

SPIE 8th Annual International Symposium on

# Smart Structures and Materials

SPIE 6th Annual International Symposium on

# NDE for Health Monitoring and Diagnostics

4-8 March 2001

Newport Beach Marriott Hotel and Tennis Club  
Newport Beach, California USA

Sponsored by



SPIE 8th Annual  
International Symposium on  
**Smart Structures  
and Materials**

**4-8 March 2001**

Newport Beach Marriott Hotel and Tennis Club  
Newport Beach, California USA



SPIE 6th Annual  
International Symposium on  
**NDE for Health  
Monitoring and  
Diagnostics**

## Welcome!

We, the organizers and executive committees of the 2001 International Symposia on Smart Structures and Materials and on NDE for Health Monitoring and Diagnostics, welcome you. We think there are significant opportunities for mutually beneficial interactions between our two symposia. While our primary objectives are to foster communications across a variety of technical disciplines and to encourage the interaction of disparate groups representing theoretical and experimental research, design, and process and product development, we also hope to excite and inspire you through the plenary presentations and special conference talks addressing our theme of "Where Are We Going? – 21st Century Growth Opportunities."

Much progress has been made in the creation of structures that will continuously and actively monitor and optimize themselves and their performance through emulation of biological systems with their adaptive capabilities and their integrated designs. The symposium for Smart Structures and Materials emphasizes the multi-/inter-disciplinary nature of the field and provides in depth coverage of the most recent results in smart materials, sensing, actuation, communications, power, advanced signal processing, structural design methodologies, and system integration across a variety of applications.

The challenge of inspecting aging structures without impairing their usefulness has evolved and advanced technologies for nondestructive evaluation (NDE) and links with biological systems for revolutionary advances in these technologies are being explored. The NDE Health Monitoring and Diagnostics Symposium addresses the current status and future directions of NDE with respect to the testing and monitoring of high-use structures such as naval vessels; aircraft and airports; and civil structures such as dams, bridges, and highways. Also included in this NDE symposium are presentations on decision-making processes, such as when degradation requires repair or replacement; and possible methods for mitigation including practical technologies, instrumentation, techniques, and case studies.

Please join us along with hundreds of engineers and scientists from the military, commercial, and academic sectors to discuss these technologies and to initiate some collaborative interactions. These symposia provide a unique opportunity for interactions across an immense cross-section of work in these critical fields.

**Steven R. Doctor**  
Pacific Northwest National Labs.

**George Y. Baaklini**  
NASA Lewis Research Ctr.  
*NDE Symposium Chairs*

**Janet M. Sater,**  
Institute for Defense Analyses

**Marc E. Regelbrugge,**  
Rhombus Consultants Group  
*Smart Structures Symposium Chairs*

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**Next year, SPIE's  
SS/NDE annual  
symposia will  
move to the San  
Diego Town and  
Country hotel!**

*SPIE would like to express its deepest appreciation to the program chairs, conference chairs, co-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. Please check schedule board outside of the conference rooms for the most current changes.*

# Special Events

## Sunday 4 March

1:00 to 4:45 pm  
Pacific Ballroom D

### Smart Structures and Materials Technology Overviews

1:00 pm

#### Introduction

**Marc E. Regelbrugge**,  
Rhombus Consultants Group

1:20 pm

#### Smart Structures

**Jack H. Jacobs**, Honeywell  
Space Systems

1:40 pm

#### Sensors

**Richard O. Claus**, Virginia  
Polytechnic Institute and State  
Univ.

2:00 pm

#### Actuators

**Victor Giurgiutiu**, Univ. of  
South Carolina

2:20 pm

#### MEMS

**Richard Singer**, Institute for  
Defense Analyses

2:40 pm

#### Controls

**Daniel J. Inman**, Virginia  
Polytechnic Institute and State  
Univ.

Coffee Break • 3 to 3:30 pm

3:30 pm

#### Damping and Isolation

**Conor D. Johnson**, CSA  
Engineering, Inc.

3:50 pm

#### Power Systems

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

4:10 pm

#### Signal Processing

**Wieslaw J. Staszewski**,  
Sheffield University

4:30 pm

#### Conclusion

**Marc E. Regelbrugge**,  
Rhombus Consultants Group

## Monday 5 March

8:00 to 8:45 am • Pacific Ballroom C/D

### Smart Structures and Materials Achievement Award

Presenter: **Janet M. Sater**, Institute for Defense  
Analyses

Plenary Presentation

#### Whither Smart Materials?

Speaker: **Dr. Dennis M. Bushnell**, Chief Scientist  
NASA Langley Research Center

Smart materials research and, increasingly, applications have inhabited the technological landscape for over a decade. This presentation considers potential further developments during the next decades in the context of the continuing/emerging triple technological revolutions in information technology, biotechnology, and nanotechnology. As a bottom line, smart [Brilliant/"Living"?] materials should inhabit the nexus of these ongoing revolutions and be totally transformed in the process along with, perhaps, the human species/society.

*Biography:* Dr. Bushnell is a Fellow of the AIAA, ASME, and The Royal Aeronautical Society and is a Member of the National Academy of Engineering. He is the author of 230 publications and has received the AIAA Sperry, Fluid and Plasma Dynamics, and Dryden Lectureship Awards. In addition he has given the Royal Aeronautical Society Lanchester and Wright Brothers Lectureships and the ICAS Guggenheim Lecture. A recipient of NASA Exceptional Scientific Achievement and Leadership Medals, Dr. Bushnell has 5 patents to his credit. Technical interests include flow modeling and control, advanced concepts, facilities, and propulsion across the speed range, and future warfare. He has made significant technical contributions to a number of national programs including Gemini, Apollo, Space Shuttle, National AeroSpace Plane (NASP), RAM, Sprint, X-15, Submarines/Torpedoes, Maglev Trains, Scramjets, and Mars Exploration.

7:00 to 9:00 pm • Newport North

Technical Group Meeting

#### Smart Structures and Materials

Chair: **Dr. Alison B. Flatau**, National Science  
Foundation

The Smart Structures and Materials Technical Group will meet to hear presentations from the three finalists in the Best Student Paper Contest, sponsored by Boeing Company. Following the presentation, technical group members will vote to determine the winning paper. The winner will be announced before the plenary session on Thursday morning.

All conference attendees are cordially invited to attend.

## Tuesday 6 March

8:00 to 8:45 am • Pacific Ballroom C/D

### Smart Structures Product Implementation Award

Presenter: **Anna-Maria Rivas McGowan**,  
NASA Langley Research Ctr.

Plenary Presentation

#### The Importance of Multidisciplinary Research in Achieving Technological Advances

Speaker: **Prof. Geof Tomlinson**, Univ. of Sheffield (UK)

Engineering is often described as being dull. Contrary to this, the physical sciences are often seen as exciting. Consider trying to excite someone by talking about fatigue failure due to crack growth compared with designing micro-machines using self assembly materials. There is a compromise which can deliver excitement, novelty and new developments, this being to bring together researchers and technologists from different disciplines such as Chemistry, Physics, Biology, Materials Science, Engineering etc to tackle fundamental problems. To make major advances in Science and engineering there is a clear role for multidisciplinary. This presentation looks at the role of multidisciplinary research for future opportunities and considers 'what might be possible' in relation to solutions to fundamental science and engineering problems. Examples of the benefits of such an approach are given where the basic problem of improving the internal energy dissipation of polymeric materials is described.

*Biography:* Prof. Geof Tomlinson has received degrees including MSc, PhD, FIMechE, FRAeS, CEng, and FRSA. He obtained his PhD in 1979 from the University of Aston in Birmingham, UK, on the topic of "Modal Properties of Complex Structures including Nonlinear Effects". He has held Lecturer and Senior Lecturer positions at the University of Manchester (1979-1986) and was Professor of Mechanical Engineering at Heriot-Watt University in Edinburgh (1986-1989). In 1989 he became Professor of Engineering Dynamics as well as the Divisional Head at the University of Manchester. He became Professor and Head of the Department of Engineering Dynamics at the University of Sheffield in 1995. Prof. Tomlinson's current positions at the University of Sheffield (since 1999) include Head of the Dynamics Research Group, Research Director for the Engineering and Physical Sciences Division, Director of the Division of Aerospace Engineering, and Director of the Rolls-Royce UTC in Materials Damping Technology. He has published over 140 technical papers and contributed to four books.

8:00 to 8:45 am • Pacific Ballroom E

### NDE Lifetime Achievement Award

Presented to: **Dr. Yoseph Bar-Cohen**, Jet Propulsion Lab.  
Presenter: **Steve R. Doctor**, Pacific Northwest National Lab

Plenary Presentation

#### NDE Emerging Technologies, Challenges, and Trends

Speaker: **Dr. Yoseph Bar-Cohen**

The field of NDE has evolved significantly in the last century reaching an advanced stage of maturity where standard NDE procedures are now applied to many areas of our lives. As we begin the new Millennium it is interesting to bookmark the accomplishments and identify the challenges and trends. Further, it can be useful to determine the technologies that can be affected by NDE concepts and methodologies and the technologies that can be used to enhance the current NDE capabilities.

*Biography:* **Dr. Yoseph Bar-Cohen** is a physicist specialized in ultrasonics and electroactive materials and mechanism. He is the Group Leader for the JPL's Nondestructive Evaluation and Advance Actuators (NDEAA) Technologies (<http://ndeaa.jpl.nasa.gov/>) and is the JPL Resident NDE Expert. He is also an Adjunct Professor at the University of California, Los Angeles (UCLA) and a Fellow of the American Society for Nondestructive Testing (ASNT). In 1991, he established the NDEAA Lab that led to a series of innovative concepts and mechanisms. Currently, he is responsible for developing ultrasonic NDE methods, real time sensing, geophysical probing techniques, piezoelectric motors, a piezoelectric pump, electroactive polymer actuators, and high power ultrasonic techniques. He discovered the leaky Lamb waves (LLW) and polar back-scattering in composite materials and co-developed the related NDE methods. He made over 210 publications, numerous presentations at national and international conferences, Chaired/CoChaired 7 Conferences, has 13-registered patents and editor of 2 books.

## Wednesday 7 March

8:00 to 8:45 am • Pacific Ballroom C/D

Plenary Presentation

### The Role of Smart Structures in Managing an Aging Highway Infrastructure

Speaker: **Steven B. Chase**, Federal Highway Administration

*Biography:* Dr. Chase has been with the Federal Highway Administration for the past 23 years. He is a team leader for research and development in Infrastructure Inspection and Management at the Federal Highway Administration. Dr. Chase has program responsibility for research, development, testing, evaluation, and validation of new technologies which can be applied to help manage the nations aging highway infrastructure.

Professional Activities:

- American Society for Nondestructive Testing, Liaison Committee on Structural Materials Technology and Infrastructure
- Chairman, American Society of Civil Engineers, Technical Committee on Bridge Rehabilitation, Evaluation, and Management
- American Society of Civil Engineers, Technical Committee on Bridge Safety and Reliability
- Past Symposium Chair, SPIE's International Symposium on NDE of Bridges and Highways
- Chairman, Transportation Research Board, Subcommittee on Nondestructive Evaluation of Structures

7:00 pm

### Caribbean Reception

All symposium attendees are invited to relax, socialize and enjoy refreshments and a Caribbean buffet-style dinner in the Pacific Ballroom. Dress is casual and please wear your conference registration badge.

## Thursday 8 March

8:00 to 8:45 am • Pacific Ballroom C/D

### Smart Structures Best Student Paper Award

Presenter: **Alison Flatau**, National Science Foundation

Plenary Presentation

### The State-of-the-Art of Intelligent Materials Research in Japan

Speaker: **Dr. Norio Shinya**, National Research Institute for Metals (Japan)

The concept of "Intelligent Materials" was created in 1989 by The Council for Aeronautics, Electronics and Other Advanced Technologies, Science and Technology Agency of the Japanese Government. By this definition, "Intelligent Materials" have three primitive functions—sensor, processor and actuator—and exhibit intelligence by combining their primitive functions. This concept bears a strong resemblance to that of "Smart Structures." Since the proposal of this Intelligent Materials concept twelve years ago, several national projects have been initiated to realize these materials. The primary research efforts in current projects are classified in the following four categories: (1) assembly technologies at the nanometer to micrometer scale; (2) sensor, processor, and actuator materials; (3) bio-related materials; and (4) adaptive structural materials. In this presentation some typical recent advances in these categories will be introduced. The following topics will also be addressed:

- Powder particles assembling technologies for fabrication of three-dimensionally controlled microstructures
- High quality shape memory alloys
- Bioactive ceramics
- Self-healing materials

*Biography:* Dr. Shinya graduated from The University of Waseda in 1967 with a Bachelor's degree in Metallurgy. He worked as a visiting researcher at Sheffield University in England from 1976-77. In 1985 he received his Doctor of Engineering degree in Materials Engineering from The University of Tokyo. Dr. Shinya is currently the Director of the Intelligent Materials Group at the National Research Institute for Metals in Japan. His research interests include assembly technologies, material damage and healing, and adaptive materials. He has published over 100 original articles and received special awards from The Iron and Steel Institute of Japan, The Japan Institute of Metals, and the Science and Technology Agency of the Japanese Government.

8:00 to 8:45 am • Pacific Ballroom E

### NDE Best Paper 2000 Award

Presenter: **Dr. Steven R. Doctor**, Pacific Northwest National Lab.

Plenary Presentation

### Health Monitoring and Diagnostics of Civil Infrastructures

Speaker: **Dr. Ken P. Chong**, National Science Foundation

New construction is the largest industry in the world, amounting to 10% of the world's gross domestic product. Civil infrastructure systems are generally the most expensive investments/assets in any country (an estimated \$20 trillion in the United States), and these systems are deteriorating at an alarming rate. Additionally, the systems have long service life compared with any other kinds of commercial product and are rarely replaceable once they are erected. Yet the feedback on the "state of health" of constructed systems is practically non-existent. Reliable health monitoring including nondestructive evaluation is an essential part of this feedback and monitoring system for infrastructures. The goal of this presentation is to provide a summary of recent research activities that will act as a catalyst to expand interest in the development of new health monitoring technologies. The paper describes the motivation for developing innovative tools for monitoring the health of the nation's infrastructure. An overview of research projects sponsored by the National Science Foundation (NSF) as well as projects at NIST and FHWA to develop and apply new technologies is presented. The paper includes a review of state-of-the-art acoustic wave methods for the evaluation of structural materials and pavements, as well as new electromagnetic methods for corrosion monitoring. Finally, efforts to develop new technologies for the assessment of the nearly 500,000 bridges along the nation's roads and highways are described.

*Biography:* Ken P. Chong, F.ASCE, M. ASME, M.IEEE, PE, received his MSE and Ph.D. in engineering mechanics from Princeton University in 1969. His professional experience includes: Senior Project Engineer of R&D, National Steel Corporation, 1969-1974; professor and chairman of Structures/ Solid Mechanics Group, University of Wyoming, teaching and research in Structural Mechanics and Solid Mechanics for 15 years. He has been a visiting professor at MIT, Houston, Washington and Hong Kong universities (honorary professor of HKU). Since 1989 he has been the director of Structural Systems and Construction Processes, and since 1999 in Mechanics and Materials at the National Science Foundation (NSF) where he formulates and administers the U.S. policy and research, educational programs in structures, construction, materials, engineering mechanics, NDE, CAD and KBES. As chair of the NSF Civil Infrastructure Systems Task Committee, 1992-93, he led the development of a major NSF-wide initiative which is changing the university culture in systems approaches and integration. He has published over 150 refereed technical papers and authored several books.

SPIE Thanks



for sponsoring the Smart Structures Best Student Paper Award.

# Daily Schedule

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY
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## Smart Structures and Materials

<b>SC125 Electroactive Polymer (EAP) Actuators and Devices</b> (Bar-Cohen, Spinks, Zhang) 8:30 am to 5:30 pm, p. 6	Conf. 4326 <b>Modeling, Signal Processing, and Control in Smart Structures</b> , p. 10-34
	Conf. 4327 <b>Smart Structures and Integrated Systems</b> , p. 10-34
	Conf. 4328 <b>Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials</b> , p. 10-20
	Conf. 4329 <b>Electro-Active Polymer Actuators and Devices</b> , p. 10-34
	Conf. 4330 <b>Smart Systems for Bridges, Structures, and Highways</b> , p. 11-29
	Conf. 4331 <b>Damping and Isolation</b> , p. 11-27
	Conf. 4332 <b>Industrial and Commercial Applications of Smart Structures Technologies</b> , p. 11-33
	Conf. 4333 <b>Active Materials: Behavior and Mechanics</b> , p. 11-35
	Conf. 4334 <b>Smart Electronics and MEMS</b> , p. 11-29

## NDE for Health Monitoring and Diagnostics

<b>SC204 Microwave NDE Techniques</b> (Varadan, Jose) 8:30 am to 5:30 pm, p. 6	Conf. 4335 <b>Advanced NDE Methods and Applications</b> , p. 160-168
	Conf. 4336 <b>NDE of Materials and Composites</b> , p. 160-168
	Conf. 4337 <b>Health Monitoring and Management of Civil Infrastructure Systems</b> , p. 160-168
<b>SC363 Structural Health Monitoring for Aircraft and Spacecraft Structures</b> (Chang) 8:30 am to 12:30 pm, p. 6	<b>Key</b> Conf = Conference SC = Short Course

## Special Events

<b>Smart Structures and Materials Technology Overviews</b> , 1:00 to 5:00 pm, p.2	<b>Smart Structures and Materials Achievement Award</b> , p. 2	<b>Smart Structures Product Implementation Award</b> , p. 2	<i>Plenary Presentation: The Role of Smart Structures in Managing an Aging Highway Infrastructure</i> (Chase), p. 3	<b>Smart Structures Best Student Paper Award</b> , p. 3
	<i>Plenary Presentation: Whither Smart Materials?</i> (Bushnell), p. 2	<i>Plenary Presentation: The Importance of Multi-disciplinary Research in Achieving Technological Advances</i> (Tomlinson), p. 2	<b>Caribbean Reception</b> , p. 3	<i>Plenary Presentation: The State-of-the-Art of Intelligent Materials Research in Japan</i> (Shinya), p. 3
	<i>Technical Group Meeting: Smart Structures and Materials</i> (Flatau), p. 2	<b>Poster Session</b> , 6 to 7:30 pm, p.4	<b>Technical Exhibit, 8:45 am to 4:00 pm</b>	
	<b>NDE Achievement Award</b> , p. 2		<i>Plenary Presentation: Health Monitoring and Diagnostics of Civil Infrastructures</i> (Chong), p. 3	
	<i>Plenary Presentation: Emerging Technologies, Challenges, and Trends</i> (Bar-Cohen), p. 2			

## Don't miss the Technical Exhibition

California Ballroom

Meet with managers and technicians to discuss your technology needs.

