill Emerson cable-stayed bridge using artificial neural networks,** W. Wang, G. Chen, Univ. of Missouri/Rolla ..... [6529-56]

4:20 pm: **Experimental verification of a bivariate regressive adaptive index for structural health monitoring,** S. Su, T. L. Kijewski-Correa, Univ. of Notre Dame ..... [6529-57]

4:40 pm: **Some data-driven modeling approaches for detecting changes in nonlinear dampers,** H. A. Yun, S. F. Masri, F. Tasbihgoo, R. W. Wolfe, Univ. of Southern California ..... [6529-58]

5:00 pm: **Reduced surface wave transmission function and neural networks for crack evaluation of concrete structures,** S. Shin, C. Yun, Korea Advanced Institute of Science and Technology (South Korea); H. Furuta, Kansai Univ. (Japan); J. S. Popovics, Univ. of Illinois at Urbana-Champaign [6529-59]

5:20 pm: **A heuristic neural network initialization scheme for modeling nonlinear restoring forces: continuous development,** J. Pei, E. C. Mai, Univ. of Oklahoma ..... [6529-60]

6529 continues on page 35

Conference 6530

continued

SESSION 7

Room: San Diego ..... Tues. 3:40 to 6:00 pm

Embedded Sensors: Modeling and Structural Integrity

Chairs: **Joseph Grant**, NASA Stennis Space Ctr.; **Yi Huang**, Univ. of California/San Diego

3:40 pm: **Effects of embedded SHM sensors on the structural integrity of glass fiber/epoxy laminates under in-plane loads,** F. Ghezzo, S. Nemat-Nasser, Univ. of California/San Diego ..... [6530-31]

4:00 pm: **Structural integrity of composite laminates with embedded micro-sensors,** Y. Huang, Univ. of California/San Diego ..... [6530-32]

4:20 pm: **Intelligent FRP retrofits for critical civil infrastructures,** G. Jiang, K. J. Peters, North Carolina State Univ. ..... [6530-33]

4:40 pm: **Interface transferring mechanism and error modification of OFBG strain sensor based on mono-scalar isotropic damage constitutive model,** J. Li, Z. Zhou, Harbin Institute of Technology (China); J. Ou, Dalian Univ. of Technology (China) ..... [6530-34]

5:00 pm: **Study on the production process and physical and mechanical performance of FRTP-OFBG (fiber reinforced thermoplastic polymer-optic fiber Bragg gratings) rods,** C. Wang, Z. Zhou, Harbin Institute of Technology (China) ..... [6530-35]

5:20 pm: **A new kind of high range FBG strain sensor based on Mechanical sensing-coefficient decreasing method,** Z. Zhou, Harbin Institute of Technology (China) ..... [6530-36]

5:40 pm: **FBG sensors used in dynamic NDE of space flight COPV,** J. Grant, NASA Stennis Space Ctr.; C. E. Banks, NASA Marshall Space Flight Ctr. ..... [6530-37]

6530 continues on page 35

Conference 6531

continued

SESSION 1 (continued)

Room: Royal PalmVI ..... Tues. 3:40 to 5:40 pm

3:40 pm: **Quantification of damage detection schemes using receiver operating characteristic (ROC) curves,** S. T. Trickey, M. E. Seaver, J. M. Nichols, Naval Research Lab. ..... [6531-06]

4:00 pm: **Nondestructive detection of delamination and debonding of CFRP by a laser-based ultrasonic visualization method,** J. Takatsubo, S. Yashiro, H. Tsuda, N. Toyama, J. Lee, AIST (Japan); T. Ogisu, Fuji Heavy Industries Ltd. (Japan) ..... [6531-07]

4:20 pm: **Smart plug-and-play system for satellites,** A. Kumar, Acellent Technologies, Inc.; B. J. Arritt, Air Force Research Lab.; R. Hannum, S. J. Beard, X. Qing, Acellent Technologies, Inc. [6531-08]

4:40 pm: **Possibility of electrical discharge pulse sound for hammering test,** Y. Akematsu, K. Kageyama, N. Mohri, H. Murayama, M. Kanai, The Univ. of Tokyo (Japan) ..... [6531-09]

5:00 pm: **A wavelength multiplexed interferometric inertial sensor network for nondestructive evaluation and distributed monitoring,** M. A. Perez, A. M. Shkel, Univ. of California/Irvine .. [6531-10]

5:20 pm: **Integrated acoustic emission/vibration sensor for detecting damage in aircraft drive train components,** V. F. Godínez-Azcuaga, Physical Acoustics Corp.; D. Ozevin, Lehigh Univ. and Physical Acoustics Corp.; R. D. Finlayson, Physical Acoustics Corp.; A. Anastassopoulos, A. Tsimogiannis, Envirocoustics (Greece) ..... [6531-11]

6531 continues on page 35

Conference 6532

continued

SESSION 7

Room: Royal Palm IV ..... Tues. 3:40 to 6:00 pm

Nonlinear Methods in SHM

Chairs: **Michael D. Todd**, Univ. of California/San Diego; **Douglas E. Adams**, Purdue Univ.

3:40 pm: **Chaotic and ambient vibration analysis of composite lap joint damage,** L. M. Pecora, J. A. Nichols, M. E. Seaver, S. T. Trickey, S. Motley, Naval Research Lab. ..... [6532-30]

4:00 pm: **Development of higher-order spectra for randomly excited quadratic nonlinear systems: Volterra functional series approach,** P. Marzocca, Clarkson Univ.; J. M. Nichols, M. E. Seaver, S. T. Trickey, Navy Research Lab.; A. Milanese, Clarkson Univ. ..... [6532-33]

4:20 pm: **Exploring the sensitivity of the auto-bispectrum as a nonlinearity detector,** J. M. Nichols, Naval Research Lab.; P. Marzocca, Clarkson Univ.; S. T. Trickey, M. E. Seaver, Naval Research Lab. ..... [6532-31]

4:40 pm: **Identification of damage in a suspension component using narrowband and broadband nonlinear signal processing techniques,** D. E. Adams, M. Haroon, Purdue Univ. ..... [6532-32]

5:00 pm: **Damage identification through generalized correlations between measurements,** L. A. Overbey, M. D. Todd, Univ. of California/San Diego ..... [6532-34]

5:20 pm: **Tailored stochastic signals and comparison metrics for structural health monitoring via evolutionary programming,** C. C. Olson, M. D. Todd, Univ. of California/San Diego ..... [6532-35]

5:40 pm: **Estimation of structural parameters of nonlinear structural system with unknown excitation and limited observations,** Y. Lei, Xiamen Univ. (China); J. P. Lynch, Univ. of Michigan; W. A. Shen, Y. Song, Xiamen Univ. (China) ..... [6532-36]

6532 continues on page 35

Tuesday 20 March - Posters

✔ Posters-Tuesday

The following posters will be displayed in the formal Poster Session and Exhibition Reception on Tuesday evening from 6:00 to 7:30 pm. Authors will be present during this time for discussion. Poster authors will be able to set up their poster papers between 10:00 am and 4:00 pm Tuesday. Poster papers can be previewed until 4:00 pm. The hall will then be closed until the formal poster session begins at 6:00 pm.

✔ **Mechanical properties of ionic polymer-metal composites,** I. Park, D. Kim, S. Kim, K. J. Kim, Univ. of Nevada/ Reno ..... [6524-10]

✔ **Thermomechanical characterization of shape memory polymers,** B. Atli, F. Gandhi, The Pennsylvania State Univ. ..... [6524-65]

✔ **EAP hydrogels for pulse-actuated cell system (PACS) architectures,** D. V. McGrath, The Univ. of Arizona; M. Banister, Medipacs, LLC; R. E. Plata, The Univ. of Arizona ..... [6524-68]

✔ **IPMC-assisted miniature disposable infusion pumps with embedded computer control,** S. Vohnout, Medipacs, LLC; S. Kim, Univ. of Nevada/ Reno; M. Banister, Medipacs, LLC; K. J. Kim, R. Tiwari, I. Park, Univ. of Nevada/Reno[6524-69]

✔ **Development of dielectric elastomer driven micro-optical zoom lens system,** H. S. Kim, K. M. Jung, J. K. Park, J. C. Koo, H. Choi, J. Nam, Y. K. Lee, Sungkyunkwan Univ. (South Korea) ..... [6524-70]

✔ **Modeling a dielectric elastomer actuator based on the McKibben muscle,** T. G. McKay, The Univ. of Auckland (New Zealand); E. P. Calius, Industrial Research Ltd. (New Zealand); I. A. Anderson, The Univ. of Auckland (New Zealand) ..... [6524-72]

✔ **Characterization of direct and converse piezoelectricity of cellulose-based electro-active paper,** G. Y. Yun, Y. Li, H. S. Kim, J. Kim, Inha Univ. (South Korea) ..... [6524-73]

✔ **Micro-ball valves driven by dielectric elastomers,** C. Fu, National Tsing Hua Univ. (Taiwan) ..... [6524-74]

✔ **Dynamic actuation and sensing behavior of dielectric elastomer membranes,** J. W. Fox, N. C. S. Goulbourne, Virginia Polytechnic Institute and State Univ. ..... [6524-75]

✔ **Conducting polypyrrole bimorph actuators in saline water,** Q. Pei, Univ. of California/Los Angeles[6524-76]

✔ **Polypyrrole actuator operating voltage limits in aqueous sodium hexafluorophosphate,** T. Shoa, J. D. W. Madden, M. Cole, The Univ. of British Columbia (Canada); V. X. D. Yang, Sunnybrook and Women's Health Sciences Ctr. (Canada) ..... [6524-77]

✔ **Nonlinear dynamics of an electroactive polymer beam in presence of charge transport,** D. R. Mahapatra, J. Yang, R. V. N. Melnik, Wilfrid Laurier Univ. (Canada); B. Balachandran, Univ. of Maryland/College Park ..... [6524-78]

✔ **Electrically driven mechanochemical artificial muscle: for smooth 3D movement in robotics and prosthetics,** L. Rasmussen, Ras Labs. LLC ..... [6524-79]

✔ **Extending applications of dielectric elastomer artificial muscle,** S. Chiba, SRI International (Japan); M. Waki, Hyper Drive Corp. (Japan); R. D. Kornbluh, R. Pelrine, SRI International ..... [6524-80]

✔ **In-plane vibration of membrane strips and sheets with piezoelectric actuation and sensing,** U. A. Korde, E. A. Petersen, D. Daugaard, South Dakota School of Mines and Technology ..... [6525-82]

✔ **Optimal excitation of a cylindrical shell by piezoelectric actuators,** L. Zhang, Y. Yang, Nanyang Technological Univ. (Singapore) ..... [6525-84]

✔ **A new designing concept for multifunctional structural material systems,** H. Asanuma, T. Nakata, T. Chiba, Chiba Univ. (Japan) ..... [6525-86]

✔ **Development of SMH actuator system using hydrogen-absorbing alloys,** T. Kwon, K. Kim, D. Pang, S. Lee, Y. Kim, N. Kim, Chonbuk National Univ. (South Korea) ..... [6525-87]

✔ **Alleviation of wind shear damage by materials,** T. C. Fan, Univ. of Washington ..... [6525-88]

✔ **A magneto-rheological grease (MRG) damper,** F. Gordaninejad, M. Miller, X. Wang, H. Sahin, Univ. of Nevada/Reno[6525-89]

✔ **Deformation behavior of polycrystalline Galfenol at elevated temperatures,** L. M. Cheng, A. Nolting, R. Ham-Su, Defence Research and Development Canada (Canada); M. A. Gharghouri, National Research Council of Canada (Canada) ..... [6526-44]

✔ **Creeping polarization and remanent strain in ferroelectrics under uniaxial electromechanical loading,** Q. Liu, Univ. of Cambridge (United Kingdom); J. E. Huber, Univ. of Oxford (United Kingdom) ..... [6526-92]

✔ **Fatigue of cracked PZT ceramics in three-point bending under electric fields,** F. Narita, Y. Shindo, F. Saito, Tohoku Univ. (Japan) [6526-93]

✔ **The derivation and simulation of an improved 2D constitutive model for shape memory alloys,** W. Wang, S. Yan, Shenyang Architectural Univ. (China) ..... [6526-94]

✔ **Nonlinear cracking of magneto-electro-elastic coupling fracture,** B. Wang, The Univ. of Sydney (Australia) ..... [6526-95]

✔ **Synthesis and characterization of low cost magnetorheological (MR) fluids,** V. K. Sukhwani, H. Hirani, Indian Institute of Technology Bombay (India) ..... [6526-96]

✔ **Resin flow monitoring in vacuum-assisted resin transfer molding using opticcal fiber distributed sensor,** S. Eum, The Univ. of Tokyo (Japan)[6526-98]

✔ **A combined NDE/FEA approach,** L. J. Ghosn, A. Abdul-Aziz, S. V. Raj, R. W. Rauser, NASA Glenn Research Ctr. ..... [6526-99]

✔ **Investigation of mechanical conductive properties of shape memory composite,** J. Leng, X. Lan, D. Zhang, Y. Liu, Harbin Institute of Technology (China) ..... [6526-100]

✔ **Influence of cross-linking degree on shape memory effect of styrene copolymer,** D. Zhang, X. Lan, Y. Liu, J. Leng, H. Lu, Harbin Institute of Technology (China) [6526-101]

✔ **New high-performance piezoelectric actuator,** F. Jensen, B. Andersen, C. Goueffon, Noliac A/S (Denmark) ..... [6526-102]

✔ **Overlapping platelets prevent microcracking: a study on fracture resistance of nano-biocomposites,** A. S. Nair, S. M. Sivakumar, G. K. Suraishkumar, Indian Institute of Technology Madras (India) ..... [6526-103]

✔ **Multifunctional devices using shape memory alloy coated by piezo-electric film,** H. Sato, National Institute of Advanced Industrial Science and Technology (Japan) [6526-104]

✔ **A study on mechanical properties of nafion fabricated by hot-pressing method,** S. J. Kim, Seoul National Univ. (South Korea) ..... [6526-105]

✔ **Multiscale analysis of active fiber reinforced composites with random material properties,** S. S. Padhee, D. K. Harursampath, Indian Institute of Science (India) ..... [6526-106]

✔ **Bill Armstrong Memorial Session: micromagnetic study on the Martensite variant rearrangement in ferromagnetic shape memory alloys,** Y. Ma, J. Li, Univ. of Washington ..... [6526-107]

✔ **Reversible field-induced phase transformation in Ni2MnGa with large actuation stress and work output,** I. Karaman, H. E. Karaca, B. Basaran, Texas A&M Univ. ..... [6526-108]

✔ **The effect of grain refinement via equal channel angular extrusion on the thermomechanical response of a NiTi alloy,** B. Kockar, I. Karaman, Texas A&M Univ. ..... [6526-109]

✔ **A thermo-hydraulic wax actuation system for high force and large displacement applications,** C. S. Long, Univ. of Pretoria (South Africa) and CSIR (South Africa); P. W. Loveday, CSIR (South Africa) ..... [6527-36]

✔ **Microwave power transmission of flexible dipole rectenna for smart sensors and devices,** J. Kim, S. Y. Yang, Inha Univ. (South Korea); K. D. Song, Norfolk State Univ.; S. H. Choi, NASA Langley Research Ctr. ..... [6528-20]

✔ **Immobilization of ε-polylysine onto the probe surface for molecular adsorption type endotoxin detection system,** K. Ooe, A. Tsuji, Ritsumeikan Univ. (Japan); N. Nishishita, Y. Hirano, Osaka Institute of Technology (Japan) ..... [6528-22]

✔ **Dynamic simulation of microresonator-based differential pressure sensor,** G. Uma, M. Umapathy, M. Shanmugavalli, National Institute of Technology/Tiruchirappalli (India) ..... [6528-25]

✔ **Variable structure control of flexible smart structure with shape memory alloy actuators,** K. Dhanalakshmi, M. Umapathy, C. Chandravathanam, D. Ezhalarasi, National Institute of Technology/Tiruchirappalli (India) ..... [6528-26]

Tuesday 20 March - Posters

✔ Posters-Tuesday

The following posters will be displayed in the formal Poster Session and Exhibition Reception on Tuesday evening from 6:00 to 7:30 pm. Authors will be present during this time for discussion. Poster authors will be able to set up their poster papers between 10:00 am and 4:00 pm Tuesday. Poster papers can be previewed until 4:00 pm. The hall will then be closed until the formal poster session begins at 6:00 pm.

- ✔ **The design of a novel biaxial shape memory alloy-based system,** K. K. Leang, J. Dodson, R. Mohr, Virginia Commonwealth Univ. ..... [6528-33]
- ✔ **Cylindrical nanocavity and nanowire electrodes for redox cycle dopamine sensing: design, fabrication, and characterization,** P. Hankins, H. Yoon, V. K. Varadan, Univ. of Arkansas ..... [6528-45]
- ✔ **Glucose sensing based on Pt-MWCNT and MWCNT,** L. Aryasomayajula, J. Xie, S. Wang, V. K. Varadan, Univ. of Arkansas..... [6528-46]
- ✔ **Synthesis and photonic property study of ZnO nanowires for a real time photodynamic therapy monitoring probe,** S. Dubakka, J. Xie, V. K. Varadan, J. K. Abraham, Univ. of Arkansas ..... [6528-47]
- ✔ **On the size-dependent behavior of the micro-wire in the micro-tensile test,** S. Ko, B. Jung, H. Lee, H. Park, Pohang Univ. of Science and Technology (South Korea) ..... [6528-54]
- ✔ **Autonomous materials: developing smart liquids based on nanoporous technologies,** Y. Qiao, A. Han, Univ. of California/San Diego [6528-61]
- ✔ **Laser interferometric sensor for seismic wave measurement,** R. De Rosa, Univ. degli Studi di Napoli Federico II (Italy); F. Acernese, Univ. degli Studi di Salerno (Italy); F. Garufi, Univ. degli Studi di Napoli Federico II (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy) ..... [6529-139]
- ✔ **Comparison of sensor placement methods in structural health monitoring of civil structures,** D. Li, Dalian Univ. of Technology (China) ..... [6529-140]
- ✔ **A fiber optic sensor for web edge detection,** A. Seshadri, P. R. Pagilla, Oklahoma State Univ. ..... [6529-141]
- ✔ **An astable multivibrator formed by a novel NDRHBT,** P. Niu, Tianjin Polytechnic Univ. (China); W. Guo, Tianjin Univ. (China); C. Miao, X. Yu, W. Wang, Tianjin Polytechnic Univ. (China); H. Qi, S. Zhang, Tianjin Univ. (China) ..... [6529-142]
- ✔ **Modeling of bimorph piezoelectric cantilever beam for voltage generation,** J. Ajitsaria, S. Choe, D. Kim, D. Shen, Auburn Univ. [6529-143]
- ✔ **Safety research on glass furnace crown based on tension test,** Y. Deng, G. Dou, Tsinghua Univ. (China)[6529-144]
- ✔ **Lateral mode piezoelectric dual oscillator sensors for health monitoring of civil infrastructures,** Y. Roh, D. Kim, I. Yun, Kyungpook National Univ. (South Korea) ..... [6529-146]
- ✔ **Determination of the size and the location of subsurface defect by lock-in thermography,** K. Kang, M. Choi, J. Park, Korea Research Institute of Standards and Science (South Korea); W. Kim, Kongju National Univ. (South Korea) ..... [6530-57]
- ✔ **Image processing for NDT of electrode profile in resistance spot welding,** A. I. Al-Shamma'a, J. D. Cullen, A. Shaw, Liverpool John Moores Univ. (United Kingdom)[6530-58]
- ✔ **Hybrid control and acquisition system for distributed sensors for environmental monitoring,** F. Garufi, Univ. degli Studi di Napoli Federico II (Italy); F. Acernese, Univ. degli Studi di Salerno (Italy); A. Boiano, Istituto Nazionale di Fisica Nucleare (Italy); R. De Rosa, Univ. degli Studi di Napoli Federico II (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy)[6530-59]
- ✔ **Stress analysis and fatigue limit evaluation of plate with notch by lock-in thermography,** W. Kim, Kongju National Univ. (South Korea); M. Choi, J. Park, K. Kang, Korea Research Institute of Standard and Science (South Korea) ..... [6530-60]
- ✔ **Battery-free system for wireless sensor network,** J. Huang, Ferro Solutions, Inc.; D. C. Bono, R. C. O'Handley, Massachusetts Institute of Technology ..... [6530-61]
- ✔ **Optical fiber gratings for structural health monitoring in high-temper-ature environments,** R. J. Black, K. K. Chau, G. Chen, B. M. Moslehi, L. Oblea, K. Sourichanh, Intelligent Fiber Optic Systems Inc. ..... [6530-62]
- ✔ **High-speed, high-resolution fiber Bragg grating matrix structural health monitoring system,** K. K. Chau, Intelligent Fiber Optic Systems Inc.; P. Qiao, W. Lestari, Washington State Univ.; R. J. Black, B. M. Moslehi, Intelligent Fiber Optic Systems Inc. ..... [6530-63]
- ✔ **High-resolution extended distance distributed fiber-optic sensing using Rayleigh backscatter,** S. T. Kreger, R. G. Duncan, D. K. Gifford, M. E. Froggatt, M. Wolfe, A. K. Sang, R. J. Seeley, B. J. Soller, Luna Innovations, Inc. ..... [6530-64]
- ✔ **High-accuracy fiber-optic position tracking,** R. G. Duncan, M. T. Raum, M. E. Froggatt, D. K. Gifford, A. K. Sang, R. J. Seeley, S. T. Kreger, M. Wolfe, B. J. Soller, Luna Innovations, Inc. ..... [6530-65]
- ✔ **Temperature compensation for CFRP sensors,** C. Yang, Z. Wu, H. Huang, Ibaraki Univ. (Japan) ..... [6530-66]
- ✔ **Integrated sensor system for smart materials: multidisciplinary approach using COTS optic fiber sensors; design, validation and calibration in aeronautical components area,** A. M. Calabro, Italian Aerospace Research Ctr CIRA (Italy); L. Mazzola, C. Caneva, Univ. degli Studi di Roma/La Sapienza (Italy) ..... [6530-67]
- ✔ **Remote assessment of new bridge deck systems using wireless sensors,** Y. K. Cho, G. Morcous, J. Youn, Univ. of Nebraska/ Lincoln ..... [6532-69]
- ✔ **Real-time long term measurement using integrated framework for ubiquitous smart monitoring,** G. Heo, G. Lee, Konyang Univ. (South Korea); W. Lee, J. Jeon, Chungnam National Univ. (South Korea); P. Kim, Konyang Univ. (South Korea) ..... [6532-70]
- ✔ **Evaluation of dermal segment on viscoelasticity measurement of skin by rheometer,** T. Nemoto, National Institute for Longevity Sciences (Japan) ..... [6532-71]
- ✔ **Study on damage identification of high-rise buildings,** S. Yu, Xiamen Univ. (China) ..... [6532-72]

Tuesday 20 March - NSF Posters

NSF Posters

The following posters are part of a special NSF Poster Session and will be displayed in the formal Poster Session and Exhibition Reception on Tuesday evening from 6:00 to 7:30 pm. Authors will be present during this time for discussion. Poster authors will be able to set up their poster papers between 10:00 am and 4:00 pm Tuesday. Poster papers can be previewed until 4:00 pm. The hall will then be closed until the formal poster session begins at 6:00 pm.

✔ **Piezoelectric paint sensor for ultrasonic NDE,** Y. Zhang, X. Li, Lehigh Univ. ..... [6529-03]

✔ **Robust structural damage detection using piezoelectric actuator and Lamb wave approach,** J. Tang, Univ. of Connecticut ..... [6529-05]

✔ **Monitoring the setting times and strength gain of mortar using one-sided ultrasonic guided wave approach,** H. L. Reis, J. L. Borgerson, Univ. of Illinois at Urbana-Champaign ..... [6529-07]

✔ **Estimation of adhesive bond strength in laminated safey glass,** H. L. Reis, S. Huo, Univ. of Illinois at Urbana-Champaign ..... [6529-10]

✔ **Integrating broadband high-fidelity acoustic emission sensors and array processing to study drying shrinkage cracking in concrete,** G. C. McLaskey, S. D. Glaser, Univ. of California/Berkeley; C. U. Grosse, Univ. Stuttgart (Germany) ..... [6529-11]

✔ **Microfabrication of a wall shear-stress sensor using side-implanted piezoresistive tethers,** Y. Li, T. Nishida, D. Arnold, M. Sheplak, Univ. of Florida ..... [6529-13]

✔ **A microfluidic biosensor for bacteria detection and identification,** D. A. Boehm, P. Gottlieb, S. Z. Hua, Univ. at Buffalo ..... [6529-15]

✔ **Ferroelectric thin-film active sensor arrays for structural health monitoring,** B. Lin, Univ. of South Carolina; A. S. Bhalla, The Pennsylvania State Univ.; C. Chen, The Univ. of Texas at San Antonio; V. Giurgiutiu, Univ. of South Carolina; J. Jiang, The Univ. of Texas at Arlington; R. Guo, The Pennsylvania State Univ. ..... [6529-16]

✔ **Surface stress sensors for detection of chemical and biological species,** P. Shrotriya, K. Kang, J. Marquardt, Iowa State Univ. ..... [6529-20]

✔ **A system-on-board approach for impedance-based structural health monitoring,** J. Kim, B. L. Grisso, D. S. Ha, D. J. Inman, Virginia Polytechnic Institute and State Univ. ..... [6529-22]

✔ **Remote control of a morphing model aircraft with distributed sensors,** A. M. Baz, J. Smoker, Univ. of Maryland/College Park ..... [6529-23]

✔ **Enhanced passive and active damage detection by directional guided-wave piezocomposite transducers,** H. M. Matt, I. Bartoli, S. Salamone, F. Lanza di Scalea, Univ. of California/San Diego; P. Rizzo, Univ. of Pittsburgh ..... [6529-24]

✔ **Lamb waves time-reversal method using frequency tuning technique for structural health monitoring,** B. Xu, V. Giurgiutiu, Univ. of South Carolina ..... [6529-25]

✔ **Miniaturized sensors for intelligent system fault detection and diagnosis,** I. Kao, Stony Brook Univ. ..... [6529-28]

✔ **Sensing rich drive trains for modern mechatronic systems,** M. Tomizuka, Univ. of California/Berkeley ..... [6529-31]

✔ **Fabrication and evaluation of hybrid glass/plastic optical fiber sensors for large strain measurement,** H. Huang, The Univ. of Texas at Arlington ..... [6529-32]

✔ **Fabrication and evaluation of a LPFG-based whitelight interferometric distance sensor,** H. Huang, The Univ. of Texas at Arlington ..... [6529-33]

✔ **Development of a MEMS acoustic emission sensor system,** I. J. Oppenheim, D. W. Greve, W. Wu, Carnegie Mellon Univ. ..... [6529-34]

✔ **A wire-guided transducer for acoustic emission sensing,** I. J. Oppenheim, D. W. Greve, I. T. Neill, Carnegie Mellon Univ. ..... [6529-35]

✔ **Encoding sensing transduction mechanisms in SWNT thin films for strain and corrosion monitoring,** K. J. Loh, J. P. Lynch, Univ. of Michigan ..... [6529-41]

✔ **A magnetic sensing approach to characterize corrosion in reinforced concrete,** J. S. Popovics, Univ. of Illinois at Urbana-Champaign ..... [6529-42]

✔ **Estimation of general corrosion damage to steel reinforced mortar using high-frequency guided mechanical waves,** H. L. Reis, B. L. Ervin, J. T. Bernhard, D. A. Kuchma, Univ. of Illinois at Urbana-Champaign ..... [6529-43]

✔ **A video-assisted approach for health monitoring,** C. Tan, Wayne State Univ.; Y. Chen, M. Feng, Y. Fukuda, Univ. of California/Irvine ..... [6529-45]

✔ **Scheduling of intelligent sensor and actuator network in flexible structures,** M. A. Demetriou, R. Potami, Worcester Polytechnic Institute ..... [6529-48]

✔ **Reliable data management in a low-cost wireless structural sensing network,** Y. Wang, Stanford Univ.; J. P. Lynch, Univ. of Michigan; K. H. Law, Stanford Univ. ..... [6529-50]

✔ **Integrated structural health monitoring system with interactively retrieved sensor data,** Y. Zhang, J. Li, Lehigh Univ. ..... [6529-55]

✔ **Reduced surface wave transmission function and neural networks for crack evaluation of concrete structures,** S. Shin, C. Yun, Korea Advanced Institute of Science and Technology (South Korea); H. Furuta, Kansai Univ. (Japan); J. S. Popovics, Univ. of Illinois at Urbana-Champaign ..... [6529-59]

✔ **A heuristic neural network initialization scheme for modeling nonlinear restoring forces: continuous development,** J. Pei, E. C. Mai, Univ. of Oklahoma ..... [6529-60]

✔ **The detection of hydrogen with a nanotube structured sensor,** H. Gu, A. Polar, Univ. of Illinois/Chicago; H. Wang, Argonne National Lab.; E. Indacochea III, M. L. Wang, Univ. of Illinois/Chicago ..... [6529-61]

✔ **Piezoresistive and piezoelectric MEMS strain sensors for vibration detection,** S. Kon, K. Oldham, R. Horowitz, Univ. of California/Berkeley ..... [6529-94]

✔ **Monitoring pavement condition using "smart dust" under surge time sychronization,** R. A. Ivey, Auburn Univ.; J. Pei, H. Lin, Jr., A. R. Landrum, C. J. Sandburg, T. King, M. M. Zaman, H. H. Refai, Univ. of Oklahoma; O. Oshlake, Rutgers Univ.; A. Heriba, South Dakota School of Mines and Technology; E. Hurt, Univ. of Oklahoma ..... [6529-97]

✔ **Optimization studies of self-sensing composites,** K. L. Schaaf, P. M. Rye, A. Starr, S. Nemat-Nasser, Univ. of California/San Diego ..... [6529-98]

✔ **Signal processing of multiplexed intrinsic Fabry-Perot interferometric fiber optic sensors,** F. Shen, M. Han, A. Wang, Virginia Polytechnic Institute and State Univ. ..... [6529-103]

Tuesday 20 March - NSF Posters

NSF Posters

The following posters are part of a special NSF Poster Session and will be displayed in the formal Poster Session and Exhibition Reception on Tuesday evening from 6:00 to 7:30 pm. Authors will be present during this time for discussion. Poster authors will be able to set up their poster papers between 10:00 am and 4:00 pm Tuesday. Poster papers can be previewed until 4:00 pm. The hall will then be closed until the formal poster session begins at 6:00 pm.

✔ **Localization and recovery of damage in plate structures through sensitivity enhancing feedback control,** C. Li, L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China); F. Yuan, North Carolina State Univ. ..... [6529-104]

✔ **Studying the effect of coupling materials in sonic IR imaging,** X. Han, R. Yu, Wayne State Univ. ..... [6529-105]

✔ **Omnidirectional guided wave PWAS phased array for thin-wall structure damage detection,** L. Yu, V. Giurgiutiu, J. Kendall, Univ. of South Carolina ..... [6529-107]

✔ **Polymer optical fiber sensors for civil infrastructure systems,** S. Kiesel, O. Abdi, K. J. Peters, M. Kowalsky, T. Hassan, North Carolina State Univ. ..... [6529-109]

✔ **In situ measurement of conductivity and temperature during concrete curing using passive wireless sensors,** M. M. Andringa, J. M. Puryear, D. P. Neikirk, S. L. Wood, The Univ. of Texas at Austin ..... [6529-120]

✔ **Low-cost wireless sensors for civil infrastructure,** J. M. Puryear, M. M. Andringa, S. L. Wood, D. P. Neikirk, The Univ. of Texas at Austin ..... [6529-121]

✔ **Wireless real-time monitoring of soil and soil-structure systems,** T. Abdoun, Rensselaer Polytechnic Institute; A. Abe, Tokyo Soil Research Co., Ltd. (Japan); V. G. Bennett, Rensselaer Polytechnic Institute; L. A. Danisch, Measurand, Inc. (Canada); M. Sato, National Research Institute for Earth Science and Disaster Prevention (Japan); K. Tokimatsu, Tokyo Institute of Technology (Japan); J. Ubilla, Rensselaer Polytechnic Institute ..... [6529-122]

✔ **Finite element simulation of piezoelectric wafer active sensors for structural health monitoring with coupled, filed, and boundary-infinite elements,** W. Liu, V. Giurgiutiu, Univ. of South Carolina ..... [6529-125]

✔ **Non-contact rail flaw detection system: first field test,** P. Rizzo, Univ. of Pittsburgh; S. Coccia, I. Bartoli, F. Lanza di Scalea, Univ. of California/San Diego; M. A. Fateh, Federal Railroad Administration ... [6529-129]

✔ **Reference-free transducer and system diagnosis and beyond,** H. Sohn, D. W. Greve, I. J. Oppenheim, S. B. Kim, S. Lee, S. Kim, A. Boscha, Carnegie Mellon Univ. ..... [6529-130]

✔ **Energy harvesting by magnetostrictive material (MsM) for powering wireless sensors in SHM,** L. Wang, F. Yuan, North Carolina State Univ. ..... [6529-135]

✔ **Structural health monitoring utilizing Intel's Imote2 wireless sensor platform,** B. F. Spencer, Jr., T. Nagayama, J. A. Rice, Univ. of Illinois at Urbana-Champaign ..... [6529-137]

✔ **Application of wireless sensing and control system to control,** C. Loh, K. Lu, Y. Lin, National Taiwan Univ. (Taiwan); P. Lin, National Ctr. for Research on Earthquake Engineering (Taiwan); J. P. Lynch, Univ. of Michigan ..... [6529-138]

✔ **Application of zonal model on indoor air sensor network design,** Y. H. Chen, J. Wen, Drexel Univ. ..... [6529-147]

✔ **Molecular luminescence sensing for global strain measurement,** J. P. Hubner, The Univ. of Alabama at Tuscaloosa ..... [6529-148]

✔ **Active nonlinear feedback system interrogation and system augmentation for sensing and damage detection,** S. Yin, K. X. D'Souza, S. Frangakis, G. Kress, B. I. Epureanu, Univ. of Michigan ..... [6529-149]

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Wednesday 21 March

Conference 6523

continued

SESSION 8

Room: California ..... Wed. 9:00 to 10:00 am

Wavelets

Chair: **Katherine J. Jones**, Rice Univ.

9:00 am: **Wavelet-based signal processing applied to deformable mirror PZT actuators for wavefront control,** K. J. Jones, Rice Univ. ..... [6523-33]

9:20 am: **Damage assessment of ATWO-SPAN RC slab using wavelet analysis,** X. Zhu, H. Hao, The Univ. of Western Australia (Australia) ..... [6523-34]

9:40 am: **Numerical modeling and simulations for optical sensor location in damage detection with Lamb waves,** B. C. Lee, W. J. Staszewski. The Univ. of Sheffield (United Kingdom) ..... [6523-45

Coffee Break ..... 10:00 to 10:30 am

6523 continues on page 36

Conference 6524

continued

SESSION 7

Room: Town & Country ..... Wed. 9:00 to 10:00 am

EAP Characteristics and Database

Chairs: **Toribio Fernandez-Otero**, Univ. Politécnica de Cartagena (Spain); **Kwang J. Kim**, Univ. of Nevada/Reno

9:00 am: **Electro-active polymer actuator database *(Invited Paper)*,** J. D. W. Madden, G. Hsu, P. Cheng, D. Irwin, The Univ. of British Columbia (Canada) ..... [6524-24]

9:40 am: **Intriguing electroactive behavior of nanostructured polymers,** R. Shankar, T. K. Ghosh, R. J. Spontak, North Carolina State Univ. ..... [6524-25]

Coffee Break ..... 10:00 to 10:30 am

6524 continues on page 36

Conference 6525

continued

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* NSF - Current and Future Programs and Initiatives**, Shih-Chi Liu, National Science Foundation (NSF)

8:20 to 9:05 *Plenary Talk* **Revolutionary Transitions of GE Technology in NDE Prognostics and Health Monitoring**, Ed Hindle, GAEA Technologies (Canada)

SESSION 10

Room: Royal Palm V ..... Wed. 9:00 to 10:00 am

Autonomous Materials I

Chair: **Donald J. Leo**, Defense Advanced Research Projects Agency

9:00 am: **DARPA initiatives in autonomous materials,** D. J. Leo, Defense Advanced Research Projects Agency ..... [6525-42]

9:20 am: **Fluidic flexible matrix composites for autonomous structural tailoring: for special session on autonomous materials and material systems,** Y. Shan, M. K. Philen, C. E. Bakis, K. Wang, C. D. Rahn, The Pennsylvania State Univ. ..... [6525-43]

9:40 am: **Microfluidic systems for reconfigurable RF surfaces and systems,** T. Larry, M. L. Van Blaricum, Toyon Research Corp. ..... [6525-44]

Coffee Break ..... 10:00 to 10:30 am

6525 continues on page 36

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Conference 6526

continued

SESSION 8

Room: Golden West ..... Wed. 9:00 to 10:00 am

Bill Armstrong Memorial Session I

Chairs: **Marc Kamlah**, Forschungszentrum Karlsruhe (Germany); **Martin L. Dunn**, Univ. of Colorado/Boulder

Keynote

9:00 am: **Design of active nanocomposites,** M. Taya, Univ. of Washington ..... [6526-38]

9:40 am: **Instrumented indentation of shape memory polymers,** M. L. Dunn, H. J. Qi, Univ. of Colorado/Boulder ..... [6526-39]

Coffee Break ..... 10:00 to 10:30 am

6526 continues on page 36

Conference 6528

continued

SESSION 1

Room: Royal Palm III ..... Wed. 9:00 to 9:30 am

Keynote Lecture

Chair: **Vijay K. Varadan**, Univ. of Arkansas

Keynote

9:00 am: **MEMS based phased array for army applications,** P. B. Ruffin, U.S. Army Aviation and Missile Research, Development and Engineering Ctr. ..... [6528-55]

SESSION 2

Room: Royal Palm III ..... Wed. 9:30 am to 10:10 pm

Nanowire and Nanotube

Chairs: **Vijay K. Varadan**, Univ. of Arkansas; **Mehrdad N. Ghasemi-Nejhad**, Univ. of Hawaii at Manoa

9:30 am: **Elastic and magneto-elastic modeling of galfenol nanowires (autonomous materials),** C. Mudivarthi, P. R. Downey, A. B. Flatau, Univ. of Maryland/College Park ..... [6528-62]

9:50 am: **Bio-inspired electric cilia development for biomedical applications: use of ionic electro-active polymer, nanowire arrays, and micro-stereo-lithography,** H. Yoon, V. Ramachandran, D. Deshpande, V. K. Varadan, Univ. of Arkansas ..... [6528-41]

Coffee Break ..... 10:10 to 10:30 am

6528 continues on page 36

Wednesday 21 March

Conference 6529

Session 14 and 18 run concurrently

Conference 6530

continued

Conference 6531

continued

Conference 6532

continued

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* NSF - Current and Future Programs and Initiatives**, Shih-Chi Liu, National Science Foundation (NSF)

8:20 to 9:05 *Plenary Talk* **Revolutionary Transitions of GE Technology in NDE Prognostics and Health Monitoring**, Ed Hindle, GAEA Technologies (Canada)

SESSION 14

Room: Royal Palm I ..... Wed. 9:00 to 10:00 am

Damage Detection

Chairs: **Tian-Wei Ma**, Univ. of Hawai'i at Manoa; **Irving J. Oppenheim**, Carnegie Mellon Univ.