- Compare the latest products and services
- Get your questions answered
- Network with colleagues and exhibitors

### Exhibit Hours

Tuesday, 6 March . . . . . 8:45 am to 4:00 pm  
 Wednesday, 7 March . . . . . 8:45 am to 4:00 pm

Tuesday • 6:00 to 7:30 pm • North Tower 3rd Floor

### Poster Session

A poster session will be held on Tuesday evening for all attendees of the symposium. Attendees will have an opportunity to view the poster papers and meet informally with authors. Refreshments and light hors d'oeuvres will be served. Attendees are requested to wear their conference registration badge.

Poster authors will be able to set up their poster papers between 9 am and 3 pm Tuesday. Poster papers can be previewed after 3 pm before the formal poster session begins at 6 pm.

Authors must remove their papers at the conclusion of the poster reception for that day. It is the author's responsibility to remove their posters. Papers not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of the poster reception.

# General Information

## Registration and Information Hours

*Newport Beach Marriott Hotel & Tennis Club, Newport Beach • California Ballroom Registration Desk*  
 Sunday 4 March . . . . . 7:30 am to 4 pm  
 Monday 5 March . . . . . 7:00 am to 4 pm  
 Tuesday 6 March . . . . . 7:15 am to 4 pm  
 Wednesday 7 March . . . . . 7:30 am to 4 pm  
 Thursday 8 March . . . . . 7:30 am to 11 am

## Technical Exhibition Hours

*California Ballroom*  
 Tuesday, 6 March . . . . . 8:45 am to 4:00 pm  
 Wednesday, 7 March . . . . . 8:45 am to 4:00 pm

## Speakers Audiovisual Desk

*California Ballroom Registration Area*  
 Sunday through Thursday . . . . 7:30 am to 5 pm  
 Speakers who have requested equipment other than an overhead projector are asked to report to the Audiovisual Desk upon arrival at the meeting to confirm equipment requests. Speakers will be responsible for delivering visual materials to the conference room and may obtain materials from the AV Room Monitor in the conference room immediately following the session.

## Breakfast

Breakfast breads and coffee will be served from 8:45 to 9:20 am Monday-Thursday for symposium attendees near SPIE Registration.

## Coffee Breaks

Coffee will be served in the California Ballroom Foyer at the following times:  
 Sunday . . . . . 10:00 to 10:30 am;  
 and 3:00 to 3:30 pm  
 Monday-Thursday . . . . . 8:45 to 9:20 am,  
 3:10 to 3:40 pm  
 (Tuesday and Wednesday coffee breaks will be in the Exhibit Area)

## Desserts

Dessert snacks will be served in the Exhibit area (California Ballroom) Tuesday and Wednesday from 1:00 to 1:30 pm. Complimentary tickets for the dessert snacks will be included in attendee registration packets.

## Continuing Education Resource Desk

SPIE has solutions to meet you and your company's continuing education needs. Stop by the Continuing Education Resource Desk on-site to see the latest courses available on video and CD-ROM, and to discover the opportunities for customized in-company courses.  
 The SPIE Continuing Education Resource Desk will be located in the SPIE registration area. It will be open during registration hours.

## Video/Digital Recording Policy

For copyright reasons, video or digital recording of any conference session or short course is strictly prohibited without written prior consent from each specific presenter to be recorded. Individuals not complying with this policy will be asked to leave a given session and to surrender their film or disc. It is the responsibility of the presenter to notify SPIE if consent is given.

## On-Site Career Bulletin Board

*Located outside the California Ballroom*  
 SPIE sponsors an on-site employment bulletin-board to help facilitate communication between individuals seeking positions and companies seeking qualified personnel. Leave a copy of your resume on file at the bulletin-board. Ample space is provided for posting descriptions of job opportunities. Candidates delivering resumes on site, and companies posting positions open, are encouraged to do so on Monday to maximize exposure.

## Proceedings of SPIE

A full-manuscript, editor-reviewed Proceedings of SPIE volume will be published for each conference and will be available within eight weeks after the symposium. If you are unable to attend, you may order Proceedings now at reduced prepublication prices. See page 42 for details and order information.

## Child Care

Several child sitting services available in Newport Beach are:  
 Sitters Unlimited: 949-650-1166  
 Sitters Around the Clock: 949-551-5111  
 Qualicare: 714-969-0405

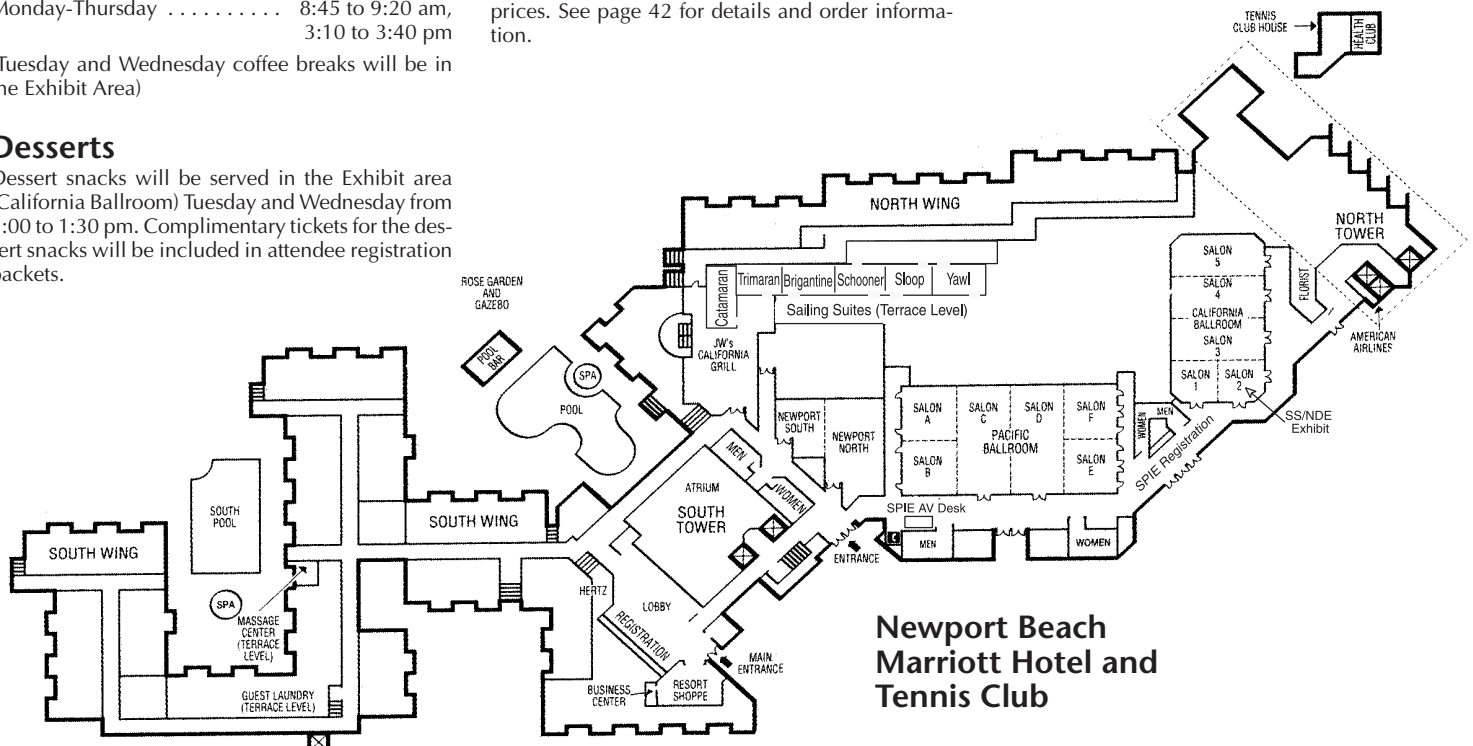
*Note:* SPIE does not imply an endorsement nor recommendation of these services. They are provided on an "information only" basis for your further analysis and decision. Other services may be available.

## Message Center

*Newport Beach Marriott Hotel  
 Phone: 949-640-4000*  
 The Message Center will be located at the Registration Desk. Ask the hotel operator to connect you to SPIE registration to leave a message. Messages will be taken during registration hours Sunday through Thursday. Please check the bulletin board at the message center daily to receive your messages.

## Local Attractions

When the ordinary just won't do, what's left is the extraordinary: Newport Beach. Located between Los Angeles and San Diego, this elegant harbor city combines the best of the West Coast's treasures: The sunlit sea. Countless outdoor activities. World-class dining and shopping. Renowned theme parks.  
 Fashion Island is located across from the Marriott. It is known as Southern California's most extraordinary shopping destination, featuring over 200 stores and restaurants overlooking the beautiful Pacific Ocean.



**Newport Beach Marriott Hotel and Tennis Club**



# SPIE Continuing Education Program

In today's competitive job market, you require continuing education and focused training. You need to stay current with changing technology.

**Invest in that training** with SPIE's live short courses. Increase your knowledge and expand your skills. Get the information you need now.

**Improve your performance!** Learn up-to-date technology and techniques. Topics range from basic to advanced technical information. You will interact with industry and academic leaders in a live, face-to-face setting.

Courses run from one-half to a full day long. As an attendee you get a bound copy of the instructor's view graphs and course notes for reference and review. Some courses include text books.

Leading industry companies send their staff to SPIE's Continuing Education Program year after year. Previous attendees had this to say about their short course experience:

*"Single best continuing education course I have taken. Huge amount of info covered well in a short time. Instructor very enthusiastic."*

Dave Schnuelle, Lucasfilm Ltd.

*"Excellent clear presentation of material! Excellent interaction with class. Best SPIE course ever taken. One of the best instructions I have ever had."*

Kenneth Jerkatis, Boeing

**Register now to ensure your participation.** Some courses fill to capacity; occasionally a course is canceled due to low attendance. Preregistration will help you maximize your time at Smart Structures and Non-Destructive Evaluations for Health Monitoring and Diagnostics.

This year's short courses cover these technical areas:

- Electroactive Polymer (EAP) Actuators and Devices
- Microwave NDE Techniques
- Structural Health Monitoring for Aircraft and Spacecraft Structures

## Money-Back Guarantee

SPIE stands behind the quality of our courses and instructors. If for any reason you are dissatisfied, SPIE will refund your course fee and consider your suggestions to improve the course.

## CEUs Offered for Short Courses

SPIE awards CEUs (Continuing Education Units) to registrants who successfully complete short courses offered in this program. The CEU is a nationally recognized unit of measure for continuing education and training programs that meet certain criteria.

Successful completion is based on the participant's attendance and completion of the evaluation form. A record of each individual's completion will remain on file at SPIE.

The Education Services Department of SPIE—The International Society for Optical Engineering has been approved as a CEU User Member of the International Association for Continuing Education and Training (IACET: registration #1001635).

## Sale! SPIE Original Video Collection

See page 203 for distance education options.

## Smart Structures and Materials

### Electroactive Polymer (EAP) Actuators and Devices

#### INSTRUCTORS

**Yoseph Bar-Cohen** is the Group Leader for the NDE and Advanced Actuators (NDEAA) Technologies and the JPL Resident NDE expert. Dr. Bar-Cohen is also an Adjunct Professor at UCLA, a Fellow of ASNT and a leading expert in advanced actuators using EAP and piezoceramics. He is the author/coauthor of over 200 publications and has many registered patents.

**Geoff Spinks** is professor at the University of Wollongong, Australia. His particular areas are conducting polymers and carbon nanotubes and he is the co-author of one book and over 50 journal articles on these materials. Dr. Spinks is an expert in electroactive polymer actuators, coatings and adhesives.

**Qiming Zhang** is associate professor at Penn State University. His particular areas are electronic materials and their applications. Dr. Zhang is a leading expert in the polar polymers such as ferroelectric and dielectric polymers. He is the author/coauthor of more than 150 journal articles in these areas.

SC125 CEU 0.65 \$340 / \$410 Sunday 8:30 am to 5:30 pm

## NDE for Health Monitoring and Diagnostics

### Microwave NDE Techniques

#### INSTRUCTORS

**Vasundara V. Varadan** is Distinguished Professor Engineering Science & Electrical Engineering at the Pennsylvania State University. Dr. Varadan has published over 250 journal articles, has edited several books and holds six patents. She has taught undergraduate and graduate courses in EM fields and waves and their interaction with materials for over 20 years. She has also developed instructional laboratories for microwave measurements. Her current areas of research interest are microwave measurement systems, wireless MEMS sensors and modeling, engineered microwave composites for tailored properties. She co-founded HVS Technologies, Inc. as a technology spin-off from her research activities at Penn State. HVS builds automated microwave inspection systems customized for customer needs.

**K.A. Jose** is Senior Research Associate at the center for the engineering of Electronic & Acoustic Materials at the Pennsylvania State University. Dr. Jose's expertise is in microwave measurements, antenna design and characterization. He has published over 40 papers in this field.

SC204 CEU 0.65 \$340 / \$410 Sunday 8:30 am to 5:30 pm

### Structural Health Monitoring for Aircraft and Spacecraft Structures

#### INSTRUCTOR

**Fu-Kuo Chang** is a Professor in the Department of Aeronautics and Astronautics at Stanford University and has been involved in structural health monitoring (SHM) research for over 10 years. He is the editor of "Structural Health Monitoring—Current Status and Perspectives" and "Structural Health Monitoring-2000."

SC363 CEU 0.35 \$190 / \$225 Tuesday 8:30 am to 12:30 pm

## Register by Short Course (SC Number)

1st price = SPIE Member; 2nd price = Nonmember  
CEU = Continuing Education Unit

*SPIE 8th Annual International Symposium on*

# Smart Structures and Materials

4-8 March 2001 • Newport Beach, CA

*Technical Program Committee*

**Gregory S. Agnes**, Air Force Institute of Technology

**Ahmet Emin Aktan**, Drexel Univ.

**Eric H. Anderson**, CSA Engineering, Inc.

**Gary L. Anderson**, U.S. Army Research Office, Army Representative

**Yoseph Bar-Cohen**, Jet Propulsion Lab.

**Amr M. Baz**, Univ. of Maryland/College Park

**Steven B. Chase**, Federal Highway Administration

**Yaosheng Chen**, Xi'an Institute of Optics and Precision Mechanics

**L. Porter Davis**, Honeywell Inc.

**Danilo De Rossi**, Univ. degli Studi di Pisa

**E. Joseph Friebele**, Naval Research Lab.

**Ephraim Garcia**, Vanderbilt Univ., DARPA Representative

**Daniele Inaudi**, SMARTEC SA

**Daniel J. Inman**, Virginia Polytechnic Institute and State Univ.

**Dimitris C. Lagoudas**, Texas A&M Univ.

**S. C. Liu**, National Science Foundation

**Christopher S. Lynch**, Georgia Institute of Technology

**David R. Martinez**, Sandia National Labs., ASME Representative

**Yuji Matsuzaki**, Nagoya Univ., Intelligent Materials Forum (Japan) Representative

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**Kam Ng**, Office of Naval Research, Navy Representative

**Darryll J. Pines**, Univ. of Maryland/College Park

**Vittal S. Rao**, Univ. of Missouri/Rolla

**Marc E. Regelbrugge**, Rhombus Consultants Group

**Janet M. Sater**, Institute of Defense Analyses

**Jeffrey N. Schoess**, Honeywell Inc.

**Richard A. Singer**, Institute of Defense Analyses, SEM Representative

**James S. Sirkis**, CiDRA Corp.

**Ralph C. Smith**, North Carolina State Univ.

**Yoshiro Suzuki**, The Ceramic Society of Japan, Representative

**Eric Udd**, Blue Road Research

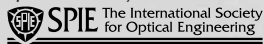
**Vijay K. Varadan**, The Pennsylvania State Univ.

**Kon-Well Wang**, The Pennsylvania State Univ.

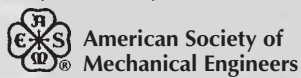
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**Intelligent Materials Forum (Japan)**

**U.S. Army Research Office**

**Jet Propulsion Lab.**



# Smart Structures and Materials

**Sunday**  
**4 March 2001**

## Smart Structures and Materials Technology Overviews

1:00 pm  
**Introduction**

**Marc E. Regelbrugge**,  
Rhombus Consultants Group

1:20 pm  
**Smart Structures**

**Jack H. Jacobs**,  
Honeywell Space Systems

1:40 pm  
**Sensors**

**Richard O. Claus**,  
Virginia Polytechnic  
Institute and State Univ.

2:00 pm  
**Actuators**

**Victor Giurgiutiu**,  
Univ. of South Carolina

2:20 pm  
**MEMS**

**Richard Singer**,  
Institute for Defense  
Analyses

2:40 pm  
**Controls**

**Daniel J. Inman**,  
Virginia Polytechnic  
Institute and State Univ.

3:00 to 3:30 pm  
**Coffee Break**

3:30 pm  
**Damping and Isolation**

**Conor D. Johnson**,  
CSA Engineering, Inc.

3:50 pm  
**Power Systems**

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

4:10 pm  
**Signal Processing**

**Wieslaw J. Staszewski**,  
Sheffield University

4:30 pm  
**Conclusion**

**Marc E. Regelbrugge**  
Rhombus Consultants Group

## Conference 4326

**Room: Pacific Ballroom A/B Mon.  
Pacific Ballroom A Tues.–Thurs.**  
Mon.–Thurs. 5–8 March 2001  
*Proceedings of SPIE Vol. 4326*

## Modeling, Signal Processing, and Control in Smart Structures

*Conference Chair: Vittal S. Rao*,  
Univ. of Missouri/Rolla

*Cochair: Ralph C. Smith*, North  
Carolina State Univ.

*Program Committee: Balakumar  
Balachandran*, Univ. of  
Maryland/College Park; **H. T.  
Banks**, North Carolina State  
Univ.; **Ulrich Gabbert**, Univ.  
Magdeburg (Germany); **Karolos  
M. Grigoriadis**, Univ. of  
Houston; **Hans Irschik**,  
Johannes Kepler Univ. Linz  
(Austria); **Qing Jiang**, Univ. of  
California/Riverside; **Narendra  
S. Khot**, Air Force Research  
Lab.; **Noboru Kikuchi**, Univ. of  
Michigan; **Jaehwan Kim**, Inha  
Univ. (Korea); **Sridhar Kota**,  
Univ. of Michigan; **Andrew J.  
Kurdila**, Univ. of Florida;  
**Reinhard Lerch**, Univ. of  
Erlangen (Germany); **Liviu  
Librescu**, Virginia Polytechnic  
Institute and State Univ.; **Ram  
Venkataraman**, Univ. of  
Maryland/College Park; **Robert  
T. Skelton**, Univ. of California/  
San Diego; **Vasundara V.  
Varadan**, The Pennsylvania State  
Univ.; **Wieslaw J. Staszewski**,  
Sheffield Univ. (UK)

## Conference 4327

**Room: Schooner/Sloop**  
Mon.–Thurs. 5–8 March 2001  
*Proceedings of SPIE Vol. 4327*

## Smart Structures and Integrated Systems

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

*Cochairs: Yuji Matsuzaki*, Nagoya  
Univ. (Japan); **Amr M. Baz**, Univ.  
of Maryland/College Park

*Program Committee: Gregory S.  
Agnes*, Air Force Institute of  
Technology; **Eric H. Anderson**,  
CSA Engineering, Inc.; **Gary L.  
Anderson**, Army Research  
Office; **Hiroshi Asanuma**, Chiba  
Univ. (Japan); **Balakumar  
Balachandran**, Univ. of  
Maryland/College Park; **Roshdy  
G. Barsoum**, Office of Naval  
Research; **Diann E. Brei**, Univ. of  
Michigan; **Allen J. Bronowicki**,  
TRW Space & Electronics  
Group; **Gregory P. Carman**,  
Univ. of California/Los Angeles;  
**Fu-Kuo Chang**, Stanford Univ.;  
**Aditi Chattopadhyay**, Arizona  
State Univ.; **Peter C. Chen**,  
Systems Planning and Analysis,  
Inc.; **Seung-Bok Choi**, Inha Univ.  
(Korea); **Alison B. Flatau**,  
National Science Foundation;  
**Ephraim Garcia**, DARPA; **John  
M. Ginder**, Ford Motor Co.;  
**Victor Giurgiutiu**, Univ. of South  
Carolina; **Nesbitt W. Hagood**,  
Massachusetts Institute of  
Technology; **T. Tupper Hyde**,  
Honeywell Space Systems;  
**Daniel J. Inman**, Virginia  
Polytechnic Institute and State  
Univ.; **George A. Lesieutre**, The  
Pennsylvania State Univ.; **John  
A. Main**, Univ. of Kentucky;  
**David R. Martinez**, Sandia  
National Labs.; **Michihiro C.  
Natori**, Institute of Space and  
Astronautical Science (Japan);  
**Darryll J. Pines**, Univ. of  
Maryland/College Park; **Roger  
Stanway**, Univ. of Sheffield (UK);  
**Friedrich K. Straub**, Boeing Co.;  
**Kon-Well Wang**, The  
Pennsylvania State Univ.;  
**Norman M. Wereley**, Univ. of  
Maryland/College Park; **Shoko  
Yoshikawa**, Active Control  
eXperts, Inc.; **Yung H. Yu**, NASA  
Ames Research Ctr.

## Conference 4328

**Room: Pacific Ballroom E**  
Mon.–Tues. 5–6 March 2001  
*Proceedings of SPIE Vol. 4328*

## Sensory Phenomena and Measurement Instrumentation for Smart Structures and Materials

*Conference Chairs: Eric Udd*,  
Blue Road Research; **Daniele  
Inaudi**, SMARTEC SA  
(Switzerland)

*Cochairs: Yaosheng Chen*, Xi'an  
Institute of Optics and Precision  
Mechanics (China); **E. J.  
Friebele**, Naval Research Lab.;  
**Jeffrey N. Schoess**, Honeywell  
Inc.; **James S. Sirkis**, CiDRA  
Corp.

*Program Committee: Xiaoyi Bao*,  
Univ. of New Brunswick  
(Canada); **Kim D. Bennett**,  
Lafayette College; **Richard O.  
Claus**, Virginia Polytechnic  
Institute and State Univ.; **Brian  
Culshaw**, Univ. of Strathclyde  
(UK); **Peter D. Dean**, Lockheed  
Martin Advanced Technology  
Ctr.; **Carolyn M. Dry**, Univ. of  
Illinois/Urbana-Champaign;  
**Peter L. Fuhr**, Univ. of Vermont;  
**Carvel E. Holton**, Virginia  
Polytechnic Institute and State  
Univ.; **Dryver R. Huston**, Univ.  
of Vermont; **Mark S. Miller**,  
BFGoodrich Aerospace; **William  
B. Spillman, Jr.**, Virginia  
Polytechnic Institute and State  
Univ.; **Pieter L. Swart**, Rand  
Afrikaans Univ. (South Africa)

## Conference 4329

**Room: Pacific Ballroom C**  
Mon.–Thurs. 5–8 March 2001  
*Proceedings of SPIE Vol. 4329*

## Electro-Active Polymer Actuators and Devices

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

*Cochair: Danilo De Rossi*, Univ.  
degli Studi di Pisa (Italy)

*Program Committee: Ray H.  
Baughman*, AlliedSignal Inc.;  
**Paul D. Calvert**, Univ. of  
Arizona; **Richard O. Claus**,  
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and State Univ.; **Michael  
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**Joycelyn S. Harrison**, NASA  
Langley Research Ctr.; **Roy D.  
Kornbluh**, SRI International;  
**Chang Liu**, Univ. of Illinois/  
Urbana-Champaign; **Ajit K. Mal**,  
Univ. of California/Los Angeles;  
**Benjamin R. Mattes**, Santa Fe  
Science and Technology Inc.;  
**Siavouche Nemat-Nasser**, Univ.  
of California/San Diego; **Keisuke  
Oguro**, Osaka National  
Research Institute (Japan);  
**Yoshihito Osada**, Hokkaido  
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**Mohsen Shahinpoor**, Univ. of  
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Robots, Inc.; **Valery P. Shibaev**,  
Moscow State Univ. (Russia);  
**Peter Sommer-Larsen**, Risø  
National Lab. (Denmark);  
**Minoru Taya**, Univ. of  
Washington; **Gordon G.  
Wallace**, Univ. of Wollongong  
(Australia); **Steven G. Wax**,  
DARPA; **Qiming Zhang**, The  
Pennsylvania State Univ.; **Miklos  
Zrinyi**, Technical Univ. of  
Budapest (Hungary)

# Smart Structures and Materials

## Conference 4330

Room: Catamaran  
Mon.–Wed. 5–7 March 2001  
*Proceedings of SPIE* Vol. 4330

## Smart Systems for Bridges, Structures, and Highways

*Conference Chair:* S. C. Liu, National Science Foundation

*Cochairs:* A. Emin Aktan, Drexel Univ.; Steven B. Chase, Federal Highway Administration; Darryll J. Pines, Univ. of Maryland/College Park

*Program Committee:* Makola M. Abdullah, Florida A&M Univ.; Satoru Aizawa, Takenaka Corp. (Japan); Thomas Baca, Sandia National Labs.; Fabio Casciati, Univ. di Pavia (Italy); Reginald DesRoches, Georgia Institute of Technology; Shirley J. Dyke, Washington Univ.; Charles R. Farrar, Los Alamos National Lab.; Maria Q. Feng, Univ. of California/Irvine; Alison B. Flatau, National Science Foundation; Dan M. Frangopol, Univ. of Colorado/Boulder; Toshiaki Fujimori, Shimizu Corp. (Japan); Yozo Fujino, Univ. of Tokyo (Japan); Gabriel V. Garcia, New Mexico State Univ.; Henri P. Gavin, Duke Univ.; Faramarz Gordaninejad, Univ. of Nevada/Reno; Dryver R. Huston, Univ. of Vermont; Sami F. Masri, Univ. of Southern California; Isao Nishimura, Musashi Institute of Technology (Japan); Shunsuke Otani, Univ. of Tokyo (Japan); James Roberts, Caltrans; Peter Schwesinger, Bauhaus Univ. (Germany); Charles S. Sikorsky, Caltrans; Mete A. Sozen, Purdue Univ.; Billie F. Spencer, Jr., Univ. of Notre Dame; Nobuo Takeda, Univ. of Tokyo (Japan); Ming L. Wang, Univ. of Illinois/Chicago; Glenn A. Washer, Federal Highway Administration; Norman M. Wereley, Univ. of Maryland/College Park; Sharon Wood, Univ. of Texas/Austin; Bojidar Yanev, New York City DOT

## Conference 4331

Room: Pacific Ballroom F  
Mon.–Wed. 5–7 March 2001  
*Proceedings of SPIE* Vol. 4331

## Damping and Isolation

*Conference Chair:* Daniel J. Inman, Virginia Polytechnic Institute and State Univ.

*Cochairs:* Gregory S. Agnes, Air Force Institute of Technology; Kon-Well Wang, The Pennsylvania State Univ.

*Program Committee:* Eric M. Austin, Clemson Univ.; H. T. Banks, North Carolina State Univ.; Amr M. Baz, Univ. of Maryland/College Park; William W. Clark, Univ. of Pittsburgh; L. Porter Davis, Honeywell Inc.; Michael L. Drake, Univ. of Dayton Research Institute; Eugene R. Fosness, Air Force Research Lab.; Faramarz Gordaninejad, Univ. of Nevada/Reno; T. Tupper Hyde, Honeywell Space Systems; Roy Ikegami, Boeing Phantom Works; Conor D. Johnson, CSA Engineering, Inc.; George A. Lesieutre, The Pennsylvania State Univ.; Donald J. Leo, Virginia Polytechnic Institute and State Univ.; Joseph R. Maly, CSA Engineering, Inc.; Gyuhae Park, Virginia Polytechnic Institute and State Univ.; Zahidul H. Rahman, Jet Propulsion Lab.; I. Y. Shen, Univ. of Washington; Roger Stanway, Univ. of Sheffield (UK); Jian Q. Sun, Univ. of Delaware; Geoffrey R. Tomlinson, Sheffield Univ. (UK); Norman M. Wereley, Univ. of Maryland/College Park

## Conference 4332

Room: Pacific Ballroom D  
Mon.–Thurs. 5–8 March 2001  
*Proceedings of SPIE* Vol. 4332

## Industrial and Commercial Applications of Smart Structures Technologies

*Conference Chair:* Anna-Maria R. McGowan, NASA Langley Research Ctr.

*Cochair:* Eric H. Anderson, CSA Engineering, Inc.

*Program Committee:* Grigory Adamovsky, NASA Glenn Research Ctr.; Christian Boller, DaimlerChrysler Aerospace (Germany); Bernie F. Carpenter, Lockheed Martin Astronautics; Peter C. Chen, Systems Planning and Analysis, Inc.; William W. Clark, Univ. of Pittsburgh; C. Robert Crowe, Virginia Polytechnic Institute and State Univ.; Keith K. Denoyer, Air Force Research Lab.; Johannes K. Dürr, Ursula Herold-Schmidt, DaimlerChrysler Aerospace (Germany); Jack H. Jacobs, Honeywell Space Systems; Jayanth N. Kudva, Northrop Grumman Corp.; Douglas K. Lindner, Virginia Polytechnic Institute and State Univ.; Craig D. Near, Materials Systems Inc.; David E. Parekh, Georgia Tech Research Institute; Brian P. Sanders, Air Force Research Lab.; Janet M. Sater, Richard A. Singer, Institute for Defense Analyses; Mia Siochi, NASA Langley Research Ctr.; Jody Viperman, Active Control eXperts, Inc.; Edward V. White, Boeing Phantom Works; William K. Wilkie, Richard W. Wlezien, NASA Langley Research Ctr.

## Conference 4333

Room: Trimaran/Brigatine  
Mon.–Thurs. 5–8 March 2001  
*Proceedings of SPIE* Vol. 4333

## Active Materials: Behavior and Mechanics

*Conference Chair:* Christopher S. Lynch, Georgia Institute of Technology

*Cochair:* Dimitris C. Lagoudas, Texas A&M Univ.

*Program Committee:* Gary L. Anderson, Army Research Office; William D. Armstrong, State Univ. of New York/Binghamton; Abhijit Bhattacharyya, Univ. of Alberta (Canada); James G. Boyd, Univ. of Illinois/Chicago; Gregory P. Carman, Univ. of California/Los Angeles; Tord Cedell, Lunds Tekniska Högskola (Sweden); Martin L. Dunn, Univ. of Colorado/Boulder; Craig L. Hom, Lockheed Martin Advanced Technology Ctr.; Robert C. O'Handley, Massachusetts Institute of Technology; Qing Jiang, Univ. of California/Riverside; Marc Kamlah, Forschungszentrum Karlsruhe GmbH (Germany); Doru C. Lupascu, Technische Univ. Darmstadt (Germany); Robert M. McMeeking, Univ. of California/Santa Barbara; Thomas R. Shrouf, The Pennsylvania State Univ.; Quanshui Zheng, Tsinghua Univ. (China)

## Conference 4334

Room: Newport Ballroom North  
Mon.–Wed. 5–7 March 2001  
*Proceedings of SPIE* Vol. 4334

## Smart Electronics and MEMS

*Conference Chair:* Vijay K. Varadan, The Pennsylvania State Univ.

*Cochair:* Pratul K. Ajmera, Louisiana State Univ.

*Program Committee:* Vasu K. Aatre, Defence Research & Development Organisation (India); Harold D. Ackler, Lawrence Livermore National Lab.; Steven W. Arms, MicroStrain, Inc.; Henry Baltes, Eidgenössische Technische Hochschule (Switzerland); John H. Belk, Boeing Co.; Thomas G. Bifano, Boston Univ.; Stephen M. Bobbio, Univ. of North Carolina/Charlotte; Karl F. Boehringer, Univ. of Washington; Howie M. Choset, Carnegie Mellon Univ.; Judah Goldwasser, Office of Naval Research; William J. Kaiser, Sensor.com; Jan G. Korvink, Albert-Ludwigs-Univ. Freiburg (Germany); Henry O. Marcy, Rockwell International Corp.; Michael S. Mattice, U.S. Army Armament Research, Development and Engineering Ctr.; Yuji Matsuzaki, Nagoya Univ. (Japan); Y. Eugene Pak, Samsung Advanced Institute of Technology & CRI (Korea); Charles H. Robinson, U.S. Army Tank-Automotive Command; Jeffrey N. Schoess, Honeywell Inc.; Norio Shinya, National Research Institute for Metals (Japan); James L. Sitomer, Charles Stark Draper Lab., Inc.; James H. Smith, Allied Signal; Robert B. Yates, Sheffield Hallam Univ. (UK)

# Smart Structures and Materials

Conference 4326

Room: Pacific Ballroom A/B Mon.

Conference 4327

Room: Schooner/Sloop

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Monday 5 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Achievement Award

Plenary Presentation

### Whither Smart Materials?

Speaker: **Dr. Dennis M. Bushnell**, Chief Scientist, NASA Langley Research Center

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 1

Room: Pacific Ballroom A/B  
Mon. 9:20 am

### Control of Smart Structures I

Chair: **H. T. Banks**, North Carolina State Univ.

9:20 am: **Status of signal processing and control in smart structures** (*Invited Paper*), V. S. Rao, S. Sana, Univ. of Missouri/Rolla . . . [4326-01]

10:00 am: **Optimal control design for vibratory system using active-passive circuits in the matrix second order framework**, S. Kwak, G. Washington, Ohio State Univ. . . . . [4326-02]

10:20 am: **Comparison of analytical results for various feedback controls using piezoelectric patches**, J. M. Sloss, J. C. Bruch, Jr., Univ. of California/Santa Barbara; I. S. Sadek, American Univ. of Sharjah (United Arab Emirates); S. Adali, Univ. of Natal (South Africa) . . . [4326-03]

10:40 am: **System identification and controller design of a self-sensing cantilever structure with piezoelectric materials**, M. Okugawa, M. Sasaki, Gifu National College of Technology (Japan) . . . . . [4326-04]

#### SESSION 1

Room: Schooner/Sloop  
Mon. 9:20 am

### Aircraft and Helicopter Applications I

Chair: **Friedrich K. Straub**, Boeing Co.

9:20 am: **Experimental study of active control of wave transmission through hollow cylindrical struts**, I. Pelinescu, B. Balachandran, Univ. of Maryland/College Park [4327-01]

9:40 am: **Improved helicopter aeromechanical stability analysis using H-infinite control method**, A. Chattopadhyay, J. S. Kim, Q. Liu, Arizona State Univ. . . . [4327-02]

10:00 am: **Optical metrology of adaptive membrane mirrors**, J. Wagner, G. S. Agnes, E. P. Magee, Air Force Institute of Technology . . . . . [4327-03]

10:20 am: **Modeling piezoceramic twist actuation in single-cell anisotropic torque box of low-observable UAV wing**, P. Cseke, Jr., Air Force Research Lab.; G. S. Agnes, Air Force Institute of Technology . . . . . [4327-04]

#### SESSION 2

Room: Schooner/Sloop  
Mon. 10:40 am

### Aircraft and Helicopter Applications II

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

10:40 am: **Design of a bidirectional piezoelectric actuator for blade trailing-edge flap**, T. Lee, I. Chopra, Univ. of Maryland/College Park . . . . . [4327-05]

11:00 am: **Design of a variable twist tilt rotor blade using SMA actuators**, H. Prahlad, I. Chopra, Univ. of Maryland/College Park . . . . . [4327-06]

11:20 am: **Development of a smart material active flap rotor**, F. K. Straub, D. K. Kennedy, Boeing Co. . . . . [4327-07]

#### SESSION 1

Room: Pacific Ballroom E  
Mon. 9:20 am

### Fiber Optic Sensors and their Application I

Chairs: **Eric Udd**, Blue Road Research; **Daniele Inaudi**, SMARTEC SA (Switzerland)

9:20 am: **Applications of optical fiber sensors in civil structural monitoring** (*Invited Paper*), D. Inaudi, SMARTEC SA (Switzerland) . . . . . [4328-01]

10:00 am: **Self-assembled nanostructured optical fiber sensors**, F. J. Arregui, I. R. Matias, Univ. Publica de Navarra (Spain); K. L. Cooper, R. O. Claus, Y. Wang, NanoSonic, Inc. . . . . [4328-02]

10:20 am: **Development of new synthetic heterodyne in sinusoidal phase modulation for optical fiber sensors**, Y. L. Lo, C. H. Chuang, National Cheng Kung Univ. (Taiwan) . . . . . [4328-03]

10:40 am: **Long-range distributed strain and temperature measurements: application to landslide and garbage tip monitoring**, L. Thévenaz, M. Facchini, P. Robert, Swiss Federal Institute of Technology (Switzerland); M. Niklès, Omnisens SA (Switzerland); D. Inaudi, SMARTEC SA (Switzerland) [4328-04]

11:00 am: **Leakage detection systems by using distributed fiber optical temperature measuring**, B. Vogel, C. Cassens, A. Graupner, A. Trostel, GESO GmbH Jena (Germany) . . . . . [4328-05]

11:20 am: **Ground strain measuring system using optical fiber sensors**, T. Sato, R. Honda, S. Shibata, N. Takegawa, Kyoto Univ. (Japan) . . . . . [4328-06]

11:40 am: **Distributed fiber optic sensor for liquid hydrocarbon detection**, A. MacLean, C. Moran, W. Johnstone, B. Culshaw, Univ. of Strathclyde (UK); D. Marsh, G. Andrews, PINACL Communications (UK) . . . [4328-07]

Lunch Break . . . Noon to 1:30 pm

#### SESSION 1

Room: Pacific Ballroom C  
Mon. 9:20 am

### EAP as Emerging Actuators

Chairs: **Yoseph Bar-Cohen**, Jet Propulsion Lab.; **Daniilo De Rossi**, Univ. degli Studi di Pisa (Italy)



**Keynote Presentation 9:20 am**  
**Brain-machine interfaces for translating thoughts into actions**, Miguel A. Nicolelis, Duke Univ. [4329-01]

10:00 am: **Transition of EAP material from novelty to practical applications: are we there yet?** Y. Bar-Cohen, Jet Propulsion Lab. . . . . [4329-02]

10:20 am: **Electro-active polymers: how muscle like are they?** K. Meijer, M. S. Rosenthal, R. J. Full, Univ. of California/Berkeley . . . . . [4329-03]

10:40 am: **Small-scale applications with EAP: toward artificial ciliates**, C. Melhuish, A. Adamatzky, Univ. of the West of England (UK); B. A. Kennedy, Jet Propulsion Lab. . . . . [4329-04]

11:00 am: **Application of the Nafion-platinum composite actuator** (*Invited Paper*), S. Tadokoro, T. Takamori, Kobe Univ. (Japan); K. Oguro, Osaka National Research Institute (Japan) . . . . . [4329-05]

Lunch Break . 11:20 am to 1:30 pm

## Technical Group Meeting

Monday 5 March  
7:00 to 9:00 pm  
Newport North

### Smart Structures and Materials

Chair: **Dr. Alison B. Flatau**, National Science Foundation

The Smart Structures and Materials Technical Group will meet to hear presentations from the three finalists in the Best Student Paper Contest. Following the presentation, technical group members will vote to determine the winning paper. All conference attendees are cordially invited to attend.