9:00 am: **The detection of hydrogen with a nanotube structured sensor,** H. Gu, A. Polar, Univ. of Illinois/Chicago; H. Wang, Argonne National Lab.; E. Indacochea III, M. L. Wang, Univ. of Illinois/Chicago ..... [6529-61]

9:20 am: **Parameter estimation techniques for multi-story civil structure monitoring and modeling,** T. Ma, N. Xu, Univ. of Hawai'i at Manoa ..... [6529-62]

9:40 am: **Fatigue crack detection in a plate girder using Lamb waves,** I. J. Oppenheim, D. W. Greve, W. Wu, P. Zheng, Carnegie Mellon Univ. ..... [6529-63]

Coffee Break ..... 10:00 to 10:30 am

SESSION 18

Room: Royal Palm II ..... Wed. 9:00 to 10:00 am

Structural Control

Chairs: **Shi Yan**, Shenyang Architectural and Civil Engineering Univ. (China); **Genda Chen**, Univ. of Missouri/Rolla

9:00 am: **Seismic response control of two-storey frame structure braced with shape memory alloy tendons,** S. Yan, Shenyang Architectural and Civil Engineering Univ. (China); G. Song, Univ. of Houston; L. Huo, Dalian Univ. of Technology (China) ..... [6529-80]

9:20 am: **Mass-variable TLD systems and their seismic effectiveness for building response control,** Y. Xin, G. Chen, Univ. of Missouri/Rolla ..... [6529-81]

9:40 am: **Non-model based vibration control of stay cables using MR damper,** M. Liu, Harbin Institute of Technology (China); G. Song, Univ. of Houston; H. Li, Harbin Institute of Technology (China) ..... [6529-82]

Coffee Break ..... 10:00 to 10:30 am

6529 continues on page 37

SESSION 8

Room: San Diego ..... Wed. 9:00 to 10:00 am

Sensing of Guided Waves II

Chairs: **Norbert G. Meyendorf**, Univ. of Dayton; **Bernd B. F. Frankenstein**, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany)

9:00 am: **Investigation of bond quality effects on piezoelectric sensing of impact damage,** J. K. Na, Univ. of Dayton Research Institute; J. L. Blackshire, Air Force Research Lab. ..... [6530-38]

9:20 am: **Eddy current enhancement for EMATs,** S. B. Palmer, S. M. Dixon, X. Jian, The Univ. of Warwick (United Kingdom) ..... [6530-39]

9:40 am: **Network for structural health monitoring in avionic applications,** B. B. F. Frankenstein, L. Schubert, F. Schubert, J. Augustin, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany) ..... [6530-40]

Coffee Break ..... 10:00 to 10:40 am

6530 continues on page 37

SESSION 2

Room: Royal Palm VI ..... Wed. 9:00 to 11:50 am

Nondestructive Evaluation in Composite Materials and Aerospace Engineering

Chairs: **Lizhi Sun**, Univ. of California/Irvine; **James C. Leslie**, Advanced Composite Products and Technology, Inc.

9:00 am: **Prospective economic analysis of a cluster of NIST/ATP programs in advanced composites with applications in the automotive, petroleum, and civil infrastructure,** H. F. Wu, National Institute of Standards and Technology .... [6531-12]

9:20 am: **Challenge of smart drilling technology: the use of composite materials increase the availability of oil and gas and reduce the cost of drilling and production operations,** J. C. Leslie, Advanced Composite Products and Technology, Inc. ..... [6531-13]

9:40 am: **Single crystal piezoelectric composites for advanced NDE ultrasound,** X. Jiang, K. A. Snook, W. S. Hackenberger, X. Geng, TRS Technologies, Inc. ..... [6531-14]

Coffee Break ..... 10:00 to 10:30 am

6531 continues on page 37

SESSION 8

Room: Royal Palm IV ..... Wed. 9:00 to 10:00 am

Novel Instrumentatioin and Sensing I

Chairs: **Sridhar Krishnaswamy**, Northwestern Univ.; **Won-Bae Na**, Pukyong National Univ. (South Korea)

9:00 am: **Flexible ultrasonic array sensors for health monitoring,** M. Kobayashi, National Research Council Canada (Canada); Q. Liu, K. Wu, McGill Univ. (Canada); C. Jen, J. Kuo, National Research Council Canada (Canada) ..... [6532-37]

9:20 am: **Development of a composite UAV wing test-bed for structural health monitoring research,** J. A. Oliver, J. B. Kosmatka, Univ. of California/San Diego ..... [6532-38]

9:40 am: **Effect on detection sensitivity for smart washer configuration, and ambient temperature characteristics on bolted joint,** T. Tanaka, M. Okugawa, Gifu National College of Technology (Japan) ..... [6532-39]

Coffee Break ..... 10:00 to 10:30 am

6532 continues on page 37

Wednesday 21 March

Conference 6523

continued

SESSION 9

Room: California ..... Wed. 10:30 to 11:50 am

Algorithms for Damage Detection

Chair: **Aditi Chattopadhyay**, Arizona State Univ.

10:30 am: **Cepstral smoothing based methodology for diagnostics of bearing impacts,** J. N. Chi, Cummins, Inc. ..... [6523-36]

10:50 am: **Hidden Markov model based classification of structural damage,** N. Kovvali, A. Papandreou-Suppappola, D. Cochran, A. Chattopadhyay, Arizona State Univ. ..... [6523-37]

11:10 am: **Quantum wave packets in fuzzy automata and neural associative memories,** G. G. Rigatos, Industrial Systems Institute (Greece) ..... [6523-38]

11:30 am: **Cable 3D nonlinear model and damping systems on stayed bridges,** R. C. Alvarado, Univ. Autónoma de Querétaro (Mexico); F. J. Carrión, Instituto Mexicano del Transporte (Mexico) ..... [6523-39]

Lunch/Exhibition Break 11:50 am to 1:30 pm

6523 continues on page 38

Conference 6524

continued

SESSION 8

Room: Town & Country ..... Wed. 10:30 am to 12:10 pm

Ionic EAP II

Chairs: **Jaehwan Kim**, Inha Univ. (South Korea); **Roy D. Kornbluh**, SRI International

10:30 am: **Polypyrrole linear actuators for use in biomimetic systems,** T. A. Fofonoff, I. W. Hunter, Massachusetts Institute of Technology ..... [6524-26]

10:50 am: **Chemo-electric characterization and modeling of the high surface area electrodes in ionic polymer transducers,** T. Wallmersperger, Univ. Stuttgart (Germany); B. J. Akle, Virginia Polytechnic Institute and State Univ.; E. Akle, American Univ. of Beirut (Lebanon); D. J. Leo, Virginia Polytechnic Institute and State Univ. ..... [6524-27]

11:10 am: **Manufacturing of ionic polymer-metal composites (IPMCs) that can actuate into complex curves,** B. L. Stoimenov, The Institute of Physical and Chemical Research (RIKEN) (Japan); J. M. Rossiter, Univ. of Bristol (United Kingdom) and The Institute of Physical and Chemical Research (RIKEN) (Japan); T. Mukai, The Institute of Physical and Chemical Research (RIKEN) (Japan) ..... [6524-28]

11:30 am: **Mixed-ion linear actuation of PPy and PEDOT in propylene carbonate-triflate electrolyte,** R. Kiefer, J. Travas-Sejdic, P. A. Kilmartin, G. A. Bowmaker, R. P. Cooney, The Univ. of Auckland (New Zealand) ..... [6524-29]

11:50 am: **Synthesis and characterization of porous polyaniline conductive polymers,** A. D. Price, W. Chen, H. E. Naguib, Univ. of Toronto (Canada) ..... [6524-30]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6524 continues on page 38

Conference 6525

continued

SESSION 11

Room: Royal Palm V ..... Wed. 10:30 am to 12:10 pm

Autonomous Materials II

Chair: **Donald J. Leo**, Defense Advanced Research Projects Agency

10:30 am: **RADAR absorbing colloidal suspensions (RACS),** C. R. Stoldt, Univ. of Colorado/Boulder; D. C. Walther, A. P. Pisano, Univ. of California/Berkeley; M. H. B. Stowell, Univ. of Colorado/Boulder ..... [6525-45]

10:50 am: **Circulatory system for unmanned air vehicles(autonomous materials),** S. C. Narang, Shakti Technologies, Inc. ..... [6525-46]

11:10 am: **Bio-inspired living skin for biofouling resistance and drag reduction,** R. Ganguli, V. Mehrotra, Rockwell Scientific Co., LLC; M. Peter, B. S. Dunn, Univ. of California/Los Angeles ..... [6525-47]

11:30 am: **Full-scale flight tests of an autonomous morphing structure using SMA actuators,** J. H. Mabe, F. T. Calkins, R. T. Ruggeri, The Boeing Co. ... [6525-48]

11:50 am: **Reversible control on anisotropic electrical conductivity,** A. Beskok, M. Bevan, Z. Ounaies, D. C. Lagoudas, P. Bahukudumbi, J. Steuber, W. N. Everett, Texas A&M Univ. ..... [6525-49]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6525 continues on page 38

Conference 6526

continued

SESSION 9

Room: Golden West ..... Wed. 10:30 am to 12:10 pm

Bill Armstrong Memorial Session II

Chairs: **Ralph C. Smith**, North Carolina State Univ.; **Geoffrey P. McKnight**, Hughes Research Labs., LLC

10:30 am: **Bill Armstrong Memorial Session: magnetostrictive research at UCLA,** G. P. Carman, Univ. of California/Los Angeles ..... [6526-40]

10:50 am: **Bill Armstrong Memorial Session: design and testing of variable stiffness composites for structural reconfiguration applications,** G. P. McKnight, C. Henry, Hughes Research Labs., LLC ..... [6526-41]

11:10 am: **Armstrong's contribution to the modelling of magnetostrictive materials *(Presentation Only)*,** J. Atulasimha, A. B. Flatau, Univ. of Maryland/College Park ..... [6526-42]

11:30 am: **Free energy model for magnetization with thermal relaxation in stress-annealed Galfenol alloys,** P. G. Evans, M. J. Dapino, The Ohio State Univ. ..... [6526-43]

11:50 am: **Efficient inverse compensation for hysteresis via homogenized energy models,** T. R. Braun, R. C. Smith, North Carolina State Univ. ..... [6526-87]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6526 continues on page 38

Conference 6528

continued

Session 2 (continued)

Room: Royal Palm III ..... Wed. 10:30 to 12:20 am

10:30 am: **Packaging of an iron-gallium (galfenol) nanowire acoustic sensor,** R. Jain, P. McCluskey, A. Flatau, Univ. of Maryland/College Park; B. J. H. Stadler, Univ. of Minnesota ..... [6528-63]

Keynote

10:50 am: **Autonomous multifunctional nanobrushes (autonomous materials),** M. N. Ghasemi-Nejhad, A. Cao, Univ. of Hawaii at Manoa ..... [6528-96]

11:20 am: **Autonomous carbon nanotube and shape memory yarn, sheet, and wire systems (autonomous materials),** R. H. Baughman, M. Zhang, S. Fang, A. A. Zakhidov, M. Kozlov, V. H. Ebron, Z. Yang, D. J. Seyer, The Univ. of Texas at Dallas; J. Oh, The Univ. of Texas at Dallas and Pusan National Univ. (South Korea); L. J. Hall, H. Xie, J. P. Ferraris, A. G. MacDiarmid, J. Razal, The Univ. of Texas at Dallas; A. B. Dalton, Univ. of Surrey (United Kingdom); E. Munoz, The Univ. of Texas at Dallas; V. R. Coluci, D. S. Galvao, Univ. Estadual de Campinas (Brazil); S. O. Dantas, Univ. Federal de Juiz de Fora (Brazil) . [6528-52]

11:40 am: **Impingement, adhesion, and size-scale effects of single polymeric nanofibers,** M. Shin, S. Kim, H. Lee, S. I. Kim, S. Kim, Hanyang Univ. (South Korea) ..... [6528-08]

12:00 pm: **Feasibility studies of carbon nanotube composites for vibration damping and control,** W. Liao, R. Dai, The Chinese Univ. of Hong Kong (Hong Kong China) ..... [6528-89]

Lunch/Exhibition Break . 12:20 to 1:30 pm

6528 continues on page 38

Wednesday 21 March

Conference 6529

Session 15 and 19 run concurrently

SESSION 15

Room: Royal Palm I ..... Wed. 10:30 to 11:50 am

Fiber Optic Sensors for SHM I

Chairs: **Edgar A. Mendoza**, Redondo Optics; **Henry C. H. Li**, Cooperative Research Ctr. for Advanced Composite Structures Ltd. (Australia)

10:30 am: **Restraint-free wearable sensing clothes using a hetero-core optic fiber for measurements of arm motion and walking action,** M. Nishiyama, H. Sasaki, K. Watanabe, SOKA Univ. (Japan) ..... [6529-64]

10:50 am: **Composite scarf repair monitoring using fiber Bragg grating sensors,** H. C. H. Li, I. Herszberg, Cooperative Research Ctr. for Advanced Composite Structures Ltd. (Australia); P. R. Stoddart, Swinburne Univ. of Technology (Australia) ..... [6529-66]

11:10 am: **Self-assembled PN semiconductor detectors on optical fiber sensors,** H. Ruan, E. Kang, J. H. Lalli, A. J. Hill, R. O. Claus, NanoSonic, Inc. ..... [6529-67]

11:30 am: **Miniature fiber Bragg grating sensor interrogator (FBG-Transceiver(tm)) system,** E. A. Mendoza, C. Kempen, Redondo Optics; C. M. Lopatin, Naval Surface Warfare Ctr. ..... [6529-68]

Lunch/Exhibition Break 11:50 am to 1:30 pm

SESSION 19

Room: Royal Palm II ..... Wed. 10:30 am to 12:10 pm

System ID and Signal Processing I

Chairs: **Steven D. Glaser**, Univ. of California/Berkeley; **Akira Mita**, Keio Univ. (Japan)

10:30 am: **Leak detection using the pattern of sound signals in water supply systems,** T. Sato, A. Mita, Keio Univ. (Japan) ..... [6529-83]

10:50 am: **Insurance derivatives based on information obtained by sensor networks to improve the safety of buildings and urban systems,** H. Tamura, A. Mita, Keio Univ. (Japan) ..... [6529-84]

11:10 am: **Real-time damage nonitoring scheme in PSC girder bridge using output-only acceleration data,** J. Kim, J. Park, H. Do, J. Lee, Pukyong National Univ. (South Korea) ..... [6529-85]

11:30 am: **Online detection of damage using autoregressive models and artificial neural networks,** O. R. de Lautour, P. Omenzetter, Univ. of Auckland (New Zealand) ..... [6529-86]

11:50 pm: **Damage indicator for building structures using artificial neural networks as emulators,** A. Mita, Y. Qian, Keio Univ. (Japan) ..... [6529-88]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6529 continues on page 39

Conference 6530

continued

SESSION 9

Room: San Diego ..... Wed. 10:40 am to 12:00 pm

Sensor and Sensor System Performance Assesments and Issues

Chairs: **Michael D. Todd**, Univ. of California/San Diego; **Gyuhae Park**, Los Alamos National Lab.

10:40 am: **Calibration verification for wideband macro fiber composite strain sensing operation,** J. R. Wait, M. D. Todd, Univ. of California/San Diego ..... [6530-41]

11:00 am: **Shape determination of large deployable space structures, through the use of fiber-optics, with integrated fiber-Bragg's gratings,** B. J. Arritt, Air Force Research Lab; C. M. Klimcak, The Aerospace Corp.; E. Pollard, CSA Engineering, Inc.; H. Dumm, Jackson & Tull Inc.; T. Murphey, Air Force Research Lab. ..... [6530-42]

11:20 am: **Early detection of changes in dynamic properties of cyclically symmetric structures,** K. Napolitano, H. I. Vold, ATA Engineering, Inc. ..... [6530-43]

11:40 am: **Development of signal processing tools for piezoelectric sensor diagnostic processes,** T. G. Overly, G. Park, C. R. Farrar, Los Alamos National Lab. ..... [6530-44]

Lunch/Exhibition Break . 12:00 to 1:30 pm

6530 continues on page 39

Conference 6531

continued

SESSION 2 (continued)

Room: Royal Palm VI ..... Wed. 10:30 to 11:50 am

10:30 am: **Design of piezoelectric transducers for health monitoring of composite aircraft structures,** T. Stepinski, M. Engholm, Uppsala Univ. (Sweden) ..... [6531-15]

10:50 am: **NDI technique development for new technologies,** S. C. Ruth, The Aerospace Corp. ..... [6531-16]

11:10 am: **Lamb wave propagation in composite laminates using a higher-order plate theory,** L. Wang, F. Yuan, North Carolina State Univ. ..... [6531-17]

11:30 am: **A scaleable integrated sensing and control system for NDE, monitoring, and control of medium to very large composite smart structures,** J. E. Jones, V. L. Rhoades, Native American Technologies Co.; R. Arner, Apex Mountain Equipment, LLC; T. Clem, A. Cuneo, Native American Technologies Co. ..... [6531-19]

Lunch/Exhibition Break 11:50 am to 1:30 pm

6531 continues on page 39

Conference 6532

continued

SESSION 9

Room: Royal Palm IV ..... Wed. 10:30 am to 12:10 pm

Novel Instrumentatioin and Sensing II

Chairs: **Kumar V. Jata**, Air Force Research Lab.; **Hwai-Chung Wu**, Wayne State Univ.

10:30 am: **The influence of the radius of the electrodes employed in coulomb excitation of acoustic waves in piezoelectric materials,** E. Twerdowski, W. Grill, Univ. Leipzig (Germany) [6532-40]

10:50 am: **Investigating a stepped ultrasonic phased array transducer for the evaluation and characterization of defects,** E. A. Blickley, B. R. Tittmann, The Pennsylvania State Univ. ..... [6532-41]

11:10 am: **Wireless energy transmission for SHM embedded sensor nodes,** M. J. Nothnagel, G. Park, C. R. Farrar, Los Alamos National Lab. ..... [6532-42]

11:30 am: **Viscosity measurement using intrinsic fiberoptic polarimetric sensor,** W. Wang, Univ. of Washington and Southern Taiwan Univ. of Technology (Taiwan) ..... [6532-43]

11:50 am: **Finite element model correlation of a composite UAV wing using modal frequencies,** J. A. Oliver, J. B. Kosmatka, Univ. of California/San Diego ..... [6532-44]

Lunch/Exhibition Break . 12:10 to 1:30 pm

6532 continues on page 39

Wednesday 21 March

Conference 6523

continued

SESSION 10

Room: California ..... Wed. 1:30 to 3:10 pm

Material Modeling

Chair: **Donald J. Leo**, Defense Advanced Research Projects Agency

1:30 pm: **Monte Carlo simulation of ion transport of the high-strain ionomer with conducting powder electrodes,** X. He, Virginia Polytechnic Institute and State Univ.; D. J. Leo, DARPA ..... [6523-40]

1:50 pm: **Modeling and simulation of electromechanical behavior of EAPap,** J. Kim, S. Jang, Inha Univ. (South Korea); P. Basappa, Norfolk State Univ. ..... [6523-41]

2:10 pm: **Load-dependent hysteresis of magnetostrictive materials,** S. Valadkhan, Univ. of Waterloo (Canada); A. Shum, Queen's Univ. (Canada); K. Morris, Univ. of Waterloo (Canada) ..... [6523-42]

2:30 pm: **Modeling of NiMnGa under dynamic magnetic fields considering magnetic diffusion and eddy current power loss,** X. Wang, M. J. Dapino, The Ohio State Univ. ..... [6523-43]

2:50 pm: **A dynamic model for the electroactive mechanical properties of hydrogels,** K. Sohn, S. Park, S. Shin, Hanyang Univ. (South Korea); B. Yi, Hanyang Univ.; S. I. Kim, S. Kim, Hanyang Univ. (South Korea) ..... [6523-44]

Conference 6524

continued

SESSION 9

Room: Town & Country ..... Wed. 1:30 to 3:10 pm

Nano and Micro EAP

Chairs: **Paul D. Calvert**, Univ. of Massachusetts; **Barbar J. Akle**, Virginia Polytechnic Institute and State Univ.

1:30 pm: **Electromechanical response of nanostructured polymer at zero prestrain,** R. Shankar, T. K. Ghosh, R. J. Spontak, North Carolina State Univ. ..... [6524-31]

1:50 pm: **Controlled charge transfer for fast and defined actuation from carbon nanotube sheets: analytic investigations of the experimental results,** D. Faller, M. H. Haque, D. G. Weis, K. Hying, I. Kolaric, Fraunhofer Technologie-Entwicklungsgruppe TEG (Germany); T. Wallmersperger, B. H. Kröplin, Univ. Stuttgart (Germany) ..... [6524-32]

2:10 pm: **Electroactive polymer nanocomposites: processing and characterization,** Z. Ounaies, S. J. Deshmukh, S. Banda, Texas A&M Univ. ..... [6524-33]

2:30 pm: **Autonomous nanomesa and nanowell formation in ferroelectric polymer films as sensor and actuator array,** J. Li, Univ. of Washington; S. Ducharme, Univ. of Nebraska/Lincoln ..... [6524-34]

2:50 pm: **Mechanical properties of electroactive polymer microactuators with ion-implanted electrodes,** S. Rosset, M. Niklaus, P. Dubois, École Polytechnique Fédérale de Lausanne (Switzerland); M. Dadras, Univ. de Neuchâtel (Switzerland); S. Mikhaïlov, École d'ingénieurs Arc (Switzerland); H. R. Shea, École Polytechnique Fédérale de Lausanne (Switzerland) ..... [6524-35]

Coffee Break ..... 3:10 to 3:40 pm

6524 continues on page 40

Conference 6525

continued

SESSION 12

Room: Royal Palm V ..... Wed. 1:30 to 3:10 pm

Controlled Systems I

Chairs: **Kon-Well Wang**, The Pennsylvania State Univ.; **Norman M. Wereley**, Univ. of Maryland/College Park

1:30 pm: **A piezoelectric-hydraulic pump-based band brake actuation system for automotive transmission control,** G. Kim, K. Wang, The Pennsylvania State Univ. ..... [6525-50]

1:50 pm: **Effectiveness enhancement of a cycloidal wind turbine by individual active control of blade motion,** S. J. Kim, I. S. Hwang, I. O. Jeong, Y. H. Lee, Seoul National Univ. (South Korea) ..... [6525-51]

2:10 pm: **Analysis of the vibration localiztion phenomenon in rotationally periodic structures,** G. Caruso, Consiglio Nazionale delle Ricerche (Italy); P. Bisegna, Univ. degli Studi di Roma Tor Vergata (Italy) ..... [6525-52]

2:30 pm: **Work of PZT ceramics sounder for sound source artificial larynx,** Y. Sugio, R. Kanetake, K. Ooe, Ritsumeikan Univ. (Japan) ..... [6525-54]

2:50 pm: **Beams with controllable flexural stiffness,** F. Gandhi, The Pennsylvania State Univ. ..... [6525-55]

Coffee Break ..... 3:10 to 3:40 pm

6525 continues on page 40

Conference 6526

continued

SESSION 10

Room: Golden West ..... Wed. 1:30 to 3:10 pm

Autonomous Materials Workshop I

Chairs: **Scott R. White**, Univ. of Illinois at Urbana-Champaign; **Marcelo J. Dapino**, The Ohio State Univ.

Keynote

1:30 pm: **Multifunctional design for autonomic structures: Air Force perspective,** B. L. Lee, Air Force Office of Scientific Research ..... [6526-45]

2:10 pm: **Microvascular autonomic composite materials,** K. S. Toohey, N. R. Sottos, S. R. White, Univ. of Illinois at Urbana-Champaign ..... [6526-46]

2:30 pm: **Nanostructured self-healing polymers,** B. J. Blaiszik, S. R. White, N. R. Sottos, Univ. of Illinois at Urbana-Champaign ..... [6526-47]

2:50 pm: **Active repair of self-healing polymers with shape memory alloy wires *(Invited Paper)*,** E. L. Kirkby, Ecole Polytechnique Fédérale de Lausanne (Switzerland); J. D. Rule, 3M Co.; V. J. Michaud, Ecole Polytechnique Fédérale de Lausanne (Switzerland); S. R. White, N. R. Sottos, Univ. of IIIlinois at Urbana-Champaign; J. E. Manson, Ecole Polytechnique Fédérale de Lausanne (Switzerland) ..... [6526-48]

Coffee Break ..... 3:10 to 3:40 pm

6526 continues on page 40

Conference 6528

continued

SESSION 3

Room: Royal Palm III ..... Wed. 1:30 to 3:10 pm

Micro/Nano Devices and MEMS

Chairs: **Jaehwan Kim**, Inha Univ. (South Korea); **Gandhi Uma**, National Institute of Technology/Tiruchirappalli (India)

1:30 pm: **U.S. Army Corrosion Office's storage and quality requirements for military MEMS program,** J. L. Zunino III, D. R. Skelton, U.S. Army Armament Research, Development and Engineering Ctr. ..... [6528-27]

1:50 pm: **NanoDAC: object deformation measurements for micro and nanotechnology applications,** J. Keller, AMIC GmbH (Germany); D. W. Vogel, B. Michel, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [6528-40]

2:10 pm: **Cellulose micropattern fabrication using silicon micromold,** J. Kim, K. S. Kang, K. Y. Cho, J. Nayak, Inha Univ. (South Korea) ..... [6528-18]

2:30 pm: **Comparison of techniques for measurement of residual stresses in multilayered micro-electro-mechanical devices,** M. E. Vechery, Univ. of Maryland/Baltimore; M. Dubey, Army Research Lab.; B. Balachandran, Univ. of Maryland/College Park ..... [6528-13]

2:50 pm: **The theory of a micro hybrid piezoelectric actuation system,** T. Xu, National Institute of Aerospace; J. Su, NASA Langley Research Ctr. ..... [6528-31]

Coffee Break ..... 3:10 to 3:30 pm

6528 continues on page 40

Wednesday 21 March

Conference 6529

Session 16 and 20 run concurrently

SESSION 16

Room: Royal Palm I ..... Wed. 1:30 to 3:10 pm

SHM for Composite Materials

Chairs: **Ryan C. Garrett**, North Carolina State Univ.; **JiangYu Li**, Univ. of Washington

1:30 pm: **Optimization of sensor configurations for in situ failure identification in woven composites throughout impact,** R. C. Garrett, J. D. Pearson, K. J. Peters, M. A. Zikry, North Carolina State Univ. ..... [6529-69]

1:50 pm: **Nanoimprinting of ferroelectric polymers as sensor array,** J. Li, L. Zhang, Univ. of Washington ..... [6529-70]

2:10 pm: **Electrical impedance tomography of carbon nanotube composite materials,** T. Hou, K. J. Loh, J. P. Lynch, Univ. of Michigan ..... [6529-71]

2:30 pm: **Trifunctional nanocomposite material based on carbon nanosphere chains,** G. Choi, V. N. Shanov, G. Seth, S. Chopra, Y. Yun, M. J. Schulz, Univ. of Cincinnati ..... [6529-72]

2:50 pm: **Use of impedance measurements for crack detection in piezoelectric ceramics,** N. Mrad, Ministry of National Defence (Canada); S. H. Ferguson, H. W. King, Univ. of Victoria (Canada); D. F. Waechter, B. Yan, R. Blacow, S. E. Prasad, Sensor Technology, Ltd. (Canada) ..... [6529-73]

Coffee Break ..... 3:10 to 3:40 pm

SESSION 20

Room: Royal Palm II ..... Wed. 1:30 to 2:50 pm

System ID and Signal Processing II

Chairs: **Jann N. Yang**, Univ. of California/Irvine; **Yan Deng**, Tsinghua Univ. (China)

1:30 pm: **Implementation and validation of net-based structural health monitoring system using smart sensor networks,** O. Iwasawa, A. Mita, Keio Univ. (Japan) ..... [6529-89]

1:50 pm: **Parametric identification for a MDOF model structure using shaking table test measurements,** B. Xu, Hunan Univ. (China) ..... [6529-90]

2:10 pm: **Substructure damage identification using adaptive quadratic sum squares error method,** J. N. Yang, Univ. of California/Irvine ..... [6529-92]

2:30 pm: **Experimental verification for adaptive tracking of structural damage,** J. N. Yang, Univ. of California/Irvine ..... [6529-93]

Coffee Break ..... 2:50 to 3:40 pm

6529 continues on page 41

Conference 6530

continued

SESSION 10

Room: San Diego ..... Wed. 1:30 to 2:50 pm

Mult-Sensor Data Fusion and Signal Processing I

Chairs: **Gyuhae Park**, Los Alamos National Lab.; **Michael D. Todd**, Univ. of California/San Diego

1:30 pm: **A flexible multiagent architecture for vehicle health monitoring,** A. C. Esterline, Jr., M. J. Sundaresan, North Carolina A&T State Univ. ..... [6530-45]

1:50 pm: **Multi sensor fusion for NTE of spot welding in automotive industry,** A. I. Al-Shamma'a, J. D. Cullen, A. Shaw, Liverpool John Moores Univ. (United Kingdom) ..... [6530-46]

2:10 pm: **Low-cost smart embedded sensor for single throw mechanical equipment,** Z. Mahmood, Univ. of Peshawar (Pakistan) ..... [6530-47]

2:30 pm: **Development of an integrated software solution for piezoelectric active-sensing in structural health monitoring,** L. D. Jacobs, G. Park, C. R. Farrar, Los Alamos National Lab. ..... [6530-48]

Coffee Break ..... 2:50 to 3:40 pm

6530 continues on page 41

Conference 6531

continued

SESSION 3

Room: Royal Palm VI ..... Wed. 1:30 to 3:10 pm

Civil Infrastructure Health Monitoring

Chairs: **Aftab A. Mufti**, Univ. of Manitoba (Canada); **Hua Gu**, Caterpillar, Inc.

1:30 pm: **Micromechanics-based analysis of material damage in civil structures,** G. Y. Zhou, L. Sun, M. Shinozuka, Univ. of California/Irvine ..... [6531-20]

1:50 pm: **Structural identification, damage identification and structural health monitoring,** S. Alampalli, New York State Department of Transportation; M. M. Ettouney, Weidlinger Associates Inc. ..... [6531-21]

2:10 pm: **Application of statistical pattern recognition methods for damage detection to field data,** C. M. Cabrera, A. Cheung, Sensametrics, Inc.; K. K. Nair, A. S. Kiremidjian, Stanford Univ. ..... [6531-22]

2:30 pm: **Application of PDE methods for image-based concrete surface damage detection,** Z. Chen, T. C. Hutchinson, Univ. of California/San Diego ..... [6531-23]

2:50 pm: **Long term health monitoring system for bridges,** M. L. Wang, Univ. of Illinois/Chicago ..... [6531-24]

Coffee Break ..... 3:10 to 3:40 pm

6531 continues on page 41

Conference 6532

continued

SESSION 10

Room: Royal Palm IV ..... Wed. 1:30 to 3:10 pm

Civil Infrastructure Applications

Chairs: **Ajit K. Mal**, Univ. of California/Los Angeles; **Shivan Haran**, Arkansas State Univ.

1:30 pm: **Health monitoring with optical fiber sensors: from human body to civil structures,** É. Pinet, C. B. Hamel, FISO Technologies, Inc. (Canada); B. Gli‰ić, D. Inaudi, Smartec SA (Switzerland) [6532-45]

1:50 pm: **PZT active health monitoring for fatigue accumulative damage of concrete beam containing nano-particles for pavement,** M. Zhang, Harbin Institute of Technology (China) .. [6532-46]

2:10 pm: **Nondestructive inspection of reinforced concrete reefs submersed in seawaters,** H. Kim, National Fisheries and Development Institute (South Korea); W. Na, Pukyong National Univ. (South Korea) ..... [6532-47]

2:30 pm: **Model updating for Binzhou Yellow River Highway Bridge considering uncertainties,** S. Li, H. Li, Harbin Institute of Technology (China) ..... [6532-48]

2:50 pm: **Dynamic assessment of undersea pipeline bedding condition,** X. Zhu, H. Hao, The Univ. of Western Australia (Australia) ..... [6532-49]

Coffee Break ..... 3:10 to 3:40 pm

6532 continues on page 41

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Conference 6524

continued

SESSION 10

Room: Town & Country ..... Wed. 3:40 to 6:20 pm

Modeling

Chairs: **Subramaniam Radhakrishnan**, National Chemical Laboratory (India); **Thomas Wallmersperger**, Univ. Stuttgart (Germany)

3:40 pm: **Development and modeling of novel extensional ionic polymer transducers *(Invited Paper)*,** B. J. Akle, Virginia Polytechnic Institute and State Univ.; T. Wallmersperger, Univ. Stuttgart (Germany); D. J. Leo, J. E. McGrath, Virginia Polytechnic Institute and State Univ. ..... [6524-36]

4:20 pm: **Modeling of electro-chemo-mechanical response of ionic polymer-metal composites with various solvents *(Presentation Only)*,** S. Nemat-Nasser, S. Zamani, Univ. of California/San Diego ..... [6524-37]

4:40 pm: **A scalable model for tri-layer conjugated polymer actuator and experimental validation,** Y. Fang, X. Tan, Y. Shen, N. Xi, Michigan State Univ.; G. Alici, Univ. of Wollongong (Australia) ..... [6524-38]

5:00 pm: **Multilayered hybrid actuators: modeling fiber-reinforced dielectric elastomer actuators,** N. C. S. Goulbourne, Virginia Polytechnic Institute and State Univ. ..... [6524-39]

5:20 pm: **Dual-response characteristics of a conducting polymer bi-layer actuator,** S. Radhakrishnan, Indian Institute of Technology (India) .... [6524-40]

5:40 pm: **On a distributed parameter model for electrical impedance of ionic polymer,** K. Takagi, The Institute of Physical and Chemical Research (RIKEN) (Japan); Y. Nakabo, National Institute of Advanced Industrial Science and Technology (Japan); Z. Luo, Kobe Univ. (Japan) and The Institute of Physical and Chemical Research (RIKEN) (Japan); K. Asaka, National Institute of Advanced Industrial Science and Technology (Japan) ..... [6524-41]

6:00 pm: **Modeling of the nonlinear effects in pH sensors based on polyelectrolytic hydrogels,** M. Guenther, G. U. Gerlach, Technische Univ. Dresden (Germany); T. Wallmersperger, Univ. Stuttgart (Germany) ..... [6524-42]

6524 continues on page 42

Conference 6525

continued

SESSION 13

Room: Royal Palm V ..... Wed. 3:40 to 5:00 pm

Controlled Systems II

Chairs: **George A. Lesieutre**, The Pennsylvania State Univ.; **Seung Jo Kim**, Seoul National Univ. (South Korea)

3:40 pm: **Modal analysis of stepped piezoelectric beams,** M. Porfiri, Polytechnic Univ.; C. Maurini, J. Pouget, Univ. Pierre et Marie Curie (France) ..... [6525-56]

4:00 pm: **System integration of Utah electrode array using a biocompatible flip chip under bump metallization scheme,** R. Bhandari, S. Negi, The Univ. of Utah; M. Toepper, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); L. Reith, The Univ. of Utah; M. Klein, H. Opermann, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); R. A. Normann, F. Solzbacher, The Univ. of Utah ..... [6525-59]

4:20 pm: **Smart vortex generator transformed by change in ambient temperature and aerodynamic force,** T. Ikeda, S. Masuda, T. Ueda, Nagoya Univ. (Japan) ..... [6525-60]

4:40 pm: **Experimental and numerical evaluation of damping capacity of an innovative multifunctional shape memory alloy damper,** W. Ren, Tianjin Univ. of Technology and Education (China) and Dalian Univ. of Technology (China); H. Li, Dalian Univ. of Technology (China); G. Song, Univ. of Houston ..... [6525-61]

6525 continues on page 42

Conference 6526

continued

SESSION 11

Room: Golden West ..... Wed. 3:40 to 6:00 pm

Autonomous Materials Workshop II

Chairs: **Donald J. Leo**, Defense Advanced Research Projects Agency; **Fu-Kuo Chang**, Stanford Univ.

Keynote

3:40 pm: **The future of autonomic materials systems,** S. R. White, Univ. of Illinois at Urbana-Champaign [6526-49]

4:20 pm: **Computational design and optimization of a biomimetic self-healing/cooling composite material,** P. H. Geubelle, A. Aragon, J. Lewis, S. R. White, Univ. of Illinois at Urbana-Champaign ..... [6526-50]

4:40 pm: **On a path toward structures with reconfigurable circulatory systems,** W. W. Clark, E. Beckman, Univ. of Pittsburgh; C. Bielawski, The Univ. of Texas at Austin; S. K. Cho, L. M. Weiland, Univ. of Pittsburgh ..... [6526-51]

5:00 pm: **Self-healing composites based on thermal activation (autonomous materials),** Y. Wang, E. Bolanos, J. S. Park, F. Wudl, T. Hahn, Univ. of California/Los Angeles ..... [6526-52]

5:20 pm: **A magnetic nanocomposite with high-particle loading: a new synthesis method and microwave absorption properties (autonomous materials),** S. S. Park, Z. Guo, H. T. Hahn, Univ. of California/Los Angeles .. [6526-53]

5:40 pm: **Durability and integrity of built-in piezoelectric-based active sensing network in structures,** F. Chang, Stanford Univ. ..... [6526-54]

6526 continues on page 42

Conference 6528

continued

SESSION 4

Room: Royal Palm III ..... Wed. 3:30 to 5:30 pm

Applications I

Chair: **Tian-Bing Xu**, National Institute of Aerospace

3:30 pm: **Fabrication of various metal electrodes on the electro-active paper actuators using soft lithography,** J. Kim, K. S. Kang, H. K. Lim, S. Y. Yang, Inha Univ. (South Korea) ..... [6528-16]

3:50 pm: **Cognitive tracking secondary electron microscope,** Y. Park, Science and Technology Corp.; G. C. King, S. H. Choi, NASA Langley Research Ctr. ..... [6528-07]

4:10 pm: **Active coatings technologies for tailorable military coating systems,** J. L. Zunino III, U.S. Army Armament Research, Development and Engineering Ctr. ..... [6528-24]

4:30 pm: **Fabrication of nonlinear plastic optical fiber (POF) and application,** E. Kim, Pusan Univ. of Foreign Studies (South Korea); Y. S. Yu, Dongeui Univ. (South Korea); M. Y. Jeong, Pusan National Univ. (South Korea); T. Kinoshita, Keio Univ. (Japan) ..... [6528-32]

4:50 pm: **Electro-mechanical optimization of a low-voltage MEMS-based SPDT,** A. Ziaei, Thales Research & Technology (France) ..... [6528-01]

5:10 pm: **Energy harvesting of dipole rectenna for airship applications,** K. D. Song, Norfolk State Univ.; S. H. Choi, NASA Langley Research Ctr. ..... [6528-60]

6528 continues on page 43

Wednesday 21 March

Conference 6529

Session 17 and 20 run concurrently

SESSION 17

Room: Royal Palm I ..... Wed. 3:40 to 5:40 pm

Vibration SHM and Other Sensors

Chairs: **Patrick R. Downey**, Univ. of Maryland/College Park; **Patricia M. Nieva**, Univ. of Waterloo (Canada)

3:40 pm: **Magneto-mechanical characterization of iron-gallium nanowire arrays for use in underwater acoustic sensors,** P. R. Downey, A. B. Flatau, Univ. of Maryland/College Park ..... [6529-74]

4:00 pm: **Mechanical monolithic sensor for low-frequency seismic noise measurement,** F. Acernese, Univ. degli Studi di Salerno (Italy); R. De Rosa, Univ. degli Studi di Napoli Federico II (Italy); R. Romano, F. Barone, Univ. degli Studi di Salerno (Italy) ..... [6529-75]

4:20 pm: **A MEMS vibration sensor based on Mach Zehnder interferometers,** T. Ma, Univ. of Hawai'i at Manoa; W. Zhao, Advanced Photonics Integrated Circuits ..... [6529-76]