SPIE thanks



for sponsoring the Smart Structures Best Student Paper Award.

## Caribbean Reception

Wednesday 7 March  
7:00 pm  
Pacific Ballroom

All symposium attendees are invited to relax, socialize, and enjoy refreshments and a Caribbean buffet-style dinner in the Pacific Ballroom. Dress is casual and please wear your conference registration badge.

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# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

Monday 5 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Achievement Award

Plenary Presentation

### Whither Smart Materials?

Speaker: **Dr. Dennis M. Bushnell**, Chief Scientist, NASA Langley Research Center

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 1

Room: Catamaran  
Mon. 9:20 am

### Information for Infrastructure Monitoring

Chair: **S. C. Liu**,  
National Science Foundation

9:20 am: **Urban damage assessment from remotely sensed imagery data**, M. Shinozuka, S. A. Rejaie, Univ. of Southern California ... [4330-01]

9:40 am: **Information system for intelligent protection of earthquake-induced urban fires**, G. Z. Qi, D. Liu, InfraTech, Inc. .... [4330-02]

10:00 am: **Building change/damage detection in Seymen-Turkey using ERS SAR data**, B. Mansouri, M. Shinozuka, Univ. of Southern California; B. Houshmand, Univ. of California/Los Angeles . [4330-03]

10:20 am: **Built-in active sensing diagnostic system for civil infrastructures**, F. Wu, F. K. Chang, Stanford Univ. .... [4330-04]

10:40 am: **Adaptive systems in architecture and civil engineering**, W. Sobek, P. Teuffel, Univ. Stuttgart (Germany) ..... [4330-05]

#### SESSION 1

Room: Pacific Ballroom F  
Mon. 9:20 am

### Modeling and Identification of Various Damping Systems I

Chair: **Gregory S. Agnes**, Air Force Institute of Technology

9:20 am: **Analytical modeling for passive damping in smart composites using a multicell method**, V. Baburaj, Y. Matsuzaki, F. Nae, T. Ikeda, Nagoya Univ. (Japan) ..... [4331-01]

9:40 am: **Using state observers to model viscoelastic effects**, L. A. da Silva, Virginia Polytechnic Institute and State Univ.; E. M. Austin, Clemson Univ.; D. J. Inman, Virginia Polytechnic Institute and State Univ. .... [4331-02]

10:00 am: **New experimental technique to identify damping matrices of a dynamics system**, J. H. Kim, J. H. Lee, Univ. of Cincinnati ..... [4331-03]

10:20 am: **CASTOR damping experiment in-flight results**, P. Guay, E. Courau, P. W. Bousquet, F. Mercier, Ctr. National d'Etudes Spatiales (France) ..... [4331-04]

#### SESSION 1

Room: Pacific Ballroom D  
Mon. 9:20 am

### Smart Structures Application Concepts

Chairs: **Brian P. Sanders**, Air Force Research Lab.; **Anna-Maria R. McGowan**, NASA Langley Research Ctr.

9:20 am: **Comments on prospects of fully adaptive aircraft wings**, D. J. Inman, F. H. Gem, R. K. Kapania, Virginia Polytechnic Institute and State Univ. [4332-01]

9:40 am: **Evaluation of new actuators in a buffet loads environment (ENABLE)**, R. W. Moses, C. D. Wieseman, W. K. Wilkie, NASA Langley Research Ctr.; A. A. Bent, Continuum Control Corp. .... [4332-02]

10:00 am: **ASSET: collaboration in Europe on smart structures**, B. Culshaw, Univ. of Strathclyde (UK) ..... [4332-03]

10:20 am: **German industrial research project ADAPTRONIK: content, results, and outlook**, D. Sachau, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany); H. Hanselka, Otto-von Guericke Univ. Magdeburg (Germany) ..... [4332-04]

10:40 am: **Piezoelectric adaptive wing model concepts**, A. Suleman, Instituto Superior Técnico (Portugal); A. P. Costa, Portuguese Air Force Academy (Portugal) ... [4332-05]

11:00 am: **Conformal load-bearing antenna structures (CLAS) technology and applications to air vehicles**, A. J. Lockyer, K. H. Alt, J. N. Kudva, Northrop Grumman Corp.; J. Tuss, Air Force Research Lab. .... [4332-06]

11:20 am: **Requirements for transition of smart structures**, E. V. White, Boeing Co. [4332-07]

### Panel Discussion ... 11:40 am Future Direction in Smart Structure Applications to Aerospace Vehicles

Moderator: **Anna-Maria R. McGowan**, NASA Langley Research Ctr.

Lunch Break ... Noon to 1:30 pm

#### SESSION 1

Room: Trimaran/Brigatine  
Mon. 9:20 am

### Smart Materials

9:20 am: **Hybrid smart materials and adaptive structures (Invited Paper)**, R. G. Barsoum, Office of Naval Research ..... [4333-01]

10:00 am: **Extruded electrostrictor fibers: preferred crystallographic orientation**, H. B. Strock, M. R. Pascucci, P. Bystrycky, CeraNova Corp. .... [4333-02]

10:20 am: **Durability of piezoelectric stack actuators under combined electro-mechanical-thermal loading**, M. Mitrovic, G. P. Carman, Univ. of California/Los Angeles; F. K. Straub, Boeing Co. .... [4333-04]

10:40 am: **Does BaTiO<sub>3</sub> lose the center-of-symmetry in a single step on the cubic-to-tetragonal transition?: a new finding by the "mK-stabilized cell"**, A. Kojima, Univ. of Shiga Prefecture (Japan); K. Tozaki, Chiba Univ. (Japan); Y. Yoshimura, H. Iwasaki, Ritsumeikan Univ. (Japan)[4333-05]

11:00 am: **New interpretation of the phase transition series in CsPbCl<sub>3</sub> based on the finding of the multistep cubic-tetragonal structure change by the mK-stabilized cell**, Y. Yoshimura, Ritsumeikan Univ. (Japan); K. Tozaki, Chiba Univ. (Japan); A. Kojima, Univ. of Shiga Prefecture (Japan); H. Iwasaki, Ritsumeikan Univ. (Japan) ..... [4333-06]

11:20 am: **Piezoelectric property of sol-gel derived composite gels**, K. Sinkó, K. Fél, J. Rohonczy, Eötvös Lorand Univ. (Hungary); N. Hüsing, Technische Univ. Wien (Austria) ..... [4333-07]

Lunch Break . . . 11:40 am to 1:30 pm

### Keynote Presentations

9:20 am: **Recent progress in MEMS technology development of military applications**, **Paul B. Ruffin**, U.S. Army Aviation and Missile Command ..... [4334-01]

10:00 am: **MEMS for high-frequency applications**, **Jung-Chih Chiao**, Univ. of Hawaii/Manoa ..... [4334-02]

#### SESSION 1

Room: Newport Ballroom North  
Mon. 10:40 am

### Smart Electronics and RF MEMS

Chairs: **Pratul K. Ajmera**, Louisiana State Univ.; **K. J. Vinoy**, The Pennsylvania State Univ.

10:40 am: **Applications of laterally movable gate FET (LMGFET) for on-chip integration of MEMS with electronics**, P. K. Ajmera, I. H. Song, Louisiana State Univ. ... [4334-03]

11:00 am: **Performance improvement of rf MEMS capacitive switches with high-dielectric film as antistiction layer**, H. Yoon, Y. Sha, P. Sharma, K. J. Vinoy, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. .... [4334-04]

11:20 am: **Performance limits of micromachined tunable-cavity filter**, J. S. Moon, A. M. Shkel, Univ. of California/Irvine ..... [4334-05]

11:40 am: **On-chip 3D air core micro-inductor for high-frequency applications using deformation of sacrificial polymer**, N. Chomnawang, J. B. Lee, Louisiana State Univ. .... [4334-06]

Noon: **Smart power integrated circuits to drive piezoelectric actuators for cm<sub>3</sub> microrobot system**, M. Puig-Vidal, P. Miribel-Català, J. López, E. Montané, S. A. Bota, J. Samitier, Univ. de Barcelona (Spain) ..... [4334-07]

Lunch Break ... 12:20 to 1:30 pm

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# Smart Structures and Materials

## Conference 4326

Room: Pacific Ballroom A/B Mon.

## Conference 4327

Room: Schooner/Sloop

## Conference 4328

Room: Pacific Ballroom E

## Conference 4329

Room: Pacific Ballroom C

Monday 5 March 2001

### SESSION 2

Room: Pacific Ballroom A/B  
Mon. 11:00 am

#### Active Control of Sound

*Chair:* Balakumar Balachandran, Univ. of Maryland/College Park

11:00 am: **Active control of radiated sound from a thick-walled cylindrical shell**, K. Song, M. J. Atalla, S. R. Hall, Massachusetts Institute of Technology . [4326-05]

11:20 am: **Rayleigh-Ritz formulation for active control of the acoustics in cabin enclosures**, S. V. Gopinathan, V. V. Varadan, V. K. Varadan, The Pennsylvania State Univ. . . . . [4326-06]

11:40 am: **Zero spillover control of enclosed sound fields**, M. Al-Bassyouni, B. Balachandran, Univ. of Maryland/College Park [4326-07]

Noon: **Active control of the reflection of flexural waves in beams**, R. de la Guardia Gonzalez, Washington Univ. (Mexico); F. Orduna Bustamante, Univ. Nacional Autonoma de Mexico . . . . . [4326-08]

Lunch Break . . . 12:20 to 1:30 pm

### SESSION 3

Room: Schooner/Sloop  
Mon. 11:40 am

#### Adaptive Optics

*Chair:* David R. Martinez, Sandia National Labs.

11:40 am: **Steerable ultrasonic source using low-power laser sources and fiber optic delivery**, C. I. Swift, S. Pierce, B. Culshaw, Univ. of Strathclyde (UK) [4327-08]

Lunch Break . . . Noon to 1:30 pm

### SESSION 3

Room: Pacific Ballroom A/B  
Mon. 1:30 pm

#### Hysteresis Materials

*Chair:* Andrew J. Kurdila, Univ. of Florida

1:30 pm: **Unified model for hysteresis in ferroic materials (Invited Paper)**, R. C. Smith, J. Massad, North Carolina State Univ. . . . . [4326-09]

2:10 pm: **Modeling the effect of piezoceramic hysteresis in structural vibration control**, M. B. Ozer, T. J. Royston, Univ. of Illinois/Chicago . . . . . [4326-10]

2:30 pm: **Control of hysteresis: theory and experimental results**, X. Tan, Univ. of Maryland/College Park; R. Venkataraman, Veridian Engineering; P. S. Krishnaprasad, Univ. of Maryland/College Park . . . . . [4326-11]

2:50 pm: **Modeling of nonlinear hysteresis behavior in shape memory alloys**, L. D. Duval, R. C. Smith, M. N. Noori, North Carolina State Univ. . . . . [4326-12]

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

### SESSION 4

Room: Schooner/Sloop  
Mon. 1:30 pm

#### Actuators and Applications I

*Chair:* Ephraim Garcia, DARPA

1:30 pm: **Stress distribution and end effect of induced strain actuation of plates**, S. Yang, B. K. Ngoi, Nanyang Technological Univ. (Singapore) . . . . . [4327-10]

1:50 pm: **Development of active composites for harse environment**, H. Asanuma, Chiba Univ. (Japan) . . . . . [4327-15]

2:10 pm: **Materials and actuators for the shape control of structures**, J. Petitniot, H. M. des Rochettes, ONERA (France) . . . . . [4327-12]

2:30 pm: **Scalable rotary actuators with embedded shape memory alloys**, B. Park, M. Shantz, F. B. Prinz, Stanford Univ. . . [4327-13]

2:50 pm: **Power characterization of THUNDER actuators**, C. Niezrecki, S. Balakrishnan, Univ. of Florida . . . . . [4327-14]

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

### SESSION 2

Room: Pacific Ballroom E  
Mon. 1:30 pm

#### Fiber Optic Sensors and their Application II

*Chair:* Jeffrey N. Schoess, Honeywell Technology Ctr.

1:30 pm: **New kind of sensors based on amalgamation of fiber optic and aquatic plant to control water pollution**, T. V. Tulaikova, Institute for Problems in Mechanics (Russia) . . . . . [4328-08]

1:50 pm: **Displacement measurements in the cryogenically cooled dipoles of the new CERN-LHC particle accelerator**, D. Inaudi, SMARTEC SA (Switzerland); B. Glisic, Swiss Federal Institute of Technology (Switzerland); W. Scandale, J. Garcia Perez, J. Billan, S. Radaelli, CERN (Switzerland) . . . . . [4328-09]

2:10 pm: **Digital spatial wavelength domain multiplexing (DSWDM) using a prism-grating-prism (PGP) and a CMOS imager: implementation and initial testing**, M. Christiansen, K. Vaithyanathan, S. Chen, Univ. of Maryland/College Park; C. S. Baldwin, J. B. Niemczuk, J. S. Kiddy, P. C. Chen, Systems Planning and Analysis, Inc.; H. K. Kopola, M. Aikio, P. Suopajaervi, VTT Electronics (Finland) [4328-10]

2:30 pm: **Static fatigue life of silica optical fibers and the significance of fiber coating and handling**, A. Skontorp, J. Cammas, Aeronautical Research Institute of Sweden (Sweden) . . . . [4328-11]

### SESSION 2

Room: Pacific Ballroom C  
Mon. 1:30 pm

#### Ionic EAP: Conductive Polymers and Nanotubes

*Chairs:* Peter Sommer-Larsen, Risø National Lab. (Denmark); John D. Madden, Massachusetts Institute of Technology

1:30 pm: **Factors influencing the efficiency of electromechanical actuators based on inherently conducting polymers or carbon nanotubes (Invited Paper)**, G. G. Wallace, G. M. Spinks, J. N. Barisci, Univ. of Wollongong (Australia); R. H. Baughman, Honeywell Technology Ctr. . . . . [4329-06]

2:10 pm: **Strain amplified electro-active conducting polymer actuator**, D. De Rossi, F. Lorusi, A. Mazzoldi, E. Pasquale Scilingo, Univ. degli Studi di Pisa (Italy) . . . . . [4329-07]

2:30 pm: **Oxygen reduction on a conducting polymer strip**, L. Bay, S. Skaarup, N. Vlachopoulos, Danmarks Tekniske Univ. (Denmark); K. West, Risø National Lab. (Denmark) . . . . . [4329-08]

2:50 pm: **Fibers from emeraldine base/N-methyl-2-pyrrolidinone/amine solution: solution spinning and macrovoid control**, D. Yang, P. N. Adams, B. R. Mattes, Santa Fe Science and Technology, Inc. . . . . [4329-09]

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



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# Smart Structures and Materials

## Conference 4330

Room: Catamaran

## Conference 4331

Room: Pacific Ballroom F

## Conference 4332

Room: Pacific Ballroom D

## Conference 4333

Room: Trimaran/Brigatine

## Conference 4334

Room: Newport Ballroom North

Monday 5 March 2001

### SESSION 2

Room: Catamaran  
Mon. 11:00 am

#### Sensors for Infrastructure Monitoring I

Chair: Ming L. Wang,  
Univ. of Illinois/Chicago

- 11:00 am: **Manufacture and analysis of the microprism array for highway road signs**, R. S. Chang, National Central Univ. (Taiwan); J. Y. Shen, Kwang Wu Institute of Technology and Commerce (Taiwan) . . . . . [4330-06]
- 11:20 am: **Design and testing of a hybrid mode PVDF displacement sensor for low-frequency infrastructure monitoring**, G. M. Lloyd, M. L. Wang, Univ. of Illinois/Chicago; Y. Zhang, Univ. of Illinois/Urbana-Champaign . . . [4330-07]
- 11:40 am: **Long-gage fiber optic Bragg grating strain sensors to monitor civil structures**, W. L. Schulz, Blue Road Research; J. P. Conte, Univ. of California/Los Angeles; E. Udd, Blue Road Research . . . . . [4330-08]
- Noon: **Inspection of bridge columns, retaining walls with electromagnetic waves**, D. R. Huston, N. V. Pelczarski, C. Key, Univ. of Vermont . . . . . [4330-09]
- Lunch Break . . . 12:20 to 1:30 pm

### SESSION 2

Room: Pacific Ballroom F  
Mon. 10:40 am

#### Passive-Active Damping Treatments I

Chair: Eric M. Austin,  
Clemson Univ.