4:40 pm: **Design and modeling of a multifunctional MEMS Fabry-Perot sensor for the simultaneous measurement of displacement, pressure and temperature,** P. M. Nieva, Univ. of Waterloo (Canada) ..... [6529-77]

5:00 pm: **Integrated force and displacement sensors for on-chip measurement and control,** T. Waterfall, B. Jensen, L. Howell, T. McLain, Brigham Young Univ. ..... [6529-78]

5:20 pm: **Strain transfer model of embedded fiber Bragg grating sensor in optional orientation,** G. Zhou, H. Li, L. Ren, D. Li, Dalian Univ. of Technology (China) ..... [6529-79]

SESSION 21

Room: Royal Palm II ..... Wed. 3:40 to 4:40 pm

Novel Sensors IV

Chairs: **Jeong-Hoi Koo**, Miami Univ.; **Zhishen Wu**, Ibaraki Univ. (Japan)

3:40 pm: **Piezoresistive and piezoelectric MEMS strain sensors for vibration detection,** S. Kon, K. Oldham, R. Horowitz, Univ. of California/Berkeley ..... [6529-94]

4:00 pm: **Monitoring pavement condition using "smart dust" under surge time sychronization,** R. A. Ivey, Auburn Univ.; J. Pei, H. Lin, Jr., A. R. Landrum, C. J. Sandburg, T. King, M. M. Zaman, H. H. Refai, Univ. of Oklahoma; O. Oshlake, Rutgers Univ.; A. Heriba, South Dakota School of Mines and Technology; E. Hurt, Univ. of Oklahoma ..... [6529-97]

4:20 pm: **Optimization studies of self-sensing composites,** K. L. Schaaf, P. M. Rye, A. Starr, S. Nemat-Nasser, Univ. of California/San Diego ..... [6529-98]

6529 continues on page 43

Conference 6530

continued

SESSION 11

Room: San Diego ..... Wed. 3:40 to 5:40 pm

Mult-Sensor Data Fusion and Signal Processing II

Chairs: **Nobuo Takeda**, The Univ. of Tokyo (Japan); **Patrick M. Rye**, Univ. of California/San Diego

3:40 pm: **Monitoring and evaluation of cracked beams based on nonlinear wave modulation,** A. Masuda, Y. Kinugawa, S. Maekawa, D. Iba, A. Sone, Kyoto Institute of Technology (Japan) ..... [6530-50]

4:00 pm: **Embedded microcontroller networks: accoustic materials health monitoring,** P. M. Rye, Univ. of California/San Diego ..... [6530-51]

4:20 pm: **Classification of novel events for structural health monitoring systems,** N. J. Dhruve, D. K. McNeill, Univ. of Manitoba (Canada) ..... [6530-52]

4:40 pm: **Optimization of the statistical model for the structural health monitoring using the SI-F method,** K. Yuguchi, A. Iwasaki, Gunma Univ. (Japan); Y. Shimamura, Shizuoka Univ. (Japan); A. Todoroki, Tokyo Institute of Technology (Japan) ..... [6530-54]

5:00 pm: **Statistical damage diagnosis of in-service structure under high noise environment using multiple reference data,** A. Iwasaki, Gunma Univ. (Japan); A. Todoroki, Tokyo Institute of Technology (Japan); Y. Shimamura, Shizuoka Univ. (Japan) ..... [6530-55]

5:20 pm: **Structural shape identification using distributed strain data from PPP-BOTDA,** M. Nishio, T. Mizutani, N. Takeda, The Univ. of Tokyo (Japan) ..... [6530-56]

Conference 6531

continued

SESSION 3 (continued)

Room: Royal Palm VI ..... Wed. 3:40 to 5:40 pm

3:40 pm: **Integrity monitoring of old steel bridge using fiber optic distributed sensors based on Brillouin scattering,** B. Glisic, D. Inaudi, D. Posenato, Smartec SA (Switzerland) ..... [6531-25]

4:00 pm: **Structural health monitoring of Lindquist Bridge,** D. Sargent, Sargent & Associates Engineering Ltd. (Canada); E. Rivera, Univ. of Manitoba (Canada); B. Bakht, JMBT Structures Research Inc. (Canada); A. A. Mufti, Univ. of Manitoba (Canada) ..... [6531-26]

4:20 pm: **Monitoring fatigue life in concrete bridge deck slabs,** J. P. Newhook, Dalhousie Univ. (Canada) ..... [6531-27]

4:40 pm: **Self repair of impacts, blasts in critical targets such as infrastructure and vehicles,** C. M. Dry, Natural Process Design, Inc. ..... [6531-28]

5:00 pm: **Measuring deflections through strains,** A. A. Mufti, Univ. of Manitoba (Canada); L. Jaeger, Dalhousie Univ. (Canada); N. Kyriakopoulos, Univ. of Manitoba (Canada); B. Bakht, JMBT Structures Research Inc. (Canada); G. Tadros, SPECO Engineering (Canada) ..... [6531-29]

5:20 pm: **Measuring axle weights and spacings of trucks through a girder bridge,** B. Bakht, JMBT Structures Research, Inc. (Canada); A. A. Mufti, J. Wu, Univ. of Manitoba (Canada); G. Tadros, SPECO Engineering (Canada) ... [6531-30]

6531 continues on page 43

Conference 6532

continued

SESSION 11

Room: Royal Palm IV ..... Wed. 3:40 to 5:40 pm

Damage Detection and Prediction

Chairs: **Amit Shukla**, Miami Univ.; **Jerome P. Lynch**, Univ. of Michigan

3:40 pm: **Impact and damage quantification in a filament wound missile casing using a single passive multi-directional sensor,** D. E. Adams, N. Stites, C. Escobar, Purdue Univ.; M. A. Triplett, U.S. Army Aviation and Missile Command ..... [6532-50]

4:00 pm: **Detection of minuscule changes in structures from spectral data,** K. V. Singh, A. Shukla, Miami Univ. ..... [6532-51]

4:20 pm: **Monitoring and characterizing corrosion in aluminum using Lamb waves and attached sensors,** T. E. Michaels, J. E. Michaels, Georgia Institute of Technology ..... [6532-52]

4:40 pm: **Mode selective actuation and reception of Lamb waves for structural health monitoring of woven composite laminates,** G. R. Kirikera, G. Petculescu, S. Krishnaswamy, J. D. Achenbach, Northwestern Univ. ..... [6532-53]

5:00 pm: **Impedance-based structural health monitoring of wind turbine blades,** C. Pitchford, B. L. Grisso, D. J. Inman, Virginia Polytechnic Institute and State Univ. ..... [6532-54]

5:20 pm: **Assessment of vibration-based damage indexes in structural health monitoring,** X. Sun, Harbin Institute of Technology (China); J. Ou, Dalian Univ. of Technology (China) ..... [6532-55]

6532 continues on page 43

Thursday 22 March

Conference 6524

Session 11 and 13 run concurrently

Conference 6525

continued

Conference 6526

Session 12 and 16 run concurrently

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* ONR - Current and Future Programs and Initiatives**, Mike Yu, Naval Air System Command

8:20 to 9:05 *Plenary Talk* **Smart Structures; The Solution to "Cheaper, Faster, Better" in the Space Industry**, Torey Davis, Honeywell Defense and Space

SESSION 11

Room: Town & Country ..... Thurs. 9:00 to 10:00 am

Applications of EAP I

Chairs: **Gabor M. Kovacs**, EMPA (Switzerland); **John D. W. Madden**, The Univ. of British Columbia (Canada)

9:00 am: **Enhanced polypyrrole actuator for packaged drug delivery systems,** H. A. Tsai, M. J. Madou, Univ. of California/ Irvine ..... [6524-43]

9:20 am: **Development of soft actuator: mechanism with vibration element using dielectric elastomer to generate large displacement,** M. Haruna, K. Kubo, T. Tamida, Mitsubishi Electric Corp. (Japan) ..... [6524-44]

9:40 am: **EAP as actuator for a gripper with variable curvature,** C. Pagano, I. Fassi, Istituto di Tecnologie Industriali e Automazione (Italy) ..... [6524-45]

Coffee Break ..... 10:00 to 10:30 am

SESSION 13

Room: San Diego ..... Thurs. 9:00 am to 10:00 pm

Applications of EAP III

Chairs: **Gürsel Alici**, Univ. of Wollongong (Australia); **Ji Su**, NASA Langley Research Ctr.

9:00 am: **Tri-layer conducting polymer actuators with variable dimensions *(Invited Paper),*** R. Minato, G. Alici, G. M. Spinks, S. T. McGovern, Univ. of Wollongong (Australia) ..... [6524-57]

9:20 am: **Design and fabrication of electroactive polymer based composites for sensor,** J. Wang, C. Xu, M. Taya, Y. Kuga, Univ. of Washington ..... [6524-58]

9:40 am: **Active membrane using electrostrictive graft elastomer for deployable and lightweight mirrors,** J. Su, NASA Langley Research Ctr.; E. Yang, Stevens Institute of Technology; T. Xu, National Institute of Aerospace; R. M. Morgan, Z. Chang, Jet Propulsion Lab. ..... [6524-59]

Coffee Break ..... 10:00 to 10:30 am

6524 continues on page 44

SESSION 14

Room: Royal Palm V ..... Thurs. 9:00 to 10:00 am

Smart Devices and Systems

Chairs: **Richard O. Claus**, Virginia Polytechnic Institute and State Univ.; **Gregory P. Carman**, Univ. of California/ Los Angeles

9:00 am: **Adaptive and controllable compliant systems with embedded actuators and sensors,** B. P. Trease, S. Kota, Univ. of Michigan ..... [6525-62]

9:20 am: **Metal Rubber(tm) sheet and fabric materials and devices,** J. H. Lalli, A. J. Hill, M. Homer, R. O. Claus, NanoSonic, Inc. ..... [6525-63]

9:40 am: **Test/analysis correlation for a Nomex-based honeycomb with piezoelectric patch,** C. Florens, ONERA (France) and École Centrale Paris (France); E. Balmès, École Centrale Paris (France); F. Cléro, ONERA (France) ..... [6525-64]

Coffee Break ..... 10:00 to 10:30 am

6525 continues on page 44

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SESSION 12

Room: Golden West ..... Thurs. 9:00 to 10:00 am

Active Composites

Chairs: **Gregory P. Carman**, Univ. of California/Los Angeles; **Hilary Bart-Smith**, Univ. of Virginia

9:00 am: **Modeling of piezo-SMA composites,** O. C. Namli, M. Taya, Univ. of Washington; J. K. Lee, Catholic Univ. of Daegu (South Korea) ..... [6526-55]

9:20 am: **Experimental development of power consumption in LIPCA-C2,** B. Smith, K. M. Mossi, Virginia Commonwealth Univ.; N. Goo, Konkuk Univ. (South Korea) ..... [6526-56]

9:40 am: **Piezoresistance property of cement-based composites filled with carbon black: theoretical model and experimental results,** H. Xiao, H. Li, J. Ou, Harbin Institute of Technology (China) ..... [6526-57]

Coffee Break ..... 10:00 to 10:30 am

SESSION 16

Room: Atlas California ..... Thurs. 9:00 to 10:00 am

Ferromagnetic Shape Memory Materials

Chairs: **Robert C. O'Handley**, Massachusetts Institute of Technology; **Chad M. Landis**, Rice Univ.

9:00 am: **A continuum thermodynamics formulation for micro-magneto-mechanics with applications to ferromagnetic shape memory alloys,** C. M. Landis, Rice Univ. ..... [6526-73]

9:20 am: **Modeling of magnetic shape memory alloys,** D. C. Lagoudas, B. Kiefer, Texas A&M Univ. ..... [6526-74]

9:40 am: **Quasi-static and acoustic energy absorption in Ni-Mn-Ga composites,** J. Feuchtwanger, Massachusetts Institute of Technology and Univ. of Basque Country (Spain); R. Techapiesancharoenkij, Massachusetts Institute of Technology; M. Mahendran, Massachusetts Institute of Technology and Thiagarajar College of Engineering (India); D. C. Bono, S. M. Allen, R. C. O'Handley, Massachusetts Institute of Technology ..... [6526-75]

Coffee Break ..... 10:00 to 10:30 am

6526 continues on page 44

Thursday 22 March

Conference 6528

continued

SESSION 5

Room: Royal Palm III ..... Thurs. 9:00 to 9:50 am

Nanostructures

Chair: **Vijay K. Varadan**, Univ. of Arkansas

Keynote

9:00 am: **Nano-bio quantum technology at NASA Langley Research Ctr.,** S. H. Choi, NASA Langley Research Ctr. ..... [6528-56]

9:30 am: **Magnetic nanotubes for biomedical applications,** L. Chen, J. Xie, Univ. of Arkansas; M. Srivatsan, Arkansas State Univ.; V. K. Varadan, Univ. of Arkansas ..... [6528-51]

6528 continues on page 45

Conference 6529

Session 22 and 26 run concurrently

8:00 to 8:05 **Announcements and Awards**

8:05 to 8:20 ***Funding Agency Talk,* ONR - Current and Future Programs and Initiatives**, Mike Yu, Naval Air System Command

8:20 to 9:05 *Plenary Talk* **Smart Structures; The Solution to "Cheaper, Faster, Better" in the Space Industry**, Torey Davis, Honeywell Defense and Space

SESSION 22

Room: Royal Palm I ..... Thurs. 9:00 to 10:00 am

Signal Processing and Damage Detection I

Chairs: **Ai-Lun Wu**, National Taiwan Univ. (Taiwan); **Amanda Carney**, Univ. of Massachusetts/Lowell

9:00 am: **Reference-based damage diagnosis of structure using embedded statistical model,** A. Wu, C. Loh, National Taiwan Univ. (Taiwan) ..... [6529-100]

9:20 am: **Research on measuring three-axis forces with four-phase sensing elements,** J. Liu, X. Mo, Chongqing Univ. (China); J. Wang, Chongqing Technology and Business Univ. (China); Y. Zhou, Y. Pan, Chongqing Univ. (China) .. [6529-101]

9:40 am: **High-strain and deformation measurements using an imaging technique and smart material sensors,** A. Carney, C. Niezrecki, E. E. Niemi, Jr., J. Chen, Univ. of Massachusetts/Lowell ..... [6529-102]

Coffee Break ..... 10:00 to 10:30 am

SESSION 26

Room: Royal Palm II ..... Thurs. 9:00 to 10:00 am

Wireless for SHM I

Chairs: **Hoon Sohn**, Carnegie Mellon Univ.; **Tarek Abdoun**, Rensselaer Polytechnic Institute

9:00 am: **In situ measurement of conductivity and temperature during concrete curing using passive wireless sensors,** M. M. Andringa, J. M. Puryear, D. P. Neikirk, S. L. Wood, The Univ. of Texas at Austin ..... [6529-120]

9:20 am: **Low-cost wireless sensors for civil infrastructure,** J. M. Puryear, M. M. Andringa, S. L. Wood, D. P. Neikirk, The Univ. of Texas at Austin ..... [6529-121]

9:40 am: **Wireless real-time monitoring of soil and soil-structure systems,** T. Abdoun, Rensselaer Polytechnic Institute; A. Abe, Tokyo Soil Research Co., Ltd. (Japan); V. G. Bennett, Rensselaer Polytechnic Institute; L. A. Danisch, Measurand, Inc. (Canada); M. Sato, National Research Institute for Earth Science and Disaster Prevention (Japan); K. Tokimatsu, Tokyo Institute of Technology (Japan); J. Ubilla, Rensselaer Polytechnic Institute ..... [6529-122]

Coffee Break ..... 10:00 to 10:30 am

6529 continues on page 45

Conference 6531

continued

SESSION 4

Room: Royal Palm VI ..... Thurs. 9:20 am to 10:00 pm

Progress in Nondestructure Evaluation

Chairs: **Masoud Ghandehari**, Polytechnic Univ.; **Brian J. Tucker**, Pacific Northwest National Lab.

9:20 am: **Progress in air-coupled ultrasound,** S. B. Jayaraman, I. Lucas, D. Pellkofer, M. Bezdek, B. R. Tittmann, The Pennsylvania State Univ. ..... [6531-32]

9:40 am: **Terahertz NDE application for corrosion detection and evaluation under shuttle tiles,** R. F. Anastasi, E. I. Madaras, J. P. Seebo, S. W. Smith, NASA Langley Research Ctr.; J. K. Lomness, P. E. Hintze, NASA Kennedy Space Ctr.; C. C. Kammerer, United Space Alliance, LLC; W. P. Winfree, NASA Langley Research Ctr.; R. W. Russell, NASA Kennedy Space Ctr. ..... [6531-33]

Coffee Break ..... 10:00 to 10:30 am

6531 continues on page 45

Conference 6532

continued

SESSION 12

Room: Royal Palm IV ..... Thurs. 9:00 to 10:00 am

Biological and Medical Applications I

Chairs: **George Zentai**, Varian Medical Systems, Inc.; **Masoud Ghandehari**, Polytechnic Univ.

9:00 am: **3-D force measurement using distributive microfabricated waveguide sensor,** W. Wang, Univ. of Washington and Southern Taiwan Univ. of Technology (Taiwan) ..... [6532-56]

9:20 am: **Mechanical characterization of bone samples by ultrasound holography at 100 MHz,** W. Grill, Univ. Leipzig (Germany); H. Hartmann, EPCOS AG (Germany); U. Cobet, Martin-Luther Univ. Halle-Wittenberg (Germany) ..... [6532-57]

9:40 am: **An approach to bioelectric DAQ,** A. Kumari, Birla Institute of Technology (India); R. Kumari, Mahadeo Singh College (India) ..... [6532-58]

Coffee Break ..... 10:00 to 10:30 am

6532 continues on page 45

Thursday 22 March

Conference 6524

Session 11 and 13 run concurrently

SESSION 11 (continued)

Room: Town & Country ..... Thurs. 10:30 to 11:50 am

10:30 am: **Study of flapping actuator modules using IPMC,** H. Kim, D. Kim, J. Han, Korea Advanced Institute of Science and Technology (South Korea) ... [6524-46]

10:50 am: **A linear actuator from a single ionic polymer-metal composite (IPMC) strip,** J. M. Rossiter, Univ. of Bristol (United Kingdom); B. L. Stoimenov, T. Mukai, The Institute of Physical and Chemical Research (RIKEN) (Japan) ..... [6524-47]

11:10 am: **Ionic polymer-metal composite as energy harvesters,** R. Tiwari, D. Dogruer, K. J. Kim, Univ. of Nevada/Reno ..... [6524-48]

11:30 am: **Sensor-actuator coupled device for active tracheal tube using solid polymer electrolyte membrane,** T. Ihara, T. Nakamura, Suzuka Univ. of Medical Science (Japan); T. Mukai, The Institute of Physical and Chemical Research (RIKEN) (Japan); K. Asaka, National Institute of Advanced Industrial Science and Technology (Japan) ..... [6524-49]

Lunch Break ..... 11:50 am to 1:30 pm

SESSION 13 (continued)

Room: San Diego ..... Thurs. 10:30 to 11:50 am

10:30 am: **New modified EAP nanofibers for biomedical applications *(Invited Paper)*,** S. Kim, M. Shin, B. Gu, S. I. Kim, S. Kim, H. Lee, Hanyang Univ. (South Korea) ..... [6524-60]

10:50 am: **Low voltage highly tunable diffraction grating based on dielectric elastomer actuators,** M. Aschwanden, A. Stemmer, ETH Zürich (Switzerland) ..... [6524-61]

11:10 am: **Concept study on active shells driven by soft dielectric EAP,** G. M. Kovacs, EMPA (Switzerland) . [6524-62]

11:30 am: **Piezoelectric polymers actuators for precise shape control of large scale space antennas,** Q. Chen, D. J. Natale III, B. P. Neese, K. Ren, M. Lin, Q. Zhang, M. J. Pattom, K. Wang, The Pennsylvania State Univ.; H. Fang, E. Im, Jet Propulsion Lab. ..... [6524-63]

11:50 am: **Electro-active polymers as a novel actuator technology for lighter-than-air vehicles,** S. A. Michel, C. Duerager, EMPA (Switzerland); E. Fink, M. Zobel, Technische Univ. Berlin (Germany) ..... [6524-64]

Lunch Break ..... 11:50 am to 1:30 pm

6524 continues on page 46

Conference 6525

continued

SESSION 15

Room: Royal Palm V ..... Thurs. 10:30 to 11:50 am

Sensors, Actuators, and Devices

Chairs: **Gregory P. Carman**, Univ. of California/Los Angeles; **Stephen M. Schultz**, Brigham Young Univ.

10:30 am: **Zero-power shock sensors using bistable compliant mechanisms,** B. Hansen, S. M. Schultz, A. R. Hawkins, C. Carron, Brigham Young Univ. [6525-65]

10:50 am: **Electric field sensor based on core-replaced optical D-fiber,** E. K. Johnson, R. H. Selfridge, S. M. Schultz, Brigham Young Univ. ..... [6525-66]

11:10 am: **Analysis, construction, and testing of a large displacement bistable piezoelectric actuator,** J. Monreal, Royal Belgian Military Academy (Belgium); G. Giannopoulos, J. Vantomme, Royal Belgian Military Academy (Belgium) and Vrije Univ. Brussel (Belgium) ..... [6525-67]

11:30 am: **Active mounts for marine application: the BMBF Research Project: active aggregate mounts to reduce structure vibrations and structure-borne sound transmission,** M. Matthias, Fraunhofer-Institut für Betriebsfestigkeit und Systemzuverlässigkeit (Germany) ..... [6525-68]

Lunch Break ..... 11:50 am to 1:40 pm

6525 continues on page 46

Conference 6526

Session 13 and 17 run concurrently

SESSION 13

Room: Golden West ..... Thurs. 10:30 am to 12:10 pm

Active Polymer Nanocomposites

Chairs: **Etienne Patoor**, École Nationale Supérieure d'Arts et Métiers (France); **Yuri M. Shkel**, Univ. of Wisconsin/Madison

10:30 am: **Electroactivity of polymeric suspensions,** Y. Peng, Y. M. Shkel, Univ. of Wisconsin/Madison ..... [6526-58]

10:50 am: **Microwave absorbing properties of ferrite-based nanocomposites,** A. Jänis, Swedish Defence Research Agency (Sweden); R. T. Olsson, Kungliga Tekniska Högskolan (Sweden) ..... [6526-59]

11:10 am: **Anisotropic electroactive polymer composites,** G. deBotton, L. Tevet-Deree, Ben-Gurion Univ. of the Negev (Israel) ..... [6526-60]

11:30 am: **Mechano-electric behaviors of ionic polymer-metal composite** *(Presentation Only),* K. M. Jung, K. J. Kim, Univ. of Nevada/Reno ..... [6526-61]

11:50 am: **Hingeless CFRP structure by using partially flexible composites,** A. Todoroki, K. Kumagai, Tokyo Institute of Technology (Japan) ..... [6526-62]

Lunch Break ..... 12:10 to 1:30 pm

SESSION 17

Room: Atlas California ..... Thurs. 10:30 am to 12:10 pm

FSMA/SMA

Chairs: **Ibrahim Karaman**, Texas A&M Univ.; **Vesselin M. Stoilov**, Univ. of Windsor (Canada)

10:30 am: **Hybrid ferromagnetic shape-memory alloy/piezoelectric actuator,** B. W. Peterson, Massachusetts Institute of Technology and Naval Surface Warfare Ctr.; J. Feuchtwanger, Massachusetts Institute of Technology and Univ. of Basque Country (Spain); R. Techapiesancharoenkij, D. C. Bono, Massachusetts Institute of Technology; J. Huang, Ferro Solutions, Inc.; S. M. Allen, R. C. O'Handley, Massachusetts Institute of Technology ..... [6526-76]

10:50 am: **Magnetomechanical characterization and unified actuator/sensor modeling of ferromagnetic shape memory alloy Ni-Mn-Ga,** N. N. Sarawate, M. J. Dapino, The Ohio State Univ. ..... [6526-77]

11:10 am: **Multiscale theory of thin film magnetic shape memory alloy microactuators,** V. M. Stoilov, Univ. of Windsor (Canada) ..... [6526-78]

11:30 am: **Relationship between slip deformation characteristics of the Martensite and Austenite phases with work behavior and dimensional stability of NiTiPd alloys,** G. S. Bigelow, S. A. Padula II, R. D. Noebe, A. Garg, NASA Glenn Research Ctr. ..... [6526-79]

11:50 am: **A dynamical system model for control of shape memory alloy microstructure and devices,** D. R. Mahapatra, R. V. N. Melnik, Wilfrid Laurier Univ. (Canada); B. Balachandran, Univ. of Maryland/College Park ..... [6526-80]

Lunch Break ..... 12:10 to 1:30 pm

6526 continues on page 46

Thursday 22 March

Conference 6528

continued

SESSION 6

Room: Royal Palm III ..... Thurs. 9:50 to 11:10 am

Biosensors and BioMEMS I

Chairs: **Jose K. Abraham**, Univ. of Arkansas; **Katsutoshi Ooe**, Ritsumeikan Univ. (Japan)

9:50 am: **High-speed microfluidic thermal stimulator for temperature-activated ion channel studies,** T. Pennell, J. Wang, S. Z. Hua, Univ. at Buffalo ..... [6528-02]

Coffee Break ..... 10:10 to 10:30 am

10:30 am: **Nanowire integrated microelectrode arrays for lab-on-a-chip applications,** J. K. Abraham, R. Reddy, H. Yoon, V. K. Varadan, Univ. of Arkansas ..... [6528-42]

10:50 am: **Miniature fiber optic pressure sensor for intradiscal pressure measurements of rodents,** S. Nesson, M. Yu, A. Hsieh, D. A. Ryan, Univ. of Maryland/College Park ..... [6528-09]

SESSION 7

Room: Royal Palm III ..... Thurs. 11:10 am to 12:30 pm

Biosensors and BioMEMS II

Chairs: **Hargsoon Yoon**, Univ. of Arkansas; **Yeo-Heung Yun**, Univ. of Cincinnati

11:10 am: **Immersive training and mentoring for laparoscopic surgery,** V. Nistor, B. Allen, G. P. Carman, P. Faloutsos, E. Dutson, Univ. of California/Los Angeles ..... [6528-39]

11:30 am: **A total patient monitoring system for point-of-care applications,** A. Whitchurch, J. K. Abraham, V. K. Varadan, Univ. of Arkansas ..... [6528-44]

11:50 am: **Performance simulation of a valveless micropump with electro-structural-fluid interaction,** K. Lee, T. T. Nguyen, N. Goo, Konkuk Univ. (South Korea) ..... [6528-17]

12:10 pm: **On-line carbon nanotube-based biosensor using microfluidics,** Y. Yun, A. Bange, W. R. Heineman, H. B. Halsall, M. Behbehani, S. K. Pixley, A. Bhattacharya, Z. Dong, V. N. Shanov, M. J. Schulz, Univ. of Cincinnati ..... [6528-11]

Lunch Break ..... 12:30 to 1:30 pm

6528 continues on page 47

Conference 6529

Session 23 and 27 run concurrently

SESSION 23

Room: Royal Palm I ..... Thurs. 10:30 am to 12:30 pm

Signal Processing and Damage Detection II

Chairs: **Fabin Shen**, Virginia Polytechnic Institute and State Univ.; **Lingyu Yu**, Univ. of South Carolina

10:30 am: **Signal processing of multiplexed intrinsic Fabry-Perot interferometric fiber optic sensors,** F. Shen, M. Han, A. Wang, Virginia Polytechnic Institute and State Univ. ..... [6529-103]

10:50 am: **Localization and recovery of damage in plate structures through sensitivity enhancing feedback control,** C. Li, L. Zhou, Nanjing Univ. of Aeronautics and Astronautics (China); F. Yuan, North Carolina State Univ. ..... [6529-104]

11:10 am: **Studying the effect of coupling materials in sonic IR imaging,** X. Han, R. Yu, Wayne State Univ. ..... [6529-105]

11:30 am: **Exploring resistance change trends associated with integrated piezoresistive sensoring elements,** G. Johns, T. Waterfall, L. Howell, B. Jensen, T. McLain, Brigham Young Univ. .. [6529-106]

11:50 am: **Omnidirectional guided wave PWAS phased array for thin-wall structure damage detection,** L. Yu, V. Giurgiutiu, J. Kendall, Univ. of South Carolina ..... [6529-107]

12:10 pm: **Coupled vibration control system for slender buildings constructed closely in urban area,** T. Azuhata, T. Ishihara, National Institute for Land and Infrastructure Management (Japan); M. Midorikawa, Hokkaido Univ. (Japan) ..... [6529-108]

Lunch Break ..... 12:30 to 1:30 pm

SESSION 27

Room: Royal Palm II ..... Thurs. 10:30 am to 12:30 pm

Modeling and Design of Smart Systems II

Chairs: **Ser-Tong Quek**, National Univ. of Singapore (Singapore); **Richard A. Livingston**, Turner-Fairbank Highway Research Ctr.

10:30 am: **Development of a new mindlin plate element with a through crack,** C. Liu, J. T. DeWolf, J. Kim, Univ. of Connecticut ..... [6529-123]

10:50 am: **Modeling of electrical resistance for shape memory alloys in hysteretic movement,** S. Yan, Shenyang Architectural and Civil Engineering Univ. (China) ..... [6529-124]

11:10 am: **Finite element simulation of piezoelectric wafer active sensors for structural health monitoring with coupled, filed, and boundary-infinite elements,** W. Liu, V. Giurgiutiu, Univ. of South Carolina ..... [6529-125]

11:30 am: **Chaos theory analysis of a cable-stayed bridge part I: finite element model development,** R. A. Livingston, S. Jin, Turner-Fairbank Highway Research Ctr. ..... [6529-126]

11:50 am: **Chaos theory analysis of a cable-stayed bridge part II: analysis of monitoring data for base-line conditions,** R. A. Livingston, S. Jin, Turner-Fairbank Highway Research Ctr.; G. Chen, Univ. of Missouri/Rolla ... [6529-127]

12:10 pm: **Technical and ethical reflections about the very critical instability of a construction in Varese, Italy,** F. Bartolozzi, Independent Researcher (Italy) ..... [6529-128]

Lunch Break ..... 12:30 to 1:30 pm

6529 continues on page 47

Conference 6531

continued

Session 4 (continued)

Room: Royal Palm VI ..... Thurs. 10:30 to 12:10 am

10:30 am: **Capacitance sensors for the nondestructive measurement of moisture content in in-shell peanuts,** C. V. K. Kandala, C. L. Butts, USDA Agricultural Research Service .... [6531-34]

10:50 am: **Nondestructive characterization of engineering materials using capillary diffusion (CDM) and gas adsorption (GAIM) methods,** G. W. Lopez, Wentworth Institute of Technology; N. G. Berezkina, I. O. Leipunsky, Russian Academy of Sciences (Russia) ..... [6531-35]

11:10 am: **Acoustic emission characteristics and damage evolution model of steel strands in tensile test,** D. Li, Harbin Institute of Technology (China) ..... [6531-36]

11:30 am: **Filtering of NDT signals obtained from wrapped steel cables,** R. E. Christen, A. Novakovic, A. E. Bergamini, M. Motavalli, EMPA (Switzerland) ..... [6531-37]

11:50 am: **Early detection of degradation of cable supported structures,** M. Ghandehari, Polytechnic Univ. ... [6531-38]

Lunch Break ..... 12:10 to 1:30 pm

6531 continues on page 47

Conference 6532

continued

SESSION 13

Room: Royal Palm IV ..... Thurs. 10:30 am to 12:10 pm

Biological and Medical Applications II

Chairs: **Wei-Chih Wang**, Univ. of Washington; **Olivier Giraudo**, ONERA (France)

10:30 am: **Ultrasonic imaging in absorptivity and velocity contrast by time selective first arrival line tomography in transmission,** E. Twerdowski, Univ. Leipzig (Germany); M. Pluta, Politechnika Wroclawska (Poland); A. Schwagmann, D. Ivanov, W. Grill, Univ. Leipzig (Germany) ..... [6532-59]

10:50 am: **New x-ray compton scatter tomography method for nondestructive evaluation and medical diagnostics,** P. Paki Amouzou, V. Grubsky, M. Gertsenshteyn, T. P. Jannson, Physical Optics Corp. ..... [6532-60]

11:10 am: **Design of a multi-layered optical bend loss sensor for pressure and shear sensing,** C. Liu, Chung Cheng Institute of Technology (Taiwan); W. Wang, Univ. of Washington and Southern Taiwan Univ. of Technology (Taiwan) ..... [6532-61]

11:30 am: **Design and implementation of a Bluetooth based infant monitoring/saver (BIMS) system,** A. E. Sonmez, M. T. Nalcaci, Fatih Univ. (Turkey); M. A. Pazarbasi, Sakarya Univ. (Turkey); O. Toker, K. Fidanboylu, Fatih Univ. (Turkey) ..... [6532-62]

11:50 am: **Design and performance of a fiber Bragg grating displacement sensor for movement measurement of tendon and ligament,** L. Ren, Dalian Univ. of Technology (China); G. Song, Univ. of Houston ..... [6532-63]

Lunch Break ..... 12:10 to 1:30 pm

6532 continues on page 47

Thursday 22 March

Conference 6524

continued

SESSION 12

Room: Town & Country ..... Thurs. 1:30 to 4:20 pm

Applications of EAP II

Chairs: **James Tangorra,** Massachusetts Institute of Technology; **Seon-Jeong Kim**, Hanyang Univ. (South Korea)

1:30 pm: **The application of conducting polymers to biorobotic fins and other devices *(Invited Paper)*,** J. L. Tangorra, P. A. Anquetil, I. W. Hunter, Massachusetts Institute of Technology ..... [6524-51]

2:10 pm: **Applications of dielectric elastomer EPAM sensors,** M. A. Rosenthal, M. Senesky, N. Bonwit, C. Duncheon, J. R. Heim, Artificial Muscle, Inc. ..... [6524-52]

2:30 pm: **The novel Braille display actuator using the electroactive polymer P(VDF-TrFE-CFE),** K. Ren, S. Liu, M. Lin, Q. Zhang, The Pennsylvania State Univ. ..... [6524-53]

2:50 pm: **Capacitive charging and background processes in carbon nanotube yarn actuators,** T. Mirfakhrai, The Univ. of British Columbia (Canada); M. Kozlov, M. Zhang, S. Fang, R. H. Baughman, The Univ. of Texas at Dallas; J. D. W. Madden, The Univ. of British Columbia (Canada) ..... [6524-54]

Coffee Break ..... 3:10 to 3:40 pm

3:40 pm: **Printed conducting polymer strain sensors for textiles,** P. D. Calvert, P. Patra, A. Sawhney, A. Agrawal, Univ. of Massachusetts ..... [6524-55]

4:00 pm: **Integrated extension sensor based on resistance and voltage measurement for a dielectric elastomer,** B. M. O'Brien, J. F. Thode, I. A. Anderson, The Univ. of Auckland (New Zealand); E. P. Calius, Industrial Research Ltd. (New Zealand); E. Haemmerle, S. Xie, The Univ. of Auckland (New Zealand) ..... [6524-56]

Conference 6525

continued

SESSION 16

Room: Royal Palm V ..... Thurs. 1:40 to 3:00 pm

Active Control I

Chairs: **Nader Jalili**, Clemson Univ.; **Umesh A. Korde**, South Dakota School of Mines and Technology

1:40 pm: **Studies on small circular membrane mirrors with electrostatic actuation and closed-loop control,** U. A. Korde, M. A. Wickersham, J. J. Farke, M. E. Hofacker, South Dakota School of Mines and Technology ..... [6525-70]

2:00 pm: **Integral control of collocated smart structures,** S. S. Aphale, A. J. Fleming, S. O. R. Moheimani, The Univ. of Newcastle (Australia) ..... [6525-71]

2:20 pm: **Performance evaluation of a new type of jetting dispenser using piezoelectic actuator,** S. Choi, M. Choi, Inha Univ. (South Korea) ..... [6525-73]

2:40 pm: **Autonomous-decenytalized smart structural control scheme: variable slip-force level damper control with microprocessor,** A. Nishitani, Waseda Univ. (Japan); Y. Nitta, Ashikaga Institute of Technology (Japan); N. Miyoshi, Obayashi Corp. (Japan) ..... [6525-74]

Coffee Break ..... 3:00 to 3:40 pm

6525 continues on page 48

Conference 6526

Session 14 and 18 run concurrently

SESSION 14

Room: Golden West ..... Thurs. 1:30 to 3:10 pm

CNT-Based Nanocomposites I

Chairs: **Zoubeida Ounaies**, Texas A&M Univ.; **Nader Jalili**, Clemson Univ.

1:30 pm: **Thermal expansion and frequency response investigation of carbon nanotubes-based thermal sensors and actuators,** M. R. Hosseini, N. Jalili, Clemson Univ. ..... [6526-63]

1:50 pm: **Three-dimensional multifunctional hierarchical nanocomposites: multifunctional materials,** M. N. Ghasemi-Nejhad, A. Cao, Univ. of Hawaii at Manoa ..... [6526-64]

2:10 pm: **Electric field tailoring of single wall carbon nanotube polymer composites for dual sensing and actuation,** S. Banda, Z. Ounaies, Texas A&M Univ. ..... [6526-65]

2:30 pm: **Self-sensing and self-actuation response of carbon nanotube composites,** H. Y. Lee, Y. M. Shkel, Univ. of Wisconsin/Madison ..... [6526-66]

2:50 pm: **Multifunctional composites with self-sensing capabilities: carbon nanotube-based networks,** E. T. Thostenson, T. Chou, Univ. of Delaware ..... [6526-67]

Coffee Break ..... 3:10 to 3:40 pm

SESSION 18

Room: Atlas California ..... Thurs. 1:30 to 3:10 pm

Shape Memory Materials

Chairs: **Dimitris C. Lagoudas**, Texas A&M Univ.; **Hui Qian**, Dalian Univ. of Technology (China)

1:30 pm: **Fatigue life characterization and modeling of SMA actuators,** D. C. Lagoudas, O. W. Bertacchini, Texas A&M Univ.; E. Patoor, École Nationale Supérieure d'Arts et Métiers (France) ..... [6526-81]

1:50 pm: **Thermomechanical characterization of TiPdNi high-temperature SMAs,** P. K. Kumar, D. C. Lagoudas, Texas A&M Univ. ..... [6526-82]

2:10 pm: **A cyclic model for superelastic shape memory alloys,** L. Saint Sulpice, ENSIETA (France); S. Arbab Chirani, Ecole Nationale d'Ingénieurs de Brest (France); S. Calloch, ENSIETA (France) .... [6526-83]

2:30 pm: **Relation between Martensite volume fraction and equivalent transformation strain in anisotropic shape memory alloys,** K. Taillard, École Normale Supérieure de Cachan (France); S. Arbab Chirani, Ecole Nationale d'Ingénieurs de Brest (France); S. Calloch, ENSIETA (France); C. Lexcellent, Univ. de Franche-Comté (France) ..... [6526-84]

2:50 pm: **Superelastic behavior of shape memory alloy wire considering the influence of loading frequency: theory and experiment,** H. Qian, Dalian Univ. of Technology (China) ..... [6526-85]

Coffee Break ..... 3:10 to 3:40 pm

6526 continues on page 48

Conference 6528

Session 8 and 10 run concurrently

SESSION 8

Room: Royal Palm III ..... Thurs. 1:30 to 2:50 pm

Biosensors and BioMEMS III

Chairs: **Thomas Otto**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **Smitha Shankar**, Royal Melbourne Institute of Technology (Australia)

1:30 pm: **Integrated polymer multimode waveguides for microfluidic sensing applications,** T. Otto, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); J. Nestler, Technische Univ. Chemnitz (Germany); M. Baum, F. Ebling, H. Schroeder, T. Gessner, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [6528-50]

1:50 pm: **Passive wireless flow sensors for point-of-care monitoring applications,** J. K. Abraham, S. Dubakka, V. K. Varadan, R. Tian, Univ. of Arkansas ..... [6528-43]