- 10:40 am: **Engineered damping treatments**, J. Oh, M. Ray, A. M. Baz, Univ. of Maryland/College Park . . . . . [4331-05]
- 11:00 am: **Hybrid vibration control of laminated composite beams using piezoceramic sensor/actuator and viscoelastic material**, Y. K. Kang, J. Kim, S. B. Choi, Inha Univ. (Korea) . . . . . [4331-06]
- 11:20 am: **Passive damping for the stratospheric observatory for infrared astronomy (SOFIA)**, J. R. Maly, CSA Engineering, Inc.; P. J. Keas, Orbital Sciences Corp. and NASA Ames Research Ctr. [4331-07]
- 11:40 am: **Advanced methods for optical jitter suppression using acoustic actuators**, S. M. Moon, R. L. Clark, Duke Univ. . [4331-08]
- Lunch Break . . . Noon to 1:30 pm

### SESSION 3

Room: Catamaran  
Mon. 1:30 pm

#### Health Monitoring of Civil Infrastructure I

Chair: Charles S. Sikorsky,  
Caltrans

- 1:30 pm: **Damage detectability limits using vibration measurements and under uncertainties**, R. A. Osegueda, Univ. of Texas/El Paso . . [4330-10]
- 1:50 pm: **Modeling and measurement for health monitoring of an existing SRC 8-story building**, M. Teshigawara, H. Isoda, T. Kashima, I. Tadashi, Building Research Institute (Japan) [4330-11]
- 2:10 pm: **Identification of damping and stiffness matrix of building structure from response measurement**, C. H. Loh, S. C. Chien, National Taiwan Univ. (Taiwan) . . . . . [4330-12]
- 2:30 pm: **System identification by video image processing**, M. Shinozuka, H. C. Chung, J. Liang, Univ. of Southern California . . . . . [4330-13]
- 2:50 pm: **Optimal sensor location of cable-stayed bridge for health monitoring**, G. Heo, Konyang Univ. (Korea); M. Y. Choi, Korea Research Institute of Standards and Science (Korea); G. Lee, Konyang Univ. (Korea) . . . . . [4330-14]
- Coffee Break . . . 3:10 to 3:40 pm

### SESSION 3

Room: Pacific Ballroom F  
Mon. 1:30 pm

#### MR-ER Dampers I

Chair: Norman M. Wereley,  
Univ. of Maryland/College Park

- 1:30 pm: **Fluid-mechanics based dynamic modeling of a magnetorheological fluid damper**, X. Wang, F. Gordaninejad, Univ. of Nevada/Reno . . . . . [4331-09]
- 1:50 pm: **Assessment of time response characteristics of electrorheological and magnetorheological dampers**, Y. T. Choi, N. M. Wereley, Univ. of Maryland/College Park . [4331-10]
- 2:10 pm: **Magnetorheological elastomers in tunable vibration absorbers**, J. M. Ginder, W. F. Schlotter, M. E. Nichols, Ford Motor Co. . . . . [4331-11]
- 2:30 pm: **Design, testing, and model validation of a magnetorheological squeeze-flow vibration damper**, N. D. Sims, R. Stanway, A. R. Johnson, P. Mellor, Univ. of Sheffield (UK) . [4331-12]
- 2:50 pm: **Active vibration control of rotor system by a magnetorheological fluid squeeze film damper**, C. Zhu, J. Jiang, D. A. Robb, D. J. Ewins, Imperial College of Science, Technology, and Medicine (UK) . . . . . [4331-13]

### SESSION 2

Room: Pacific Ballroom D  
Mon. 1:30 pm

#### Structural Health Monitoring Applications

Chairs: Peter C. Chen, Systems Planning and Analysis, Inc.;  
Christian Boller, DaimlerChrysler Aerospace (Germany)

- 1:30 pm: **Structural health management for aging aircraft**, R. Ikegami, E. Hauge, Boeing Phantom Works . . . . . [4332-08]
- 1:50 pm: **Common optical interconnect for systems and sensors**, R. C. Stevens, Lockheed Martin Co. . . . . [4332-09]
- 2:10 pm: **Structural health monitoring using FBG sensor in space environment**, S. Kabashima, T. Ozaki, Mitsubishi Electric Corp. (Japan); N. Takeda, Univ. of Tokyo (Japan) . . . . . [4332-10]
- 2:30 pm: **Structural health monitoring system for aircraft condition based maintenance**, J. Saniger, L. Reithler, D. Guedra-Degeorges, J. Dupuis, Aerospatiale Matra (France); N. Takeda, Univ. of Tokyo (Japan) . . . . . [4332-11]
- 2:50 pm: **Smart layer and smart suitcase for active diagnostic structural health monitoring**, M. Lin, A. Kumar, Accellent Technologies, Inc.; F. Chang, Stanford Univ. . . . . [4332-12]
- Coffee Break . . . 3:10 to 3:40 pm

### SESSION 2

Room: Trimaran/Brigatine  
Mon. 1:30 pm

#### Reliability of Ferroelectrics

- 1:30 pm: **Electrical fatigue in ferroelectric PZT (Invited Paper)**, J. Rödel, Technische Univ. Darmstadt (Germany) . . . . . [4333-08]
- 2:10 pm: **Constitutive and fracture behaviors of PZN single crystals**, S. Wan, C. S. Lynch, Georgia Institute of Technology . . . . . [4333-09]
- 2:30 pm: **Measuring the strength and fracture properties of ferroelectric materials using beams in flexure**, C. S. Lynch, Georgia Institute of Technology . [4333-10]
- 2:50 pm: **Application and implications of Kelvin probe force microscopy to study the electrical surface potential around cracks in PZT**, G. A. Schneider, F. Felten, Technische Univ. Hamburg-Harburg (Germany); R. M. McMeeking, Univ. of California/Santa Barbara . . . . . [4333-11]
- Coffee Break . . . 3:10 to 3:40 pm

### SESSION 2

Room: Newport Ballroom North  
Mon. 1:30 pm

#### Accelerometers and Gyroscopes

Chairs: K. A. Jose, The Pennsylvania State Univ.;  
P. Xavier, DSO National Labs. (Singapore)

- 1:30 pm: **Micromachined gyroscopes: challenges, design solutions, and opportunities (Invited Paper)**, A. M. Shkel, Univ. of California/Irvine . . . . . [4334-08]
- 2:00 pm: **Study of a novel isotropic suspension design for an angular gyroscope**, C. Painter, A. M. Shkel, Univ. of California/Irvine [4334-09]
- 2:20 pm: **Design simulation and testing of IDT-based gyroscopes**, W. Suh, K. A. Jose, P. Xavier, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. [4334-10]
- 2:40 pm: **Microgyroscopes with dynamic disturbance rejection**, C. Acar, A. M. Shkel, Univ. of California/Irvine . . . . . [4334-11]
- 3:00 pm: **Hybrid MEMS-IDT based accelerometer and gyroscope in a single chip**, V. K. Varadan, W. Suh, K. A. Jose, V. V. Varadan, The Pennsylvania State Univ. [4334-12]
- Coffee Break . . . 3:20 to 3:50 pm

# Smart Structures and Materials

Conference 4326

Room: Pacific Ballroom A/B Mon.

Conference 4327

Room: Schooner/Sloop

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Monday 5 March 2001

## Conference 4329

Room: Pacific Ballroom C  
Mon. 5:00 pm

### EAP in Action Session

Chair: Yoseph Bar-Cohen,  
Jet Propulsion Lab.

This session provides "hands-on" experience with the technology while personally meeting the developers. Recently emerging EAP actuators and devices will be demonstrated in this session.

- **Roy Kornbluh, Ron Pelrine, Qibing Pei, Jonathan Heim, Richard Heydt, Joseph Eckerle, Seajin Oh**, SRI International; "Dielectric Elastomers (Electroelastomers): Stretching the Capabilities of Actuators, Generators and Sensors."
- **Satoshi Tadokoro and students**, Kobe Univ. (Japan), "Soft micromanipulation device with multiple degrees of freedom using IPMC actuators."
- **Giovanni Pioggia**, Univ. of Pisa (Italy), "Android with facial expressions - a platform for EAP actuators."
- **Peter Sommer-Larsen**, The Danish Polymer Ctr., Risoe National Laboratory (Denmark), "Dielectric elastomer actuator."
- **Arun R. Srinivasa, Jana Venkataraghavan**, Texas A&M Univ., "Design of Compliant Mechanisms Using Magneto Active Polymers."
- **Jaehwan Kim, Inha Univ.** (Korea), "Electroactive Papers acting on electric field."

### SESSION 4

Room: Pacific Ballroom A/B  
Mon. 3:40 pm

#### Modeling Applications I

Chair: Vasundara V. Varadan,  
The Pennsylvania State Univ.

3:40 pm: **Overall design of actively controlled smart structures by the finite element method**, U. Gabbert, H. Köppe, F. Seeger, Univ. Magdeburg (Germany) . [4326-13]

4:00 pm: **Dynamic modeling and compensation of fine wire thermocouple based on rocket engine**, Q. Xu, G. Liao, Univ. of Science and Technology (China) . . . . . [4326-14]

4:20 pm: **Cylindrical bending of a piezoelectric plate with a 7th order plate theory**, R. C. Batra, S. Vidoli, Virginia Polytechnic Institute and State Univ. . . . . [4326-15]

4:40 pm: **Finite element modeling of smart materials: application to an adaptive structure using SMA**, A. Hladky-Hennion, S. Rafanomezantsoa, L. Buchailot, IEMN (France); P. Bouchilloux, Magsoft Corp. . . . . [4326-16]

5:00 pm: **Vibration measurement and mode analysis on concrete structures with embedded fiber Bragg grating sensors**, Y. Wang, S. C. Tjin, X. M. Sun, P. Moyo, X. Zheng, J. M. Brownjohn, Nanyang Technological Univ. (Singapore) . . . . . [4326-17]

5:20 pm: **Nonlinear finite element analysis of magnetostrictive transducers**, M. Kaltenbacher, S. M. Schneider, R. Simkovic, H. Landes, R. Lerch, Friedrich-Alexander Univ. Erlangen-Nuernberg (Germany) . [4326-18]

### SESSION 5

Room: Schooner/Sloop  
Mon. 3:40 pm

#### Actuators and Applications II

Chair: Shoko Yoshikawa,  
Active Control eXperts, Inc.

3:40 pm: **Simultaneous vibration isolation and pointing control of flexure jointed hexapods**, X. Li, J. C. Hamann, J. E. McInroy, Univ. of Wyoming . . . . . [4327-16]

4:00 pm: **Impedance matching of piezoelectric actuators to dynamic loads for maximum power output**, A. G. Cox, M. A. Gogola, M. Goldfarb, Vanderbilt Univ.; E. Garcia, DARPA . . . . [4327-17]

4:20 pm: **Mega-power metal hydride anthroform biorobotic actuator**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico and Environmental Robots, Inc. . . [4327-18]

4:40 pm: **Optimal integration of smart actuators for the enhancement of the operating speed and precision of robot manipulators**, J. S. Rastegar, L. Yuan, SUNY/Stony Brook . . . . [4327-19]

5:00 pm: **Design advances for high-efficiency regenerative piezoelectric drive amplifier**, P. Wlodkowski, Wilcoxon Research, Inc. . . . . [4327-91]

### SESSION 6

Room: Schooner/Sloop  
Mon. 5:20 pm

#### ER/MR Fluids and Devices I

Chair: Norman M. Wereley,  
Univ. of Maryland/College Park

5:20 pm: **Characteristics of automotive suspension systems with MR dampers**, W. H. Liao, H. F. Lam, Chinese Univ. of Hong Kong . . . . . [4327-20]

5:40 pm: **Electrorheological clutch for robotics application: experimental validation of mathematical models**, K. P. Tan, R. Stanway, A. R. Johnson, W. A. Bullough, Univ. of Sheffield (UK) . . . . . [4327-21]

6:00 pm: **Design of an MR hydraulic power actuation system**, J. Yoo, J. Sirohi, N. M. Wereley, Univ. of Maryland/College Park . . . . . [4327-22]

### SESSION 3

Room: Pacific Ballroom E  
Mon. 2:50 pm

#### Health Monitoring Sensors and Systems

Chair: Kim D. Bennett,  
Lafayette College

2:50 pm: **Using GPS in structural health monitoring**, A. Knecht, L. Manetti, Professional Univ. of Southern Switzerland (Switzerland) . . . . . [4328-12]

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

3:40 pm: **Neural system for structural health monitoring**, M. J. Sundaresan, M. J. Schulz, A. Ghoshal, North Carolina A&T State Univ.; P. R. Pratap, Univ. of North Carolina/Greensboro . . [4328-13]

### SESSION 4

Room: Pacific Ballroom E  
Mon. 4:00 pm

#### Fiber Grating Sensors I

Chair: Eric Udd,  
Blue Road Research

4:00 pm: **Demodulation system for fiber optic Bragg grating dynamic pressure sensing**, J. Lekki, G. Adamovsky, NASA Glenn Research Ctr. . . . . [4328-16]

4:20 pm: **Optical fiber grating sensor network basing on high-reliable fibers and components for spacecraft health monitoring**, W. Ecke, S. Grimm, I. Latka, Institute for Physical High Technology (Germany); A. Reutlinger, Kayser-Threde GmbH (Germany); J. Sparschuh, R. Willsch, Institute for Physical High Technology (Germany) . [4328-17]

4:40 pm: **Implementation of a Bragg grating strain rosette embedded in composites**, J. Matrat, K. Levin, R. Jarlås, Aeronautical Research Institute of Sweden (Sweden) . . . . . [4328-18]

5:00 pm: **Bragg grating fiber optic sensor for composite process monitoring**, N. Mrad, National Research Council Canada . . . . . [4328-20]

### SESSION 2 (cont.)

Room: Pacific Ballroom C  
Mon. 3:40 pm

3:40 pm: **Polypyrrole actuators: modeling and performance**, J. D. Madden, Massachusetts Institute of Technology; I. W. Hunter, MIT BiolInstrumentation Lab. [4329-73]

4:00 pm: **Optimal electrode design of ion-exchange polymer metal composite (IPMC) actuators**, J. Nam, J. H. Lee, S. D. Hwang, H. R. Choi, J. W. Jeon, H. M. Kim, Sung Kyun Kwan Univ. (Korea); Y. S. Tak, Inha Univ. (Korea); H. K. Kim, Sung Kyun Kwan Univ. (Korea) [4329-63]

4:20 pm: **Characterization of triple layers**, T. F. Otero, Univ. del País Vasco and Univ. Politécnic a Cartagena (Spain); T. Cortés, Univ. del País Vasco (Spain) . . [4329-11]

4:40 pm: **Properties of polypyrrole doped with alkyl benzene sulfonate**, L. Bay, S. Skaarup, Danmarks Tekniske Univ. (Denmark); K. West, Risoe National Lab. (Denmark) . . . . . [4329-12]

5:00 pm: **EAP actuator with enhanced force using a parallel combination of polypyrrole and solid polymer electrolyte films that work in air**, J. M. Sansiñena, V. Olazábal, Y. Bar-Cohen, Jet Propulsion Lab. . . . . [4329-13]

Room: Pacific Ballroom C  
Mon. 5:00 pm

### EAP in Action Session

Chair: Yoseph Bar-Cohen,  
Jet Propulsion Lab.

See copy far left.

# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

Monday 5 March 2001

## SESSION 4

Room: Catamaran  
Mon. 3:40 pm

### Health Monitoring of Civil Infrastructure II

Chair: Charles S. Sikorsky, Caltrans

3:40 pm: **Novelty detection under changing environmental conditions**, H. Sohn, C. R. Farrar, Los Alamos National Lab.; K. Worden, Univ. of Sheffield (UK) . . . . . [4330-15]

4:00 pm: **Detecting damage in a civil building model under seismic excitation**, J. Ma, D. J. Pines, Univ. of Maryland/College Park [4330-16]

4:20 pm: **Damage assesment using local attractor variance**, J. M. Nichols, L. N. Virgin, Duke Univ.; M. D. Todd, L. M. Pecora, Naval Research Lab. . . . . [4330-17]

4:40 pm: **Seismic damage sensing of bridge structures with TRIP reinforcement steel bars**, Y. Adachi, Hanshin Expressway Public Corp. (Japan); S. Unjoh, Ministry of Construction (Japan) . . . [4330-18]

5:00 pm: **Instrumentation and manufacture of a smart composite bridge for short-span applications**, S. E. Watkins, Univ. of Missouri/Rolla; J. F. Unser, Composite Product Inc.; A. Nanni, K. Chandrashekhara, A. Belarbi, Univ. of Missouri/Rolla . . . . . [4330-19]

5:20 pm: **Evaluation of structural dynamic characteristics using CCD measurement principle**, M. Choi, Korea Research Institute of Standards and Science (Korea); G. Heo, Konyang Univ. (Korea); K. Park, S. Oh, Korea Research Institute of Standards and Science (Korea) . . . . . [4330-20]

5:40 pm: **Local and global structural identification of FRP composite structural element**, K. Ciloglu, F. N. Catbas, M. Pervizpour, A. S. Wang, A. Aktan, Drexel Univ. . [4330-21]

6:00 pm: **Health monitoring of the Kings Stormwater Channel Bridge**, C. S. Sikorsky, Caltrans . [4330-61]

## SESSION 4

Room: Pacific Ballroom F  
Mon. 3:40 pm

### Absorption/Isolation

Chair: T. Tupper Hyde, Honeywell Space Systems

3:40 pm: **Multifrequency piezoelectric vibration absorber for variable frequency harmonic excitations**, R. A. Morgan, K. Wang, The Pennsylvania State Univ. . . . . [4331-14]

4:00 pm: **Piezoelectric isolation system for lightweight automotive seats**, M. Malowicki, Milford Proving Grounds; D. J. Leo, Virginia Polytechnic Institute and State Univ. . . . . [4331-15]

4:20 pm: **Multi-axis whole-spacecraft vibration isolation for small launch vehicles**, C. D. Johnson, P. S. Wilke, CSA Engineering, Inc.; K. R. Darling, Orbital Sciences Corp. . [4331-16]

4:40 pm: **Experimental results for a three degrees-of-freedom isolator for launch isolation**, F. Khorrami, J. S. Rastegar, OmniTek Research & Development, Inc. . . . . [4331-17]

5:00 pm: **Active and adaptive control for payload launch vibration isolation**, G. S. Agnes, J. Jarosh, Air Force Institute of Technology . . . . . [4331-18]

5:20 pm: **Viscous and metallic dampers in a building structure subjected to varying levels of ground motion**, M. Vilcheck, Caltrans; W. Pong, San Francisco State Univ. . . . . [4331-19]