2:10 pm: **MEMS glaucoma monitoring device,** S. Shankar, M. Austin, Royal Melbourne Institute of Technology (Australia) ..... [6528-36]

2:30 pm: **Viability study of oscillatory flow pumps using bimorph piezoelectric actuators,** S. L. Vatanabe, A. Choi, INOVEO Automação de Sistemas (Brazil); R. F. Pires, P. H. Nakasone, Escola Politécnica da Univ. de São Paulo (Brazil); C. R. de Lima, INOVEO Automação de Sistemas (Brazil); E. C. N. Silva, Escola Politécnica da Univ. de São Paulo (Brazil) ..... [6528-28]

Thursday 22 March

Conference 6528

Session 8 and 10 run concurrently

SESSION 10

Room: San Diego ..... Thurs. 1:30 to 2:20 pm

Packaging

Chair: **Silke Spiesshoefer**, NeoNanoSys

Keynote

1:30 pm: **The role of nano- and micro-devices in cardiovascular surgery and neurosurgery,** V. K. Varadan, Univ. of Arkansas ..... [6528-57]

2:00 pm: **Electronic packaging for medical devices,** V. Wang, V. K. Varadan, Univ. of Arkansas; S. Spiesshoefer, NeoNanoSys ..... [6528-58]

6528 continues on page 48

Conference 6529

Session 24 and 28 run concurrently

SESSION 24

Room: Royal Palm I ..... Thurs. 1:30 to 3:10 pm

Fiber Optic Sensors for SHM II

Chairs: **Rola L. Idriss**, New Mexico State Univ.; **Jinping Ou**, Harbin Institute of Technology (China)

1:30 pm: **Polymer optical fiber sensors for civil infrastructure systems,** S. Kiesel, O. Abdi, K. J. Peters, M. Kowalsky, T. Hassan, North Carolina State Univ. ..... [6529-109]

1:50 pm: **Low-cost fiber Bragg grating interrogation system for in situ assessment of structures,** J. R. Zayas, D. P. Roach, Sandia National Labs.; W. R. Allan, D. A. Horsley, Univ. of California/Davis ..... [6529-110]

2:10 pm: **Application of an embedded FBG sensor system to RC structure health monitoring,** S. Li, H. Li, Dalian Univ. of Technology (China) ..... [6529-112]

2:30 pm: **Dynamic shape estimation by modal approach using fiber Bragg grating strain sensors,** S. Rapp, Technische Univ. München (Germany); L. Kang, Korea Advanced Institute of Science and Technology (South Korea); U. C. Mueller, H. J. Baier, Technische Univ. München (Germany); J. Han, Korea Advanced Institute of Science and Technology (South Korea) ..... [6529-113]

2:50 pm: **Monitoring of an interstate highway bridge from construction thru service with a built-in fiber optic sensor system,** R. L. Idriss, Z. Liang, New Mexico State Univ. ..... [6529-114]

Coffee Break ..... 3:10 to 3:40 pm

SESSION 28

Room: Royal Palm II ..... Thurs. 1:30 to 2:50 pm

Modeling and Design of Smart Systems III

Chairs: **Piervincenzo Rizzo**, Univ. of Pittsburgh; **Hoon Sohn**, Carnegie Mellon Univ.

1:30 pm: **Non-contact rail flaw detection system: first field test,** P. Rizzo, Univ. of Pittsburgh; S. Coccia, I. Bartoli, F. Lanza di Scalea, Univ. of California/San Diego; M. A. Fateh, Federal Railroad Administration ..... [6529-129]

1:50 pm: **Reference-free transducer and system diagnosis and beyond,** H. Sohn, D. W. Greve, I. J. Oppenheim, S. B. Kim, S. Lee, S. Kim, A. Boscha, Carnegie Mellon Univ. ..... [6529-130]

2:10 pm: **Multi-mode models of atomic force microscopes and enhanced selectivity by exploiting sensitivity vector fields,** J. Lim, B. I. Epureanu, Univ. of Michigan ..... [6529-132]

2:30 pm: **Characterization and 3D modeling of Ni60Ti SMA for actuation of a variable geometry jet engine chevron,** D. C. Lagoudas, D. J. Hartl, Texas A&M Univ.; F. T. Calkins, J. H. Mabe, The Boeing Co. ..... [6529-133]

Coffee Break ..... 2:50 to 3:40 pm

6529 continues on page 49

Conference 6531

continued

SESSION 5

Room: Royal Palm VI ..... Thurs. 1:30 to 3:10 pm

Remote Sensing and Homeland Security Applications

Chairs: **Guo-Hua Feng**, National Chung Cheng Univ. (Taiwan); **Juan D. Valencia**, Pacific Northwest National Lab.

1:30 pm: **Building inventory extraction method using remote sensing for urban risk management,** P. Sarabandi, Stanford Univ.; H. Chung, ImageCat, Inc. [6531-39]

1:50 pm: **Performance evaluation of decentralized wireless sensing and control in civil structures,** Y. Wang, Stanford Univ.; R. A. Swartz, J. P. Lynch, Univ. of Michigan; K. H. Law, Stanford Univ. ..... [6531-40]

2:10 pm: **Passive wireless displacement sensor for civil structural health,** D. J. Thomson, G. E. Bridges, D. Card, C. S. Klowak, A. A. Mufti, Univ. of Manitoba (Canada) ..... [6531-41]

2:30 pm: **Study on the weights of different human face geometric feature values,** J. Liu, Y. Lan, Y. Zhou, Y. Pan, Chongqing Univ. (China) ..... [6531-42]

2:50 pm: **Role of structural health monitoring for bridge security: a workshop finding,** M. M. Ettouney, Weidlinger Associates Inc.; S. Alampalli, New York State Department of Transportation ..... [6531-43]

Coffee Break ..... 3:10 to 3:40 pm

6531 continues on page 49

Conference 6532

continued

SESSION 14

Room: Royal Palm IV ..... Thurs. 1:30 to 3:10 pm

Guided Waves and Vibration Based Techniques for SHM

Chairs: **Hoon Sohn**, Carnegie Mellon Univ.; **Sauvik Banerjee**, St. Louis Univ.

1:30 pm: **Detection of structural damage in carbon fiber and metal structures using Lamb waves,** A. MacLean, G. J. Thursby, H. Hogg, B. Culshaw, Univ. of Strathclyde (United Kingdom) .... [6532-64]

1:50 pm: **Strategies for overcoming the effect of temperature on guided wave structural health monitoring,** P. D. Wilcox, A. J. Croxford, G. Konstantinidis, B. W. Drinkwater, Univ. of Bristol (United Kingdom) ..... [6532-65]

2:10 pm: **Autonomous health monitoring of stiffened composite structures using statistical damage index approach,** S. Banerjee, St. Louis Univ.; F. Ricci, Univ. degli Studi di Napoli Federico II (Italy); A. K. Mal, Univ. of California/Los Angeles ..... [6532-66]

2:30 pm: **Monitoring cracks and prestress-loss in PSC girder bridges using vibration-based damage detection techniques,** J. Park, J. Kim, Y. Ryu, J. Lee, Pukyong National Univ. (South Korea) ..... [6532-67]

2:50 pm: **Hybrid health monitoring of PSC girder bridges using vibration and impedance based methods,** D. Hong, J. Kim, W. Na, H. Do, Pukyong National Univ. (South Korea) ..... [6532-68]

Thursday 22 March

Conference 6525

continued

SESSION 17

Room: Royal Palm V ..... Thurs. 3:40 to 6:00 pm

Active Control II

Chairs: **Roger Ohayon**, Conservatoire National des Arts et Métiers (France); **Seung-Bok Choi**, Inha Univ. (South Korea)

3:40 pm: **Adaptive sound absorption for small to medium class payload fairings,** M. A. Creasy, D. J. Leo, Virginia Polytechnic Institute and State Univ.; K. M. Farinholt, NanoSonic, Inc. ..... [6525-75]

4:00 pm: **Broadband noise and vibration reduction for lightweight chassis design using smart structure technologies,** M. Gusenbauer, T. Rittenschober, L. Messner, Profactor Produktionsforschungs GmbH (Austria) ..... [6525-76]

4:20 pm: **Vibration suppression of hull structure using macro fiber composite actuators and sensors,** S. Choi, J. Sohn, Inha Univ. (South Korea) ..... [6525-77]

4:40 pm: **Nonlinear modeling of piezoelectric layered beams,** N. Jalili, Clemson Univ.; M. Saghafi, Sharif Univ. of Technology (Iran) ..... [6525-78]

5:00 pm: **A novel approach for feedforward hysteresis compensation of piezoelectrically driven systems,** S. Bashash, N. Jalili, Clemson Univ. ..... [6525-79]

5:20 pm: **Negative capacitance shunts for vibration control and suppression of reactive input power,** K. A. Cunefare, Georgia Institute of Technology . [6525-80]

5:40 pm: **Fuzzy control for nonlinear structure with semi-active friction damper,** Z. Dahai, Dalian Univ. of Technology (China) ..... [6525-81]

Conference 6526

Session 15 and 19 run concurrently

SESSION 15

Room: Golden West ..... Thurs. 3:40 to 5:00 pm

CNT-Based Nanocomposites II

Chairs: **Hilary Bart-Smith**, Univ. of Virginia; **Nader Jalili**, Clemson Univ.

3:40 pm: **High-homogeneity of LBL composites from SWNT leads to efficient charge tranport and integration of conductivity and mechanical strength,** B. S. Shim, N. A. Kotov, Z. Tang, Univ. of Michigan ..... [6526-69]

4:00 pm: **Performance and characteristics of functionalized multiwalled carbon nanotubes/cellulose EAPap actuator,** J. Kim, S. Yun, S. Lee, K. Cho, Inha Univ. (South Korea) .... [6526-70]

4:20 pm: **Axially compressed buckling of an embedded carbon nanotube subjected to thermo-electro-mechanical loading,** A. Salehi-Khojin, N. Jalili, Clemson Univ. ..... [6526-71]

4:40 pm: **Alignment of multiwalled carbon nanotubes in cellulose EAPap by electric fields,** J. Kim, S. Yun, Inha Univ. (South Korea); S. Banda, Z. Ounaies, Texas A&M Univ. ..... [6526-72]

SESSION 19

Room: Atlas California ..... Thurs. 3:40 to 5:20 pm

Magnetostrictive Materials

Chairs: **Constantin Ciocanel**, Univ. of Toledo; **William S. Oates**, Florida State Univ.

3:40 pm: **Producing and quantifying induced anisotropy in stress-annealed polycrystalline galfenol,** J. R. Boer, Etrema Products, Inc.; J. B. Restorff, Naval Surface Warfare Ctr.; E. M. Summers, Etrema Products, Inc. ..... [6526-86]

4:00 pm: **Magnetostrictive bending micro-actuator using iron-gallium alloy,** T. Ueno, T. Higuchi, The Univ. of Tokyo (Japan) ..... [6526-88]

4:20 pm: **Magneto-mechanical model of sensor-actuator in bending mode,** S. Datta, A. B. Flatau, Univ. of Maryland/ College Park ..... [6526-89]

4:40 pm: **Experimental implementation of a nonlinear control design for a magnetostrictive actuator,** W. S. Oates, R. C. Smith, North Carolina State Univ.; P. G. Evans, M. J. Dapino, The Ohio State Univ. ..... [6526-90]

5:00 pm: **Soft ferromagnetic materials blend and extension effect of magnetostrictive composite,** X. Guan, X. Dong, J. Ou, Harbin Institute of Technology (China) ..... [6526-91]

Conference 6528

Session 9 and 11 run concurrently

SESSION 9

Room: Royal Palm III ..... Thurs. 2:50 to 4:50 pm

Applications II

Chair: **Sang H. Choi**, NASA Langley Research Ctr.

2:50 pm: **Measurement of stresses in MEMS structures by stress release,** D. W. Vogel, N. Sabate, A. Gollhardt, B. Michel, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [6528-30]

Coffee Break ..... 3:10 to 3:30 pm

3:30 pm: **Three-dimensional fiber optical trap for biological force measurement,** Y. Liu, M. Yu, Univ. of Maryland/College Park ..... [6528-12]

3:50 pm: **In situ monitoring of volatile organic compounds using a single-mode D-fiber and polydimethylsiloxane-evanescent field interaction,** J. D. Gordon, S. M. Schultz, R. H. Selfridge, Brigham Young Univ. ..... [6528-10]

4:10 pm: **Hologram-based humidity indicator for domestic and packaging applications,** I. Naydenova, J. M. Raghavendra, Dublin Institute of Technology (Ireland); V. Toal, Dublin Institute of Technology (Ireland) and Ctr. for Industrial and Engineering Optics (Ireland); S. Martin, Dublin Institute of Technology (Ireland) ..... [6528-29]

4:30 pm: **Uncertainty analysis of mircoresonator using interval algorithm,** B. Vasuki, M. Umapathy, G. Uma, M. Shanmugavalli, National Institute of Technology/Tiruchirappalli (India) ..... [6528-23]

SESSION 11

Room: San Diego ..... Thurs. 2:20 to 4:20 pm

Integrated Nano- and Micro-structures

Chairs: **Yu Qiao**, Univ. of California/San Diego; **Nader Jalili**, Clemson Univ.

2:20 pm: **Point-of-care (POC) flexible organic thin film transistor based sensors in smart fabrics,** S. Jung, T. Ji, V. K. Varadan, Univ. of Arkansas .... [6528-59]

2:40 pm: **Fused vision force feedback based optimal robust control of a nanomanipulator for nanofiber grasping applications,** R. Saeidpourazar, N. Jalili, Clemson Univ. ..... [6528-15]

Coffee Break ..... 3:00 to 3:20 pm

3:20 pm: **Studying insect motion with piezoelectric sensors,** B. Mika, H. Lee, J. Gonzalez, B. Lam, V. Godinich, B. Vinson, H. Liang, Texas A&M Univ. ..... [6528-21]

3:40 pm: **Developing high-performance energy absorption structures based on nanoporous technologies,** Y. Qiao, Univ. of California/San Diego ..... [6528-06]

4:00 pm: **Development of amperometric glucose sensors with heterostructured nanowire arrays for continuous subcutaneous monitoring,** D. Deshpande, H. Yoon, A. Khaing, V. K. Varadan, Univ. of Arkansas ..... [6528-48]

Thursday 22 March

Conference 6528

continued

SESSION 12

Room: San Diego ..... Thurs. 4:20 to 5:40 pm

Fabrication and Characterization

Chairs: **Dietmar W. Vogel**, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany); **C. Y. Wu**, National Taiwan Univ. (Taiwan)

4:20 pm: **Coupled flexural-torsional nonlinear vibrations of microcantilever beams,** S. N. Mahmoodi, N. Jalili, Clemson Univ. ..... [6528-14]

4:40 pm: **Visualization of buried structures in atomic force acoustic microscopy,** A. Striegler, B. Koehler, B. Bendjus, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); N. Pathuri, N. G. Meyendorf, Univ. of Dayton ..... [6528-38]

5:00 pm: **Microdeformation analysis by atomic force acoustic microscopy,** B. Bendjus, B. Koehler, A. Striegler, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); N. G. Meyendorf, Univ. of Dayton; D. W. Vogel, Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration (Germany) ..... [6528-49]

5:20 pm: **Study of the transverse shear mode resonator with coupled viscoelastic layer by scanning tunneling microscopy,** G. K. Chen, C. Y. Wu, K. Wu, W. Wu, C. K. Lee, National Taiwan Univ. (Taiwan) ..... [6528-19]

Conference 6529

Session 25 and 29 run concurrently

SESSION 25

Room: Royal Palm I ..... Thurs. 3:40 to 5:00 pm

Fiber Optic Sensors for SHM III

Chairs: **Hiroyuki Yamanouchi**, Building Research Institute (Japan); **Chung-Bang Yun**, Korea Advanced Institute of Science and Technology (South Korea)

3:40 pm: **Effect of residual strain on sensing property of FRP-OFBG smart rebar,** Z. Zhang, Z. Zhou, J. Ou, Harbin Institute of Technology (China) [6529-115]

4:00 pm: **Strain and acceleration measurements of steel structure by FBG sensors,** X. Ji, H. Li, R. Liang, Dalian Univ. of Technology (China) ..... [6529-116]

4:20 pm: **Multiplexing low-coherence interferometer sensors: laboratory tests and design for integration within RC structures,** M. Pozzi, D. Zonta, H. Wu, Univ. degli Studi di Trento (Italy); D. Inaudi, Smartec SA (Switzerland) ..... [6529-117]

4:40 pm: **Modal flexibility-based damage detection technique for online structural health monitoring using smart FBG sensors,** H. Park, S. Shin, K. Koo, C. Yun, Korea Advanced Institute of Science and Technology (South Korea) ..... [6529-118]

SESSION 29

Room: Royal Palm II ..... Thurs. 3:40 to 5:20 pm

Wireless for SHM II

Chairs: **Xiaoqi Bao**, Jet Propulsion Lab.; **Fuh-Gwo Yuan**, North Carolina State Univ.

3:40 pm: **Wireless piezoelectric acoustic-electric power feedthru,** X. Bao, B. J. Doty, S. Sherrit, M. Badescu, Y. Bar-Cohen, J. Aldrich, Z. Chang, Jet Propulsion Lab. ..... [6529-134]

4:00 pm: **Energy harvesting by magnetostrictive material (MsM) for powering wireless sensors in SHM,** L. Wang, F. Yuan, North Carolina State Univ. ..... [6529-135]

4:20 pm: **Power loss considerations in wireless piezoelectric acoustic-electric power feedthru,** Z. Chang, X. Bao, B. J. Doty, S. Sherrit, Y. Bar-Cohen, M. Badescu, J. Aldrich, Jet Propulsion Lab. ..... [6529-136]

4:40 pm: **Structural health monitoring utilizing Intel's Imote2 wireless sensor platform,** B. F. Spencer, Jr., T. Nagayama, J. A. Rice, Univ. of Illinois at Urbana-Champaign ..... [6529-137]

5:00 pm: **Application of wireless sensing and control system to control,** C. Loh, K. Lu, Y. Lin, National Taiwan Univ. (Taiwan); P. Lin, National Ctr. for Research on Earthquake Engineering (Taiwan); J. P. Lynch, Univ. of Michigan ..... [6529-138]

Conference 6531

continued

SESSION 6

Room: Royal Palm VI ..... Thurs. 3:40 to 5:00 pm

Applied Imaging

Chairs: **Aaron A. Diaz**, Pacific Northwest National Lab.; **Amrita Kumar**, Acellent Technologies, Inc.

3:40 pm: **Application of 3-D visualization based on computed tomography to oral implantation orientation,** B. Wei, Chongqing Univ. (China); Y. Wang, HuiZhou Hospital of Stomatology (China); D. Mi, P. Feng, F. Yao, Chongqing Univ. (China); Z. Wang, HuiZhou Hospital of Stomatology (China) ..... [6531-44]

4:00 pm: **On an image reconstruction method for ECT,** S. Akira, T. Suzuki, Y. Nishimura, National Institute of Advanced Industrial Science and Technology (Japan) ..... [6531-45]

4:20 pm: **Sampling phased array: a new method of signal processing and image reconstruction in ultrasonic non-destructive testing,** M. Kroening, A. Boulavinov, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); K. M. Reddy, Quality Network Pvt. Ltd. (India); L. von Bernus, Q Net Quality Management GmbH (Germany); D. Joneit, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany) ..... [6531-46]

4:40 pm: **Advanced hybrid piezoelectric energy harvesting power supply for sensor networks,** T. Xu, National Institute of Aerospace; J. Su, NASA Langley Research Ctr.; X. S. Jiang, W. S. Hackenberge, TRS Technologies, Inc. ..... [6531-47]

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Electroactive Polymer Actuators and Devices

SC634

Course level: Introductory
CEU .65 $460 / $545 USD
Sunday 8:30 am to 5:30 pm

This course will provide an overview of the field of EAP covering the state of the art, challenges and potential. Two general classes of polymer materials are described, namely those that involve ionic mechanisms (Ionic EAP), and field activated materials (Electronic EAP). The basic mechanisms responsible for the electroactive behavior of EAP materials will be covered and compared with natural muscles. Analytical models, fabrication processes and methods of characterizing these materials will be described. Moreover, the currently considered applications will be reviewed including actuators, robotics, animatronics, medical, and biologically inspired mechanisms, so called biomimetics. The course begins with an overview of the field, current capabilities, potential and challenges. The course follows with a description of the currently available EAP materials and principles of operating them as actuators and artificial muscles. The course ends with a review of the future prospect of EAP as actuators in systems, mechanisms and smart structures for space, industrial and medical applications.