Coffee Break . . . . . 8:45 to 9:20 am

## SESSION 3

Room: Pacific Ballroom D  
Mon. 3:40 pm

### Applications of Photonics Technologies

Chairs: Grigory Adamovsky, NASA Glenn Research Ctr.; Gerard G. Walles, Naval Air Systems Command

3:40 pm: **Integrated photonic systems redefine air vehicle management**, F. Fazi, D. L. Francis, Lockheed Martin Co. . . [4332-13]

4:00 pm: **Application of smart optical fiber sensors for structural load monitoring**, H. Davies, L. A. Everall, A. M. Gallon, Smart Fibres Ltd. (UK) . . . . . [4332-14]

4:20 pm: **Structural testing of an LPD-17 propulsion propeller using Bragg gratings and digital spatial wavelength domain multiplexing (DSWDM)**, C. S. Baldwin, P. C. Chen, J. S. Kiddy, J. B. Niemczuk, Systems Planning and Analysis, Inc.; S. Chen, K. Vaithyanathan, M. Christiansen, Univ. of Maryland/College Park . . . . . [4332-15]

4:40 pm: **Use of 3000 Bragg grating strain sensors distributed on four eight-meter optical fibers during static load tests of a composite structure**, B. A. Childers, M. E. Froggatt, Luna Innovations, Inc.; S. G. Allison, T. C. Moore, D. A. Hare, C. F. Batten, D. C. Jegley, NASA Langley Research Ctr. . . . . [4332-17]

5:00 pm: **Feasibility study of embedded fiber-optic strain sensing for composite propeller blades**, V. E. Zetterlind III, Air Force Institute of Technology; S. E. Watkins, Univ. of Missouri/Rolla; M. W. Spoltman, Hartzell Propeller, Inc. . [4332-18]

## SESSION 3

Room: Trimaran/Brigatine  
Mon. 3:40 pm

### Characterization of Ferroelectrics

3:40 pm: **Nonlinear properties of piezoelectric ceramics** (Invited Paper), B. K. Mukherjee, W. Ren, G. Yang, S. F. Liu, A. J. Masys, Royal Military College (Canada) [4333-12]

4:20 pm: **Property measurement on piezoelectric single crystals and the implications for transducer design**, J. M. Powers, D. D. Viehland, L. Ewart, Naval Undersea Warfare Ctr. . . . . [4333-13]

4:40 pm: **Rate dependence of polarization and strain in soft PZT ferroelectric ceramics**, D. Zhou, M. Kamlah, D. Munz, Forschungszentrum Karlsruhe (Germany) . . . . . [4333-14]

5:00 pm: **Resonance measurements as predictors of large-signal material performance**, H. C. Robinson, E. A. McLaughlin, Naval Undersea Warfare Ctr. . [4333-15]

5:20 pm: **Recoverable strain and spontaneous polarization of ferroelectric ceramics and thin films: the effect of crystal symmetry and texture**, J. Li, K. Bhattacharya, California Institute of Technology . . . . . [4333-16]

5:40 pm: **Electro-elastic moduli of piezoelectric polycrystals with bulk and film textures**, J. Li, California Institute of Technology; M. L. Dunn, Univ. of Colorado/Boulder . . . . . [4333-17]

6:00 pm: **Kinetics of fatigue in bulk ferroelectrics**, V. Y. Shur, E. L. Romyantsev, E. Nikolaeva, E. Shishkin, I. Baturin, Ural State Univ. (Russia); D. C. Lupascu, J. Nuffer, J. Rödel, Technische Univ. Darmstadt (Germany); C. A. Randall, M. Ozgui, The Pennsylvania State Univ. . . . . [4333-18]

## SESSION 3

Room: Newport Ballroom North  
Mon. 3:50 pm

### Smart Skin Antenna and Frequency Selective Surface (FSS) I ARO/ NATO Invited Session

Chairs: Gary L. Anderson, Army Research Office; Gregory Washington, Ohio State Univ.

3:50 pm: **Electronically reconfigurable and mechanically conformal apertures using low-voltage MEMS and flexible membranes for space-based radar applications** (Invited Paper), J. T. Bernhard, N. Chen, R. Clark, M. Feng, C. Liu, P. Mayes, E. Michielssen, R. Wong, Univ. of Illinois/Urbana-Champaign . . . . . [4334-13]

4:10 pm: **Overview of the DoD's rf multifunction structural aperture (MUSTRAP) program** (Invited Paper), K. H. Alt, A. J. Lockyer, D. P. Coughlin, J. N. Kudva, Northrop Grumman Corp.; A. C. Goetz, TRW Corp.; J. Tuss, Air Force Research Lab. . . . . [4334-14]

4:30 pm: **Point actuated aperture antenna development** (Invited Paper), G. Washington, M. Angelino, Ohio State Univ. . . . . [4334-15]

4:50 pm: **Micromachined systems for rf microwave antenna applications** (Invited Paper), K. J. Vinoy, K. A. Jose, V. V. Varadan, V. K. Varadan, The Pennsylvania State Univ. . . . . [4334-16]

5:10 pm: **Shape control of distributed parameter reflectors using sliding mode control** (Invited Paper), G. Washington, F. Andoh, V. Utkin, Ohio State Univ. [4334-17]

5:30 pm: **Optimized multilayered wideband absorbers with graded fractal FSS** (Invited Paper), K. J. Vinoy, K. A. Jose, V. V. Varadan, V. K. Varadan, The Pennsylvania State Univ. . . . . [4334-18]

## Technical Group Meeting • 7:00 to 9:00 pm • Newport North Smart Structures and Materials

Chair: Dr. Alison B. Flatau, National Science Foundation

The Smart Structures and Materials Technical Group will meet to hear presentations from the three finalists in the Best Student Paper Contest. Following the presentation, technical group members will vote to determine the winning paper. All conference attendees are cordially invited to attend.

SPIE thanks  for sponsoring the Smart Structures Best Student Paper Award.



# Smart Structures and Materials

Conference 4326

Pacific Ballroom A Tues.–Thurs.

Conference 4327

Room: Schooner/Sloop

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Tuesday 6 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Product Implementation Award

Plenary Presentation

### The Importance of Multi-disciplinary Research in Achieving Technological Advances

Speaker: Prof. Geof Tomlinson, Univ. of Sheffield (UK)

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 5

Room: Pacific Ballroom A  
Tues. 9:20 am

#### Signal Processing for Structures Damage Detection

Chair: Vittal S. Rao,  
Univ. of Missouri/Rolla

- 9:20 am: **Signal processing for passive impact damage detection in composite structures** (*Invited Paper*), P. Pedemonte, Univ. degli Studi di Cagliari (Italy); W. J. Staszewski, F. Aymerich, M. S. Found, Univ. of Sheffield (UK); P. Priolo, Univ. degli Studi di Cagliari (Italy) ..... [4326-19]
- 10:00 am: **Structural damage detection using substructural identification and probabilistic approach**, P. Liu, V. S. Rao, Univ. of Missouri/Rolla ..... [4326-20]
- 10:20 am: **Overview of optimal sensor location methods for damage detection**, W. J. Staszewski, K. Worden, Univ. of Sheffield (UK) ..... [4326-21]
- 10:40 am: **Influence of lamination direction on fracture behavior and mechanical properties of TiNi SMA wire embedded CFRP smart composites**, B. K. Jang, N. Toyama, J. H. Koo, T. Kishi, National Institute for Advanced Interdisciplinary Research (Japan) ..... [4326-22]

#### SESSION 6

Room: Pacific Ballroom A  
Tues. 11:00 am

#### Signal Processing Applications

Chair: Qing Jiang, Univ. of California/Riverside

- 11:00 am: **Development of pseudo-wavelets and their applications for system identification**, Z. Hou, A. Hera, Worcester Polytechnic Institute ..... [4326-23]
- 11:20 am: **Experimental validation of a thermo-elastic model for SMA hybrid composites**, T. L. Turner, NASA Langley Research Ctr. .... [4326-24]
- 11:40 am: **Optimal switching policy of smart actuators in flexible structures**, M. A. Demetriou, Worcester Polytechnic Institute ..... [4326-25]
- Noon: **Role of damping in state-switched absorber for vibration control**, M. Holdhusen, K. Cunefare, G. D. Larson, Georgia Institute of Technology . [4326-26]
- Lunch/Exhibit Break 12:20 to 1:30 pm

#### SESSION 7

Room: Schooner/Sloop  
Tues. 9:20 am

#### ER/MR Fluids and Devices II

Chair: John M. Ginder,  
Ford Motor Co.

- 9:20 am: **ER suspension units for vibration control of a tracked vehicle**, S. B. Choi, D. W. Park, Inha Univ. (Korea); M. S. Suh, M. J. Shin, Korea Agency for Defense Development (Korea) ... [4327-23]
- 9:40 am: **Smart structures for shock-wave attenuation using ER inserts**, J. Kim, J. Y. Kim, S. B. Choi, K. S. Kim, Inha Univ. (Korea) ..... [4327-24]
- 10:00 am: **Vibration control by smart structure with electrorheological fluid**, S. Machida, Fuji Heavy Industries Ltd. (Japan); Y. Matsuzaki, Nagoya Univ. (Japan); T. Hagi, Fuji Heavy Industries Ltd. (Japan) . . [4327-25]
- 10:20 am: **Experimental evaluation of smart structure with electrorheological fluid**, T. Hagi, Fuji Heavy Industries Ltd. (Japan); Y. Matsuzaki, Nagoya Univ. (Japan); N. Oshima, Osaka City Univ. (Japan); S. Machida, Fuji Heavy Industries Ltd. (Japan) . . [4327-26]

#### SESSION 8

Room: Schooner/Sloop  
Tues. 10:40 am

#### Health Monitoring I

Chair: Hiroshi Asanuma,  
Chiba Univ. (Japan)

- 10:40 am: **Investigation of a self-healing bolted joint employing a shape memory actuator**, D. E. Muntges, G. Park, D. J. Inman, Virginia Polytechnic Institute and State Univ. .... [4327-27]
- 11:00 am: **Health monitoring on stitched composite structures**, D. Lee, S. S. Suh, G. P. Carman, J. M. Yang, H. T. Hahn, Univ. of California/Los Angeles; P. Shyprykevich, FAA William J. Hughes Technical Ctr. [4327-28]
- 11:20 am: **Multifunctional system for active noise control and damage detection on a typical aeronautical structure**, L. Lecce, M. Viscardi, G. Zumpano, Univ. degli Studi di Napoli Federico II (Italy) [4327-29]

#### SESSION 5

Room: Pacific Ballroom E  
Tues. 9:20 am

#### Fiber Grating Sensors II

Chair: Eric Udd,  
Blue Road Research

- 9:20 am: **Strain and temperature transducer on one fiber Bragg grating**, J. López-Higuera, Univ. de Cantabria (Spain); A. Quintela, J. Echevarria, C. Jauregui, A. Cobo, Univ. de Cantabria (Spain)[4328-21]
- 9:40 am: **Performance of fiber optic Bragg grating sensors in CFRP structures**, M. Kehlenbach, A. Horoschenkoff, M. N. Trutzel, D. Betz, DaimlerChrysler (Germany) ..... [4328-22]

#### SESSION 6

Room: Pacific Ballroom E  
Tues. 10:00 am

#### Acoustic Sensing/ Ultrasonics

Chair: Daniele Inaudi,  
SMARTEC SA (Switzerland)

- 10:00 am: **Analysis of the frequency dependence of the ultrasound responsivity of Bragg grating sensors**, G. Coppola, A. Cusano, A. Minardo, G. Breglio, Univ. degli Studi di Napoli Federico II (Italy); A. Cutolo, Univ. degli Studi del Sannio (Italy); M. Giordano, L. Nicolais II, Univ. degli Studi di Napoli Federico II (Italy); A. Calabro, Italian Aerospace Research Ctr. (Italy) ..... [4328-23]
- 10:20 am: **Fiber integrating sensor for ultrasonic flaw detection**, F. Dong, K. Atherton, S. Pierce, K. Zhou, C. I. Swift, B. Culshaw, Univ. of Strathclyde (UK) [4328-24]
- 10:40 am: **CH-46 rotor acoustics analysis: continued analysis of in-flight maneuvers**, J. N. Schoess, S. Menon, Honeywell Technology Ctr. .... [4328-25]
- 11:00 am: **Experimental research on acousto-ultrasonic inspection of composites by PZT patches and wavelet analysis**, L. Shi, B. Chen, Nanjing Engineering Institute (China); S. Yuan, B. Tao, Nanjing Univ. of Aeronautics and Astronautics (China) . . . [4328-27]

#### SESSION 4

Room: Pacific Ballroom C  
Tues. 9:20 am

#### Electronic EAP: Ferroelectrics Dielectrics

Chairs: Roy D. Kornbluh, SRI International; Qiming Zhang, The Pennsylvania State Univ.

- 9:20 am: **Electrostrictive P(VDF-TrFE)-based terpolymers and its device performance**, Q. M. Zhang, H. S. Xu, Z. Y. Cheng, M. Tian, T. C. Chung, The Pennsylvania State Univ.; R. Y. Ting, Univ. of Central Florida ..... [4329-14]
- 9:40 am: **Ferroelectric polymers with giant electrostriction based on semicrystalline VDF/TrFE/CTFE terpolymers**, T. C. Chung, A. Petchsuk, The Pennsylvania State Univ. .... [4329-15]
- 10:00 am: **Electrostrictive and ferroelectric properties of P(VDF-TrFE)/P(VDF/HFP) copolymer blends**, J. I. Scheinbeim, Rutgers Univ. .... [4329-16]
- 10:20 am: **High-temperature stable piezoelectric PVDF/Nylon11 powder blend films**, J. I. Scheinbeim, Rutgers Univ. .... [4329-17]
- 10:40 am: **Electrostrictive P(VDF-TrFE)-based high-performance micromachined unimorph system**, T. B. Xu, Z. Y. Cheng, H. Xu, W. Chen, Q. M. Zhang, The Pennsylvania State Univ. [4329-18]
- 11:00 am: **Action response of polyacrylate dielectric elastomers**, G. Kofod, Risø National Lab. (Denmark); R. D. Kornbluh, R. Pelrine, SRI International; P. Sommer-Larsen, Risø National Lab. (Denmark) ..... [4329-19]
- 11:20 am: **Dielectric elastomers: generator-mode fundamentals and applications**, R. Pelrine, R. D. Kornbluh, J. Eckerle, P. Jeuck, S. Oh, Q. Pei, S. Stanford, SRI International ..... [4329-20]
- 11:40 am: **Response of dielectric elastomer actuators**, P. Sommer-Larsen, J. C. Hooker, G. Kofod, K. West, Risø National Lab. (Denmark); M. Benslimane, P. Gravesen, Danfoss A/S (Denmark) ..... [4329-21]
- Lunch/Exhibit Break Noon to 1:30 pm

## Poster Session

6 to 7:30 pm  
North Tower 3rd Floor

A poster session will be held on Tuesday evening for all attendees of the symposium. Attendees will have an opportunity to view the poster papers and meet informally with authors. Refreshments and light hors d'oeuvres will be served.

# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

Tuesday 6 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Product Implementation Award

Plenary Presentation

### The Importance of Multi-disciplinary Research in Achieving Technological Advances

Speaker: Prof. Geof Tomlinson, Univ. of Sheffield (UK)

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 5

Room: Catamaran  
Tues. 9:20 am

#### ER/MR Device Design, Modeling, and Performance

Chair: Erik A. Johnson, Univ. of Southern California

9:20 am: **Multiduct ER devices**, H. P. Gavin, C. Chompucot, Duke Univ. .... [4330-22]

9:40 am: **Quasi-steady analysis of magnetorheological dampers**, N. M. Wereley, Univ. of Maryland/College Park ..... [4330-23]

10:00 am: **Dynamic performance and modeling of magnetorheological damper**, H. Fujitani, Building Research Institute (Japan); K. Sunakoda, Sanwa Tekki Corp. (Japan); K. Hata, Bando Chemical Industries Ltd. (Japan); S. Soda, Waseda Univ. (Japan) ..... [4330-24]

10:20 am: **Conceiving semi-active control devices for large-size monolithic monuments**, F. Casciati, Univ. di Pavia (Italy); A. El Attar, Univ. of Cairo (Egypt); L. Faravelli, Univ. di Pavia (Italy) ... [4330-25]

10:40 am: **Experimental testing and control of an electrorheological long-stroke vibration damper**, N. D. Sims, R. Stanway, A. R. Johnson, Univ. of Sheffield (UK) ..... [4330-26]

#### SESSION 6

Room: Catamaran  
Tues. 11:00 am

#### Smart SMA Devices Applied to Civil Infrastructure

Chairs: Reginald DesRoches, Georgia Institute of Technology; Yozo Fujino, Univ. of Tokyo (Japan)

11:00 am: **Innovative beam-column joint connections using SMA components**, R. DesRoches, R. Leon, G. Hess, Georgia Institute of Technology; J. Ocel, Univ. of Minnesota ..... [4330-27]

11:20 am: **SMA recentering devices for seismic isolation of civil structures**, M. Dolce, D. Cardone, Univ. degli Studi di Basilicata (Italy); R. Marnetto, T.I.S. SpA (Italy) ..... [4330-28]

#### SESSION 5

Room: Pacific Ballroom F  
Tues. 9:20 am

#### Passive-Active Damping Treatments II

Chair: Conor D. Johnson, CSA Engineering, Inc.

9:20 am: **Design methodology for particle damping**, B. L. Fowler, E. M. Flint, CSA Engineering, Inc.; S. E. Olson, Univ. of Dayton Research Institute ..... [4331-20]

9:40 am: **Enhancement and evaluation of damping performance in layered CLD type coatings**, V. R. Buravalla, J. A. Rongong, G. R. Tomlinson, Univ. of Sheffield (UK) ..... [4331-21]

10:00 am: **Optimal NiTi hybrid tendon system for structural vibration control**, S. Saadat, M. N. Noori, North Carolina State Univ.; H. Davoodi, Univ. of Puerto Rico/Mayaguez ..... [4331-22]

#### SESSION 6

Room: Pacific Ballroom F  
Tues. 10:20 am

#### Passive PZT Treatments I

Chair: Geoffrey R. Tomlinson, Univ. of Sheffield (UK)

10:20 am: **Attenuation and localization of waves in rods with periodic shunted piezoelectric patches**, O. Throp, U.S. Naval Academy; M. Ruzzene, Catholic Univ. of America; A. M. Baz, Univ. of Maryland/College Park [4331-24]

10:40 am: **New method for multiple-mode shunt damping of structural vibration using a single piezoelectric transducer**, S. O. R. Moheimani, S. Behrens, A. J. Fleming, Univ. of Newcastle (Australia) ..... [4331-25]

11:00 am: **Broadband piezoelectric shunts for passive structural vibration control**, S. Y. Wu, Boeing Co. .... [4331-26]

11:20 am: **Comparison of low-frequency piezoceramic shunt techniques for structural damping**, L. R. Corr, W. W. Clark, Univ. of Pittsburgh ..... [4331-27]

Lunch/Exhibit  
Break ..... 11:40 am to 1:30 pm

#### SESSION 4

Room: Pacific Ballroom D  
Tues. 9:20 am

#### Vibration Isolation and Space Applications

Chairs: Jack H. Jacobs, Honeywell Space Systems; Keith K. Denoyer, Air Force Research Lab.

9:20 am: **Recent transitions of smart structures technologies through flight experiments**, K. K. Denoyer, Air Force Research Lab. .... [4332-19]

9:40 am: **Miniature vibration isolation system for space applications**, J. H. Jacobs, P. Buchele, J. Boyd, D. Quenon, D. Osterberg, Honeywell Space Systems ..... [4332-21]

10:00 am: **Heavy load vibration isolation system for airborne payloads**, S. Hadden, T. Davis, P. Buchele, J. Boyd, R. Self, Honeywell Space Systems [4332-22]

10:20 am: **ELITE-3 active vibration isolation workstation**, E. H. Anderson, CSA Engineering, Inc.; B. Houghton, Newport Corp. .... [4332-23]

#### SESSION 5

Room: Pacific Ballroom D  
Tues. 10:40 am

#### Automotive Applications

Chairs: Jody Vipperman, Active Control eXperts, Inc.; Johannes K. Dürr, DaimlerChrysler Aerospace (Germany)

10:40 am: **Application of smart materials in automotive structures**, H. Manz, Volkswagen AG (Germany); E. J. Breitbach, Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany) [4332-24]

11:00 am: **Narrow and broad-band sound reduction in automotive panels**, M. Giovanardi, Active Control eXperts, Inc.; K. Schmidt, H. Kunze, Volkswagen AG (Germany) ..... [4332-25]

11:20 am: **Environmentally responsive material to address human-system interaction in the automotive cockpit**, J. D. Rehkopf, S. D. Barbat, Ford Motor Co.; K. Cureton, Amcol International Corp.; N. M. Goldman, Smart Materials; H. Gold, Foster-Miller, Inc. [4332-26]

Lunch/Exhibit  
Break ..... 11:40 am to 1:30 pm

#### SESSION 4

Room: Trimaran/Brigatine  
Tues. 9:20 am

#### Ferroelectric Materials

9:20 am: **Polarization and strain behavior in perovskite structure ferroelectric crystals and ceramics (Invited Paper)**, L. E. Cross, The Pennsylvania State Univ. .... [4333-19]

10:00 am: **Single crystal piezoelectrics for advanced transducer and smart structures applications**, W. S. Hackenberger, P. W. Rehrig, M. Pan, D. M. Anderson, TRS Ceramics, Inc.; T. R. Shrout, The Pennsylvania State Univ. .... [4333-20]

10:20 am: **Self-assembled electro-optic materials and devices**, K. L. Cooper, NanoSonic, Inc.; L. Zhang, T. Zeng, Virginia Polytechnic Institute and State Univ.; R. O. Claus, NanoSonic, Inc. and Virginia Polytechnic Institute and State Univ.; Y. Wang, NanoSonic, Inc. .... [4333-21]

10:40 am: **Raman study of overlap of phase transitions in Zr-doped barium titanate ceramics**, P. Dopal, A. Dixit, R. S. Katiyar, Univ. of Puerto Rico; A. S. Bhalla, The Pennsylvania State Univ. [4333-22]

11:00 am: **Electro-mechanical behavior of 90-degree domain motion in barium titanate single crystals**, E. N. Burcsu, G. Ravichandran, K. Bhattacharya, California Institute of Technology ..... [4333-23]

11:20 am: **Strong nonlinear behavior of piezoceramics excited with a weak electric field**, W. Seemann, R. Gausmann, Univ. Kaiserslautern (Germany) [4333-25]

Lunch/Exhibit  
Break ..... 11:40 am to 1:30 pm

#### Keynote Presentations

9:20 am: **MEMS and nanotechnology research for the electronics industry**, Y. Eugene Pak, Samsung Advanced Institute of Technology & CRI (Korea) ..... [4334-19]

10:00 am: **Mechatronic devices for neurorehabilitation**, David J. Reinkensmeyer, Univ. of California/Irvine .... [4334-20]

#### SESSION 4

Room: Newport Ballroom North  
Tues. 10:40 am

#### Smart Skin Antenna and Frequency Selective Surface (FSS) II ARO/NATO Invited Session

Chair: Vijay K. Varadan, The Pennsylvania State Univ.

10:40 am: **Planar reconfigurable slot antenna for communications (Invited Paper)**, K. Sarabandi, L. P. Katehi, Univ. of Michigan; B. S. Perlman, Army Research Lab. .... [4334-21]

11:10 am: **Distortion of conformal antennas on aircraft structures (Invited Paper)**, H. Schippers, J. Verpoorte, G. Vos, National Aerospace Lab. (Netherlands) ..... [4334-22]

11:40 am: **Small resonant fractal antennas (Invited Paper)**, K. J. Vinoy, K. A. Jose, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. .... [4334-23]

Noon: **Antenna model for conformal array performance prediction**, P. Knott, C. von Winterfeld, FGANFHR (Germany) ..... [4334-54]

Lunch/Exhibit  
Break ..... 12:20 to 1:30 pm

# Smart Structures and Materials

Conference 4326

Pacific Ballroom A Tues.–Thurs.

Conference 4327

Room: Schooner/Sloop

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Tuesday 6 March 2001

## SESSION 8 (cont.)

Room: Schooner/Sloop  
Tues. 11:40 am

11:40 am: **Damage detection of structures using piezoelectric actuator and sensor with modal and power spectral density analysis combined**, S. Liberatore, G. P. Carman, Univ. of California/Los Angeles ..... [4327-30]  
Lunch/Exhibit  
Break ..... Noon to 1:30 pm

## SESSION 7

Room: Pacific Ballroom A  
Tues. 1:30 pm

### Numerical Modeling I

Chair: Ulrich Gabbert, Univ. Magdeburg (Germany)

1:30 pm: **Applicability of equivalent circuit models to piezoelectric devices and comparison with finite element simulation** (*Invited Paper*), V. V. Varadan, R. Srinivasan, V. K. Varadan, The Pennsylvania State Univ. .... [4326-27]

2:10 pm: **Nonlinear finite element analysis of piezoceramic multilayer actuators**, R. Simkovic, H. Landes, M. Kaltenbacher, R. Lerch, Friedrich-Alexander Univ. Erlangen-Nuermberg (Germany) . [4326-28]

2:30 pm: **Displacement model for THUNDER actuators having general loads and boundary conditions**, R. Wieman, R. C. Smith, North Carolina State Univ.; Z. Ounaies, NASA Langley Research Ctr.; J. D. Bernd, Princeton Univ. .... [4326-29]

2:50 pm: **Finite element analysis of multimode passive piezoelectric damping tuned by using electrical impedance**, J. Kim, Inha Univ. (Korea); M. Kaltenbacher, R. Simkovic, R. Lerch, Friedrich-Alexander Univ. Erlangen-Nuermberg (Germany) . [4326-30]  
Coffee Break ... 3:10 to 3:40 pm

## SESSION 9

Room: Schooner/Sloop  
Tues. 1:30 pm

### Health Monitoring II

Chair: Darryll J. Pines, Univ. of Maryland/College Park

1:30 pm: **Damage assessment in smart composite structures: the DAMASCOS program**, S. Pierce, B. Culshaw, Univ. of Strathclyde (UK) ..... [4327-31]

1:50 pm: **Active sensor wave propagation health monitoring of beam and plate structures**, V. Giurgiutiu, J. Bao, W. Zhao, Univ. of South Carolina ..... [4327-32]

2:10 pm: **Development of structural health monitoring systems for composite bonded repairs on aircraft structures**, S. C. Galea, I. G. Powlesland, S. D. Moss, M. J. Konak, S. P. van der Velden, A. A. Baker, Defence Science and Technology Organisation (Australia); B. Stade, Aerostructures Technologies Pty., Ltd. (Australia) ..... [4327-33]

2:30 pm: **Structural health monitoring using wavelet transforms**, V. K. Amaravadi, V. S. Rao, L. R. Koval, Univ. of Missouri/Rolla ..... [4327-34]

2:50 pm: **Feasibility analysis of acoustic arrays for health monitoring of gear mesh dynamics**, A. A. Hood, D. J. Pines, Univ. of Maryland/College Park . [4327-35]  
Coffee Break ... 3:10 to 3:40 pm

## SESSION 7

Room: Pacific Ballroom E  
Tues. 11:20 am

### Sensing and Diagnostics in Composite Materials I

Chair: Mark S. Miller, BFGoodrich Aerospace

11:20 am: **Sensing capabilities of ionic polymer-metal composites**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico; S. F. Griffin, Air Force Research Lab.; D. J. Leo, Virginia Polytechnic Institute and State Univ. .... [4328-28]

11:40 am: **Integrated fiber optic sensing system for in-situ characterization of the curing process of thermoset-based composites**, A. Cusano, G. Breglio, Univ. degli Studi di Napoli Federico II (Italy); A. Cutolo, Univ. degli Studi del Sannio (Italy); M. Giordano, L. Nicolais II, Univ. degli Studi di Napoli Federico II (Italy); A. Calabro, Italian Aerospace Research Ctr. (Italy) ..... [4328-29]  
Lunch/Exhibit  
Break ..... Noon to 1:30 pm

## SESSION 8

Room: Pacific Ballroom E  
Tues. 1:30 pm

### Sensing and Diagnostics in Composite Materials II

Chair: Mark S. Miller, BFGoodrich Aerospace

1:30 pm: **Polyimide-coated small-diameter optical fiber sensors for embedding in composite laminate structures**, K. Satori, K. Fukuchi, Y. Kurosawa, A. Hongo, Hitachi Cable, Ltd. (Japan); N. Takeda, Univ. of Tokyo (Japan) ..... [4328-30]

1:50 pm: **Application of small-diameter FBG sensors for detection of damages in composites**, Y. Okabe, T. Mizutani, S. Yashiro, N. Takeda, Univ. of Tokyo (Japan) ..... [4328-31]

2:10 pm: **Wavelet crack detection algorithm for smart structures**, K. J. Jones, Rice Univ. . [4328-32]

2:30 pm: **Development of conductive FRP containing carbon phase for self-diagnosis structures**, Y. Okuhara, H. Matsubara, H. Yanagida, Japan Fine Ceramics Ctr. (Japan); N. Takeda, Univ. of Tokyo (Japan) ..... [4328-33]

2:50 pm: **In-situ health monitoring of CFRP composites using electrical characteristics**, J. B. Park, T. Okabe, D. Y. Song, N. Takeda, Univ. of Tokyo (Japan); A. Kitano, Toray Industries, Inc. (Japan) . [4328-34]  
Coffee Break ... 3:10 to 3:40 pm

## SESSION 5

Room: Pacific Ballroom C  
Tues. 1:30 pm

### Ionic EAP: IPMC and Others

Chairs: Geoffrey M. Spinks, Univ. of Wollongong (Australia); Mohsen Shahinpoor, Univ. of New Mexico and Environmental Robots, Inc.

1:30 pm: **Fundamentals of ionic metal composites (IPMCs)** (*Invited Paper*), S. Nemat-Nasser, Univ. of California/San Diego . . [4329-22]

2:10 pm: **Novel ionic polymeric hydraulic actuators**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico and Environmental Robots, Inc. .... [4329-23]

2:30 pm: **Novel physically loaded and interlocked electrode developed for ionic polymer-metal composites (IPMCs)**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico and Environmental Robots, Inc. .... [4329-24]

2:50 pm: **Experimental investigation of ICPF artificial polymer actuator behavior depending on varying actuating waveform**, H. Choi, S. Ryew, K. Jung, J. Nam, J. W. Jeon, H. Kim, Sung Kyun Kwan Univ. (Korea) ..... [4329-25]  
Coffee Break ... 3:10 to 3:40 pm

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# Smart Structures and Materials

## Conference 4330

Room: Catamaran

## Conference 4331

Room: Pacific Ballroom F

## Conference 4332

Room: Pacific Ballroom D

## Conference 4333

Room: Trimaran/Brigatine

## Conference 4334

Room: Newport Ballroom North

Tuesday 6 March 2001

### SESSION 6 (cont.)

Room: Catamaran  
Tues. 11:40 am

11:40 am: **Progress of application, research and development, and design guidelines for shape memory alloy devices for cultural heritage structures in Italy**, M. G. Castellano, FIP Industriale SpA (Italy); M. Indirli, A. Martelli, ENEA (Italy) [4330-29]

Noon: **Demo-application of shape memory alloy devices: the rehabilitation of the S. Giorgio Church bell-tower**, M. Indirli, ENEA (Italy); M. G. Castellano, FIP Industriale SpA (Italy); P. Clemente, A. Martelli, ENEA (Italy) [4330-30]

Lunch/Exhibit

Break . . . . . 12:20 to 1:30 pm

### SESSION 7

Room: Catamaran  
Tues. 1:30 pm

#### Modeling/Analysis of Smart Systems and Devices

*Chair: Norman M. Wereley, Univ. of Maryland/College Park*

1:30 pm: **Systems integration issues in active control of a phenomenological model**, J. M. Curtis, M. Kam, F. N. Catbas, M. Pervizpour, A. Aktan, Drexel Univ. . [4330-31]

1:50 pm: **Optimization methods in designing MR devices**, H. P. Gavin, M. E. Dobossy, P. P. Phule, Duke Univ. . . . . [4330-32]

2:10 pm: **Fuzzy control of a bridge using magnetorheological fluid dampers**, Y. Liu, F. Gordaninejad, C. A. Evrensel, G. Hitchcock, Univ. of Nevada/Reno . . . . . [4330-43]

2:30 pm: **Simplified 3D model for analysis of high-speed train-smart bridge interactions**, C. K. Choi, M. K. Song, Korea Advanced Institute of Science and Technology (Korea) . . . . . [4330-33]

2:50 pm: **Seismic response mitigation of adjacent high-rise structures via stochastic optimal coupling-control**, Z. G. Ying, Y. Q. Ni, J. M. Ko, G. Zheng, Hong Kong Polytechnic Univ. (China) [4330-34]

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

3:40 pm: **Stochastic system invariant spectrum analysis applied to smart systems in highway bridges**, S. Jin, R. A. Livingston, Federal Highway Administration; D. Marzougui, George Washington Univ. . . . . [4330-35]

### SESSION 7

Room: Pacific Ballroom F  
Tues. 1:30 pm

#### Passive PZT Treatments II

*Chair: Geoffrey R. Tomlinson, Univ. of Sheffield (UK)*

1:30 pm: **Effect of shunted piezoelectric materials on increasing sound transmission loss**, M. Ahmadian, Virginia Polytechnic Institute and State Univ.; K. M. Jeric, Corning Corp. . . . . [4331-28]

1:50 pm: **Application of shunting piezoceramics for damped and undamped structures**, M. Ahmadian, Virginia Polytechnic Institute and State Univ.; K. M. Jeric, Corning Corp.; D. J. Inman, Virginia Polytechnic Institute and State Univ. . . . . [4331-29]

### SESSION 8

Room: Pacific Ballroom F  
Tues. 2:10 pm

#### Modeling and Identification of Various Damping Systems II

*Chair: Amr M. Baz, Univ. of Maryland/College Park*

2:10 pm: **Modeling particle vibration damping with a discrete element method**, M. Y. Wang, T. Chen, K. Mao, Chinese Univ. of Hong Kong . . . . . [4331-30]

2:30 pm: **Friction in the presence of ultrasonic oscillations**, W. Littmann, H. Storck, J. Wallaschek, Univ. Paderborn (Germany) . . [4331-31]

2:50 pm: **Development and validation of anelastic displacement fields-based dynamic finite elements**, R. Rusovici, STI Technologies Inc.; D. J. Inman, G. R. Goodson, Virginia Polytechnic Institute and State Univ.; G. A. Lesieutre, The Pennsylvania State Univ. . . . . [4331-32]

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

### SESSION 6

Room: Pacific Ballroom D  
Tues. 1:30 pm

#### Enabling Actuator Technologies and Devices Interactive Session

*Each presentation in this session will provide a technology demonstration at the end of the day.*

*Chairs: Douglas K. Lindner, Virginia Polytechnic Institute and State Univ.; Eric H. Anderson, CSA Engineering, Inc.*

1:30 pm: **Mechanisms based on piezoactuators**, F. Claeysen, Cedrat Recherche, S.A. (France); P. Bouchilloux, Magsoft Corp. . . . . [4332-27]

1:50 pm: **Proof-of-concept of a novel cage SMA actuator**, C. W. Deyer, Continental Teves, Inc.; D. E. Brei, Univ. of Michigan [4332-28]

2:10 pm: **Piezo-hydraulic pump performance**, L. D. Mauck, C. S. Lynch, Georgia Institute of Technology . . . . . [4332-29]

2:30 pm: **Light-weight low-frequency woofer for active sound control in payload fairings**, R. D. Corsaro, Naval Research Lab. . . . . [4332-30]

2:50 pm: **Flex patch: a highly flexible piezoceramic composite with attached electrical leads**, G. C. Horner, J. Teter, E. Robbins, NASA Langley Research Ctr. . . [4332-31]

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

### SESSION 5

Room: Trimaran/Brigatine  
Tues. 1:30 pm

#### SMA and MSMA Materials

1:30 pm: **Ferromagnetic shape memory actuators at large and small scales** (*Invited Paper*), R. D. James, Univ. of Minnesota/Twin Cities . . . . . [4333-26]

2:10 pm: **Fabrication, modeling, and characterization of porous shape memory alloys**, D. C. Lagoudas, Texas A&M Univ.; Y. C. Chen, K. Ravi-Chandar, Univ. of Houston . . . . . [4333-27]

2:30 pm: **Modeling the performance of ferromagnetic shape memory actuators**, R. C. O'Handley, Massachusetts Institute of Technology; S. J. Murray, Mide Technology Corp.; M. Marioni, P. G. Tello, S. M. Allen, Massachusetts Institute of Technology . [4333-28]

2:50 pm: **Magneto-elastics of the double molybdates family (symmetry approach)**, N. Nesterenko, B. Verkin Institute of Low Temperature Physics and Engineering (Ukraine) . . [4333-29]

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

### SESSION 5

Room: Newport Ballroom North  
Tues. 1:30 pm

#### Wireless Telemetry

*Chairs: John H. Belk, Boeing Co.; Vijay K. Varadan, The Pennsylvania State Univ.*

1:30 pm: **Microsystems engineering** (*Invited Paper*), S. D. Collins, Univ. of California/Davis . . . . [4334-24]

2:00 pm: **Surface conforming MEMS: a new approach for vehicle dynamics monitoring** (*Invited Paper*), J. N. Schoess, Honeywell Technology Ctr. . . . . [4334-25]

2:30 pm: **Telemetered sensors for dynamic activity and structural performance monitoring**, C. P. Townsend, M. J. Hamel, S. W. Arms, MicroStrain, Inc. . . . . [4334-26]

2:50 pm: **Web-control wireless network sensors for structural health monitoring**, K. Mitchell, N. Dang, S. Sana, V. S. Rao, H. J. Pottinger, Univ. of Missouri/Rolla . . . . . [4334-27]

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

# Smart Structures and Materials

## Conference 4326

Pacific Ballroom A Tues.–Thurs.