LEARNING OUTCOMES

This course will enable you to:

- identify EAP based available and emerging actuators
- learn the fundamentals of electroactive behavior in leading EAP materials
- describe the capabilities, limitations and benefits of electroactive polymers
- assess the applicability of current EAP actuators while accounting for their limitations
- understand mechanical analysis and design principles associated with EAP
- describe the future prospects of EAP materials as actuators and their applications

INTENDED AUDIENCE

Engineers, scientists and managers who need to understand the basic concepts of EAP, or are interested in learning, applying or engineering mechanisms or devices using EAP materials. Also those who wish to discover the excitement of research and development in EAP materials and their applications - present and future.

INSTRUCTORS

Yoseph Bar-Cohen is Senior Research Scientist and Supervisor, Advanced Technologies Group, at JPL. He is a leading expert in advanced actuators using electroactive polymers and ceramic materials. Dr. Bar-Cohen is a Fellow of SPIE and ASNT. He is the author/coauthor of numerous publications, has many registered patents and is the recipient of many awards and honors. Further information on: http://ndeaa.jpl.nasa.gov/nasa-nde/yosi/yosi.htm

John Madden is an Assistant Professor of Electrical & Computer Engineering at the University of British Columbia, Vancouver, Canada. His research areas include the application of EAP materials in active catheters, as well as the development and characterization of molecular and carbon nanotube actuators. http://mm.ece.ubc.ca/

Qibing Pei is professor of materials science and engineering at the University of California, Los Angeles. His research interests cover a wide range of soft materials and span from materials synthesis, processing, to design of functional devices. He applies molecular design and nano-scale engineering in the discovery of new polymers with novel electronic or mechanical property. http://www.seas.ucla.edu/ms/faculty1/qibing_pei.html

SPIE
Smart Structures and Materials *and* NDE for Health Monitoring and Diagnostics

18 – 22 March 2007

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Onsite Registration Hours

San Diego Town and Country Resort & Convention Center

Atlas Foyer

Sunday 18 March ..... 11:00 am to 4:00 pm
Monday 19 March ..... 7:00 am to 5:15 pm
Tuesday 20 March ..... 7:00 am to 4:00 pm
and 5:30 to 7:00 pm
Wednesday 21 March ..... 7:30 am to 4:00 pm
Thursday 22 March ..... 7:30 am to 11:00 am

Technical Exhibition Hours

Grand Exhibition Hall

Tuesday 20 March ..... 10:00 am to 4:00 pm
6:00 pm to 7:30 pm
Wednesday 21 March ..... 10:00 am to 4:00 pm

- Meet managers and technicians to discuss your technology needs
- Compare the latest products and services
- Network with colleagues and exhibitors

For information about exhibiting at this symposium please contact, SPIE Exhibition Sales (1) 360/676-3290 or email sales@spie.org.

Welcome Reception

Poolside by Terrace Pavilion

Monday 19 March ..... 6:00 to 7:30 pm
Sponsored by: San Diego Town and Country Resort & Convention Center, and SPIE.
All attendees are invited to relax, socialize and enjoy refreshments at the Town and Country resort poolside. Please remember to wear your conference registration badge. Dress is casual.

Coffee Breaks

Coffee will be served at the following locations at approximately these times (see your final program listing for specific coffee break times per conference): ***Note:*** Breakfast baked goods will be served with the 10:00 am break each day.

Atlas Foyer
Sunday ..... 3:00 to 3:30 pm

Atlas Foyer
Monday ..... 10:00 to 10:30 am
and 3:00 to 3:30 pm

Grand Exhibit Hall
Tuesday and Wednesday ..... 10:00 to 10:30 am
and 3:00 to 3:30 pm

Atlas Foyer
Thursday ..... 10:00 to 10:30 am
and 3:00 to 3:30 pm

Desserts

Dessert snacks will be served in the Grand Exhibit Hall Tuesday and Wednesday from 3:00 and 3:30 pm. Complimentary tickets for dessert snacks will be included in attendee registration packets.

Poster/Exhibition Reception

Grand Exhibit Hall

Tuesday 20 March ..... 6:00 to 7:30 pm
The exhibition hall will be open Tuesday evening in conjunction with the poster session, to allow attendees specific exhibition and poster viewing time during the symposium. Take the opportunity to see the exhibits and talk with company representatives as well as review posters. Refreshments will be served.

Setup

Poster authors will be able to set up their poster papers between 10:00 am and 4:00 pm Tuesday. Poster papers can be previewed up until 4:00 pm. The Exhibition/Poster area will be closed from 4:00 to 6:00 pm and then reopen at 6:00 pm for the formal poster session and evening exhibition visiting hours.

Removal

Presenters must remove their posters imme-diately after poster session. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of a poster session.

Display Hours

Posters will be on display from 10 am to 4 pm, and from 6:00 to 7:30 pm.

Message Center

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The SPIE Message Board will be located near the Registration Desk. Messages will be taken during registration hours Saturday through Thursday. To leave a message, call the hotel and ask the hotel operator for the SPIE Registration Desk.

Internet Access

Monday - Wednesday ..... 7:00 am to 6:00 pm
Thursday ..... 7:00 am to 1:30 pm
An internet access area will be equipped with stations so attendees may access their internet e-mail during the conference. There will be a 10-minute time limit per each person's internet session when others are waiting.

Wireless Internet Access (Wi-Fi)

Guest rooms at The San Diego Town and Country Resort & Convention Center are equipped with high speed wireless internet, available at a special discounted rate of $4.95 for 24 hours for attendees of the Symposium. Laptops will need an appropriate wireless card and access is available in all guest room areas. Please contact internet call center at Ext. 1234 in order to get this discounted rate. You will need a credit card for this access. Note: WiFi service is not available in or near meeting rooms. Properly secure your computer before accessing the Public Wireless network. Failure to do so may allow unauthorized access to your laptop.

General Information

Speakers Audiovisual Desk

Terrace Salon I

Sunday through Thursday ..... 7:30 am to 5:00 pm
All conference rooms will have a computer, LCD projector, screen, lapel microphone, and laser pointer. All Presenters are requested to come to the speaker audiovisual desk to confirm display settings of their presentations from their memory devices or laptops with the audiovisual equipment being used at this symposium.

IMPORTANT LASER POINTER SAFETY INFORMATION

- SPIE supplies tested and safety approved laser pointers for all conference meeting rooms, and for course rooms if instructors request one. For safety reasons, SPIE requests that presenters use our provided laser pointers available in each meeting room.
- If using your own laser pointer, have it tested at your facility to make sure it has <5 mW power output. Laser pointers in Class II and IIIa (<5 mW) are eye safe if power output is correct - but don't automatically trust the labeling. Commercially available laser pointers, red or green (or any color), could be incorrectly labeled as to their wavelength and power output.
- Presenters intending to use their own laser pointer for presentations are required to come to the Audiovisual Desk onsite and test their pointer on our power meter. If the pointer fails the safe power level you may not use the pointer at the conference. You will be required to sign a waiver releasing SPIE of any liability for use of potentially non-safe laser pointers.
- Use of a personal laser pointer at an SPIE event represents user's acceptance of liability for use of a non-SPIE supplied laser pointer device. Misuse of any laser pointer could lead to eye damage. In California, it is a criminal misdemeanor to shine a laser pointer at individuals "who perceive they are at risk."

SPIE Books on Display

Atlas Foyer

Open during registration hours
On display near Registration, SPIE will have a wide range of scholarly books, tutorials, proceedings, and CD-ROMs for professionals and educators in the fields of optics, photonics and imaging. Be sure to visit the display and browse the newest SPIE publications, and take advantage of special meeting prices for ordering any of the display publications. You may purchase items on-site from the Registration Cashier.

Audio/Video/Digital Recording Policy

Due to copyright restrictions, strictly no recordings of any kind are permitted without prior written consent of the presenter in any conference session, short course or posters. Consent forms are available at the SPIE Audiovisual Desk and anyone wishing to record must have a written consent form signed and filed for each presenter being recorded. Individuals not complying with this policy will be asked to leave a given session and asked to surrender their film or recording media.

In the Exhibition Hall: For security and courtesy reasons, photographing or videotaping individual booths and displays in the exhibit hall is allowed ONLY with explicit permission from on-site company representatives. Individuals not complying with this policy will be asked to surrender their film and to leave the exhibition hall.

Underage Persons on Show Floor

For safety and insurance reasons, no persons under the age of 16 will be allowed in the exhibition area during move-in and move-out. During open exhibition hours, only children over the age of 12 accompanied by an adult will be allowed in the exhibition area.

Photography

Personal photographs and video taping of individual booths (and their displays) is not allowed without the explicit permission from the company representative on-site. Failure to obtain consent could result in losing your film and being asked to leave the Exhibition Hall.

Proceedings of SPIE

A full-manuscript, editor-reviewed Proceedings of SPIE volume will be published for each conference and will be available within four to eight weeks after the symposium. If you are unable to attend, you may order Proceedings now at reduced prepublication prices. See page 54 for details and order information.

Business Center Services

Conference Center, Upper Level of Atlas Foyer

Monday through Thursday
The business center can make copies, print documents or transparencies from your laptop, fax services and offices supplies. Prices for services are posted on site.

Sightseeing / Shopping / Restaurants

The Town and Country Resort & Convention Center features 1,000 guest rooms spread over 40 lushly landscaped acres in San Diego's Mission Valley. The hotel has five restaurants providing diverse dining experiences and several lounges offer a relaxing retreat from the day's activities. For casual dining, try the Terrace Café or for a quick bite visit the Sunshine Deli. You'll enjoy Charlie's for fun eats, a game of pool or the latest sports events on their big screen TV. Trellises Garden Grille features creative appetizers, healthy light entrees, a variety of pastas and pizzas, fish, vegetable entrees and lavish desserts. Kelly's Steakhouse & Irish Pub continues a tradition of serving some of the best slow-roasted prime rib you'll ever taste as well as hosting nightly sing-along's in Kelly's famous piano bar. Three swimming pools, full service spa and health club, barber and beauty services, in-room movies, valet and room services, and a complimentary morning newspaper are available to each guest! Located in the heart of Mission Valley, the Town and Country Resort is ideally situated for attendees and their guests to enjoy the many adjacent and nearby attractions.

Attendees wishing to arrange for tours/sightseeing for themselves, or traveling guests, may contact the hotel concierge prior to the meeting to make arrangements concierge@towncountry.com. Concierge services are offered on-site in the main lobby.
Services include:

- Discount tickets to San Diego Zoo and Seaworld
- Discount rates for Riverwalk Golf Course
- Priority seating at Hotel Restaurants and off property restaurants
- San Diego City, Mexico, wine tours or harbor excursions
- Public Transit Information, local driving directions/maps

Fashion Valley Mall

Located directly behind the hotel. Two level outdoor garden center featuring over 300 specialty shops and restaurants and an 18 screen movie complex. It is the largest shopping area in San Diego!

Old Town

Take the Trolley or Hotel Shuttle to the founding site of San Diego with excellent Mexican dining and shopping.

Horton Plaza/Gas Lamp Quarter

Take the Trolley to downtown San Diego and enjoy shopping at Horton Plaza and/or the exciting nightlife of excellent restaurants and clubs of the Gas Lamp District.

Seaport Village

Situated on 22 acres of parkland at the water's edge, over 60 shops, galleries, and boutiques along with restaurants are found in this unique village.

Child Care

Marion's Child Care, email marionschildcare@gmail.com, within San Diego call (619) 303-4379, or 1-888-891-5029, www.hotelchildcare.com
SPIE does not imply an endorsement or recommendation of this service. It is provided on an "information only" basis for your further analysis and decision. Other services may be available.

IV Pan-American Conference on END

Buenos Aires, Argentina

October 22 to 27 of 2007 - Panamericano Buenos Aires Hotel & Resort

CALL FOR PAPERS

Oral Presentations - Poster Presentations

IV Pan-American conferences for NDT is organized by the Pan American Committee for Non Destructing Testing which brings together Associations in American continents that have related NDT activities. The conferences will be held in cooperation with the International Energy Agency. Three major events will take place jointly the ISO TC-135, ICNDT PGP and VI Corende meetings.

The purpose of the IV PANNDT it is to support the exchange the ideas and discussions of topics in relation to all availables disciplines and to evaluate component, systems and structures: Non destructive methods, staff certification, rules and regulation, welding inspections, optical and laser techniques, vibrations etc..

- Abstract due date: March, 15th.
- Abstract acceptance notice: April, 1st.
- Manuscript due date: June, 1st.

Special extension for Smart Structures/NDE 2007 attendees and SPIE members only:		
Abstract due date: March 30th	Abstract acceptance notice: April 15th	Manuscript due date: June 1st

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ICNDT

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International Atomic Energy Agency

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Travel

Ground Transportation

Hertz Car Rental has been selected as the official car rental agency for this Symposium. To reserve a car, identify yourself as a **Smart Structures/NDE Conference attendee** using the **Hertz Meeting Code CV# 029B0010**.
In the United States call 1-800-654-2240.

Shuttles & Taxis, Etc.

Xpress Shuttle from the San Diego Airport to the Town and Country Resort is $10 per person each way. Cash or credit cards accepted, no checks. After baggage claim, take the Skybridge to the "Shuttles for Hire" Island and call on the courtesy phone. The shuttle will pick you up within 10 minutes. Watch for the yellow & blue van. For further information from Xpress Shuttle call 1-800-900-7433.
Cloud Nine Shuttle from the San Diego Airport to the Town and Country Resort is six miles and the cost is $11.50 per person one-way (prices subject to change). After baggage claim, take the Skybridge to the "Shuttles for Hire" Island and ask the attendant in the blue jacket for assistance boarding. Reservations not required for transportation to the Town & Country Resort, but are required for transportation back to the airport. Cloud 9 Shuttle recommends a pickup time of at least 2 hours prior to flight departure time. Method of payment can be cash or credit card, but no checks. There is no roundtrip discount when traveling to/from hotels. Shuttle stops en route to load/unload passengers. To book online www.cloud9shuttle.com or call 1-858-974-8885.

Taxi from San Diego Airport

Taxi service between the airport and the Town and Country Resort is approximately $23 one-way.

San Diego Trolley/Light Rail *(Metropolitan Transit System)*

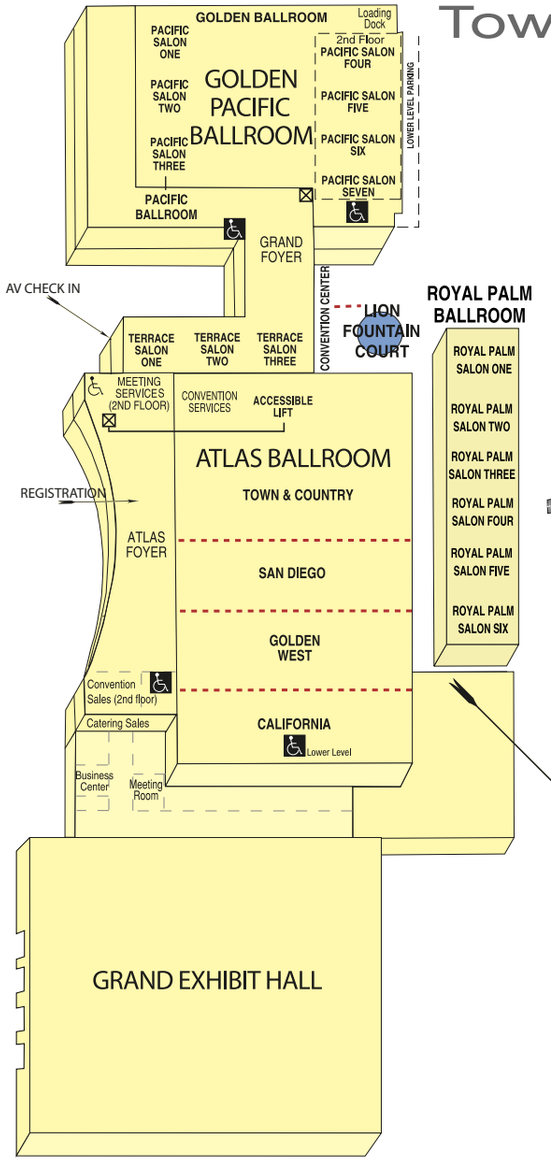
The San Diego Trolley, i.e. the light rail, is referred to as the "moving landmark" and is a fun way to get around, serving a wide area from the International Border, to Centre City's shopping harbor, Mission Valley, Fashion Valley, Old Town, Downtown including the Gas Lamp Quarter, etc. Fares are based on the trip distance. The fare ranges from $1.25 to $3.00 depending on how many stations are traveled (fares are subject to change). Trolley cars are red, and they travel above ground on light rail lines. The closest trolley stop, the Fashion Valley.

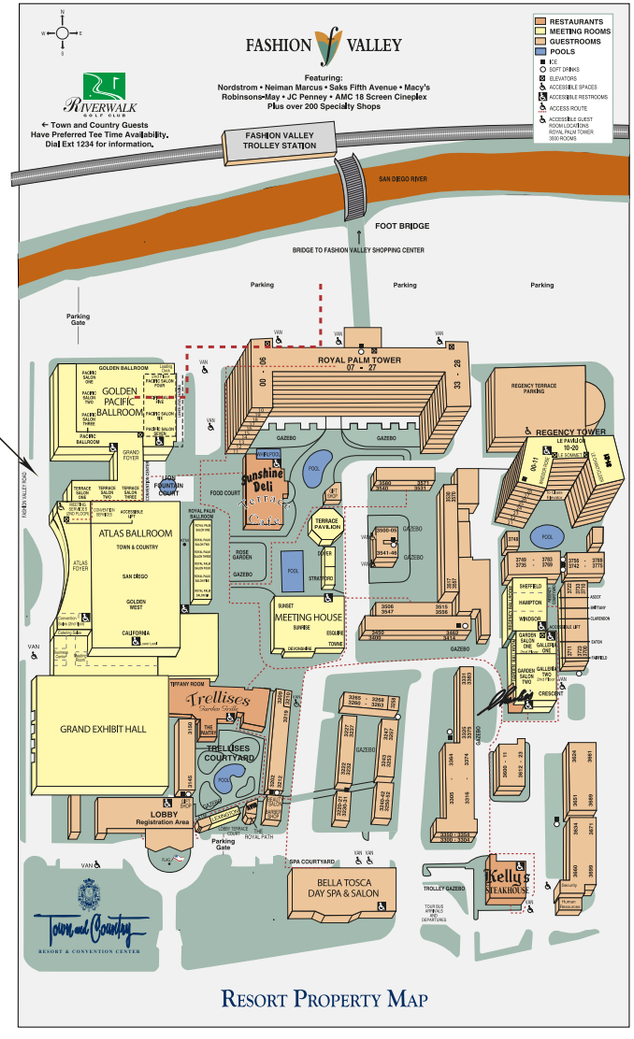
Parking

Discounted parking for registered hotel guests is $5 per day. Public parking at the Convention Center is $3 for the first hour, $2 each additional hour, not to exceed $14 per day. If you are staying at the Town & Country Hotel, please make sure you identify yourself as a conference attendee to receive the discounted rate.

Town and Country Resort

The Town and Country Resort & Convention Center features 1,000 guest rooms spread over 40 lushly landscaped acres in San Diego's Mission Valley. The hotel has five restaurants providing diverse dining experiences and several lounges offer a relaxing retreat from the day's activities.





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