## Conference 4327

Room: Schooner/Sloop

## Conference 4328

Room: Pacific Ballroom E

## Conference 4329

Room: Pacific Ballroom C

Tuesday 6 March 2001

### SESSION 8

Room: Pacific Ballroom A  
Tues. 3:40 pm

#### Control of Smart Structures II

Chair: **Narendra S. Khot**, Air Force Research Lab.

3:40 pm: **Lower-order robust controller design for smart structures**, S. Sana, V. S. Rao, Univ. of Missouri/Rolla . . . . . [4326-31]

4:00 pm: **Distributed four-layer PVDF actuator/sensor arrangement for the control of beam motion**, Y. S. Lee, S. J. Elliott, P. Gardonio, Univ. of Southampton (UK) . . . . . [4326-32]

4:20 pm: **Vibration isolation/suppression: research experience for undergraduates in mechatronics and smart structures**, J. Fonda, R. Clemon, S. Sana, Univ. of Missouri/Rolla . . . . . [4326-33]

4:40 pm: **Static aeroelastic control for pull-up maneuver of a flexible wing with internal actuation**, N. S. Khot, Air Force Research Lab.; K. Appa, Appa Technology Initiatives . . . . . [4326-34]

5:00 pm: **Vibration control of adaptive aircraft wings modeled as tapered thin-walled beams**, L. Librescu, Virginia Polytechnic Institute and State Univ.; S. Na, Korea Polytechnic Univ. (Korea) . . . . . [4326-35]

### SESSION 10

Room: Schooner/Sloop  
Tues. 3:40 pm

#### Health Monitoring III

Chair: **John W. Moore**, Boeing Co.

3:40 pm: **Integrated approach to robust active control and fault diagnosis of flexible structures**, N. Mechbal, M. Vergé, Ecole Nationale Supérieure d'Arts et Métiers de Paris (France) . . . . . [4327-36]

4:00 pm: **Impact damage detection of stiffened composite panel by using embedded small-diameter optical fibers**, H. Tsutsui, A. Kawamata, T. Sanda, Kawasaki Heavy Industries, Ltd. (Japan); N. Takeda, Univ. of Tokyo (Japan) . . . . . [4327-37]

4:20 pm: **Health monitoring of sandwich plates based on the analysis of the interaction of lamb waves with damages**, D. L. Osmont, D. Devillers, F. Taillade, ONERA (France) . . . . . [4327-38]

4:40 pm: **Monitoring surface damages with piezoelectric sensors and actuators**, A. L. Gama, Univ. Federal Fluminense (Brazil); A. M. Braga, S. R. K. Morikawa, Pontificia Univ. Católica do Rio de Janeiro (Brazil) . . . . . [4327-39]

5:00 pm: **Design of embedded transducers for structural health monitoring applications**, G. Hayward, B. Hailu, A. Gachagan, A. McNab, R. Farlow, Univ. of Strathclyde (UK) [4327-41]

### SESSION 9

Room: Pacific Ballroom E  
Tues. 3:40 pm

#### Measurement of Surfaces and Membranes

Chair: **Dryer R. Huston**, Univ. of Vermont

3:40 pm: **Characterization of piezoelectric membranes subjected to pressurization**, R. Kolar, C. Whittinghill, B. N. Agrawal, Naval Postgraduate School . . . . . [4328-35]

4:00 pm: **Sensitivity of atomic force microscope vibration modes to changes in surface stiffness**, J. Wiehn, J. A. Turner, Univ. of Nebraska/Lincoln . . . . . [4328-36]

### SESSION 10

Room: Pacific Ballroom E  
Tues. 4:20 pm

#### Chemical/Biological Sensing

Chair: **Carolyn M. Dry**, Univ. of Illinois/Urbana-Champaign

4:20 pm: **Smart interactive electronic system for monitoring the electromagnetic activities of biological systems**, M. Shahinpoor, S. G. Popa, Interactive Electronic Inc. . . . . [4328-37]

4:40 pm: **Thick film odor sensor with g-Fe<sub>2</sub>O<sub>3</sub> semiconductor oxide**, G. Telipan, Research and Development Institute for Electrical Engineering (Romania) . . . . . [4328-38]

5:00 pm: **Sensory mechanism and instrumentation for calixarene optical sensors**, S. Panigrahi, N. B. Das, Regional Engineering College Rourkela (India); A. K. Hassan, A. K. Ray, Sheffield Hallam Univ. (UK) . . . . . [4328-39]

Standby Oral/Posters

**FMCW reflectometric optical fiber strain sensor**, P. C. Won, L. K. Seah, A. K. Asundi, Nanyang Technological Univ. (Singapore) . . . . . [4328-40]

**Simultaneous determination of curvature, plane of curvature, and temperature using a miniaturized sensing head based on fiber Bragg gratings**, F. M. Araújo, L. Ferreira, INESC Porto and Univ. do Porto . . . . . [4328-51]

### SESSION 5 (cont.)

Room: Pacific Ballroom C  
Tues. 3:40 pm

3:40 pm: **Synthesis of nanoscale platinum particles: their role in performance improvement of artificial muscles and fuel cells**, K. J. Kim, M. Shahinpoor, Univ. of New Mexico and Environmental Robots, Inc. . . . . [4329-26]

4:00 pm: **Conducting polymer: carbon nanotube hybrid actuator materials**, G. M. Spinks, C. D. Carter, G. G. Wallace, Univ. of Wollongong (Australia); R. H. Baughman, Honeywell Technology Ctr. . . . . [4329-27]

4:20 pm: **Microfabricated electroactive carbon nanotube actuators**, A. Ahluwalia, Univ. degli Studi di Pisa (Italy); R. H. Baughman, Honeywell Technology Ctr.; D. De Rossi, A. Mazzoldi, G. Vozzi, Univ. degli Studi di Pisa (Italy) . . . . . [4329-28]

4:40 pm: **Electrically driven miniature hydrogel as muscle-like actuators**, Y. Yoshioka, P. D. Calvert, Univ. of Arizona . . . . . [4329-29]



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# Smart Structures and Materials

## Conference 4330

Room: Catamaran

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## Conference 4333

Room: Trimaran/Brigatine

## Conference 4334

Room: Newport Ballroom North

Tuesday 6 March 2001

### SESSION 8 (cont.)

Room: Pacific Ballroom F  
Tues. 2:10 pm

3:40 pm: **Damping in single crystals of Cu-Zn-Al SMA: predictable effects related to external amplitudes and temperature**, V. Torra, A. Isalgue, Univ. Politecnica de Catalunya (Spain); F. C. Lovey, M. Sade, Centro Atómico de Bariloche (Argentina) . . . . . [4331-34]

4:00 pm: **Viscoelastic properties of MR fluids under oscillatory shear**, W. Li, G. Chen, S. H. Ye, H. Du, Nanyang Technological Univ. (Singapore) . . . . . [4331-54]

### SESSION 7 (cont.)

Room: Catamaran  
Tues. 4:00 pm

4:00 pm: **Phenomenological modeling for intelligent systems research**, R. A. Barrish, Jr., K. Ciloglu, J. M. Curtis, M. Pervizpour, A. Aktan, Drexel Univ. . . [4330-36]

### SESSION 8

Room: Catamaran  
Tues. 4:20 pm

#### Active/Passive/Hybrid Systems for Vibration Control

Chair: **Henri P. Gavin**, Duke Univ.

4:20 pm: **Performance-based design of active/hybrid protective systems for vibration reduction of buildings**, J. N. Yang, S. Lin, F. Jabbari, Univ. of California/Irvine . . . . . [4330-37]

4:40 pm: **Analysis of structural systems augmented with passive dampers**, S. Park, W. P. Yen, H. Ghasemi, J. D. O'Fallon, Federal Highway Administration [4330-38]

5:00 pm: **Experimental study on semi-active control of bridges with use of magnetorheological damper**, A. Ruangrassamee, K. Kawashima, Tokyo Institute of Japan . . [4330-39]

5:20 pm: **Seismic response control of nonlinear base isolated structures using variable fluid dampers**, M. D. Symans, N. Wongprasert, Washington State Univ. . . . . [4330-40]

5:40 pm: **Smart variable stiffness control systems**, S. Nagarajaiah, V. Nadathur, Rice Univ. [4330-41]

### SESSION 6 (cont.)

Room: Pacific Ballroom D  
Tues. 3:40 pm

3:40 pm: **Applications of actuators based on field-activated electroactive elastomers: power conversion as a systems issue**, J. Eckerle, J. Marlow, S. Stanford, S. Shastri, SRI International [4332-32]

4:00 pm: **Comparison of drive amplifier for piezoelectric actuators**, D. K. Lindner, D. J. Leo, Virginia Polytechnic Institute and State Univ. . . . . [4332-33]

### SESSION 7

Room: Pacific Ballroom D  
Tues. 4:20 pm

#### Magnetorheological Devices Interactive Session

*Each presentation in this session will provide a technology demonstration at the end of the day.*

Chair: **Eric H. Anderson**, CSA Engineering, Inc.

4:20 pm: **Device performance of a commercially practical magnetorheological fluid damper design**, S. P. Kelso, CSA Engineering, Inc. . . . . [4332-34]

4:40 pm: **Pneumatic motion control using magnetorheological fluid technology**, M. R. Jolly, Lord Corp. . . . . [4332-35]

5:00 pm: **Smart prosthetics based on magnetorheological fluids**, J. Carlson, Lord Corp.; W. Matthis, Biederman Motech GmbH (Germany); J. R. Toscano, Lord Corp. . . . . [4332-36]

### SESSION 6

Room: Trimaran/Brigatine  
Tues. 3:40 pm

#### Rare Earth Magnetostrictive Materials

3:40 pm: **Magnetostrictive and piezomagnetic properties of Tb(1-x)Dy(x)Zn at low temperatures**, M. Wun-Fogle, J. B. Restorff, Naval Surface Warfare Ctr.; A. E. Clark, Clark Associates, Inc.; J. R. Cullen, Univ. of Maryland/College Park; T. A. Lograsso, Iowa State Univ. . . . . [4333-30]

4:00 pm: **Magneto-thermo-mechanical characterization of magnetostrictive composites**, N. Nersessian, G. P. Carman, Univ. of California/Los Angeles [4333-31]

4:20 pm: **Strain response characterization of Terfenol-D composite materials for high-frequency applications**, G. P. McKnight, G. P. Carman, Univ. of California/Los Angeles . . [4333-32]

4:40 pm: **Cyclic strain damage in magnetostrictive polymer composite transducer materials**, W. D. Armstrong, SUNY/Binghamton . . . . . [4333-33]

5:00 pm: **Magnetic and magnetomechanical properties of Ni-Mn-Ga alloys with easy axis and easy plane of magnetization**, A. Sozinov, A. A. Likhachev, K. Ullakko, Helsinki Univ. of Technology (Finland) . . [4333-34]

5:20 pm: **Effect of constant stress and magnetic field on the magnetomechanical properties of NiMnGa shape memory alloy**, A. A. Likhachev, A. Sozinov, K. Ullakko, Helsinki Univ. of Technology (Finland) . . . . . [4333-35]

5:40 pm: **RF magnetron sputtered crystalline TiNiCu shape memory alloy thin film**, Y. Fu, H. Du, Nanyang Technological Univ. (Singapore) . . . . . [4333-36]

### SESSION 5 (cont.)

Room: Newport Ballroom North  
Tues. 3:40 pm

3:40 pm: **MEMS high-speed angular-position sensing system with rf wireless transmission**, W. Sun, W. J. Li, Chinese Univ. of Hong Kong . . . . . [4334-28]

4:00 pm: **Design simulation and testing of wireless temperature sensor**, W. Suh, K. A. Jose, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. [4334-29]

### SESSION 6

Room: Newport Ballroom North  
Tues. 4:20 pm

#### Fabrication and Characterization

Chairs: **Norio Shinya**, National Research Institute for Metals (Japan); **Jeong-Bong Lee**, Louisiana State Univ.

4:20 pm: **Fabrication of microstructures and microdevices by the particle assemblage**, M. Kobayashi, T. Konno, T. Dan, H. Fudouzi, N. Shinya, National Research Institute for Metals (Japan) . . . . . [4334-30]

4:40 pm: **Method for suppressing the residual mechanical stress in thin films for MEMS applications**, B. Ghodsian, Titan Corp.; V. Milanovic, Univ. of California/Berkeley . . . . . [4334-31]

5:00 pm: **Massive replication of polymeric high-aspect ratio microstructures using PDMS casting**, K. Kim, S. Park, J. B. Lee, Louisiana State Univ. . . [4334-32]

5:20 pm: **Microstereo lithography for 3D MEMS devices**, V. K. Varadan, X. N. Jiang, V. V. Varadan, The Pennsylvania State Univ. . . . . [4334-33]

# Smart Structures and Materials

Conference 4326

Pacific Ballroom A Tues.–Thurs.

Conference 4328

Room: Pacific Ballroom E

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Tuesday 6 March 2001

## ✓ Posters—Tuesday

*The following posters will be displayed in the formal poster session on Tuesday evening between 6:00 and 7:30 pm. Authors will be present at this time for discussion. Poster authors will be able to set up their poster papers between 9 am and 3:00 pm Tuesday. Poster papers can be previewed after 3 pm before the formal poster session begins at 6 pm.*

- ✓ **One-dimensional modeling of shape memory alloy with improved kinematic relation for phase transitions**, X. Wu, J. Wu, G. Sun, C. Xie, Shanghai Jiao Tong Univ. (China) . . . . . [4326-50]
- ✓ **Effects of thermo-viscoelastic properties of polymer on the actuation of shape memory alloy**, S. Sun, G. Sun, C. Xie, J. Wu, Shanghai Jiao Tong Univ. (China) . . . . . [4328-51]
- ✓ **Electrosensitive fluids as a basis of acoustic devices of a new type**, A. Korobko, Belarusian State Univ. (Belarus); Y. Korobko, Intel Corp. [4328-26]
- ✓ **FMCW reflectometric optical fiber strain sensor**, P. C. Won, L. K. Seah, A. K. Asundi, Nanyang Technological Univ. (Singapore) . . . . . [4328-40]
- ✓ **Temperature, displacement, and acceleration fiber optics sensor for large machinery monitoring**, J. López-Higuera, A. Cobo, J. Echevarria, O. M. Conde, F. J. Madruga Saavedra, Univ. de Cantabria (Spain) . . . . . [4328-41]
- ✓ **High-temperature optical fiber transducer for a smart structure on iron-steel production industry**, J. López-Higuera, F. J. Madruga Saavedra, D. A. Gonzalez Fernandez, V. Alvarez Ortego, Univ. de Cantabria (Spain); J. Hierro, Global Steel Wire (Spain) . . . . . [4328-42]
- ✓ **Acoustic emission detection using fiber Bragg gratings**, I. M. Perez, Naval Air Warfare Ctr.; H. Cui, Stevens Institute of Technology; E. Udd, Blue Road Research . . . . . [4328-45]
- ✓ **Monitoring of beam deflection subjected to bending load using Brillouin distributed optical fiber sensors**, J. Lee, S. Kim, D. Seo, Korea Advanced Institute of Science and Technology (Korea) . [4328-46]
- ✓ **In-plane strain monitoring of film adhesive and composite plates using a Brillouin-scattering-based distributed optical fiber sensor**, C. Huang, Univ. of Ottawa (Canada); A. Arcand, Univ. of New Brunswick (Canada); X. Zeng, Univ. of Ottawa (China); P. Sullivan, Univ. of New Brunswick (Canada); X. Bao, Univ. of Ottawa (Canada) . . . . . [4328-47]
- ✓ **Measurement of compressive and tension strains with the distributed sensor system based on Brillouin scattering**, M. D. DeMerchant, Univ. of New Brunswick (Canada); X. Bao, Univ. of Ottawa (Canada) . . . . . [4328-48]
- ✓ **Static strain measurement with submicro strain resolution and large dynamic range using twin grating Febry-Perot sensor**, M. G. Shlyagin, Centro de Investigacion Científica y de Educacion Superior de Ensenada; P. L. Swart, Rand Afrikaans Univ. (South Africa); S. V. Miridonov, Centro de Investigacion Científica y de Educacion Superior de Ensenada; A. A. Chitchebakov, Rand Afrikaans Univ. (South Africa); I. Marquez Borbon, V. V. Spirin, Centro de Investigacion Científica y de Educacion Superior de Ensenada . . . . . [4328-49]
- ✓ **Coherent optical frequency domain reflectometry for interrogation of microbend and macrobend based fiber optic hydrocarbon sensors**, R. M. Lopez, V. V. Spirin, M. G. Shlyagin, S. V. Miridonov, I. Marquez Borbon, Centro de Investigacion Científica y de Educacion Superior de Ensenada . . . . . [4328-50]
- Conference 4328 ends ■
- ✓ **Concentrated polyaniline solutions**, G. Zuccarello, D. Yang, Santa Fe Science and Technology, Inc. . . . . [4329-61]
- ✓ **Molecular weight dependence of the physical properties of protonated polyaniline films and fibers**, P. N. Adams, D. Yang, B. R. Mattes, Santa Fe Science and Technology, Inc. . . . . [4329-62]
- ✓ **Electrostrictive polyurethane actuator**, S. S. Bae, Nanopolymer Inc. (Korea); J. D. Nam, Sung Kyun Kwan Univ. (Korea); Y. Tak, Inha Univ. (Korea); J. W. Jeon, H. Kim, H. Choi, Sung Kyun Kwan Univ. (Korea) . . . . . [4329-64]
- ✓ **Actuator model of electrostrictive polymers (EPs) for microactuators**, H. Kim, S. Oh, K. Hwang, H. R. Choi, J. W. Jeon, J. D. Nam, Sung Kyun Kwan Univ. (Korea) . . . . . [4329-65]
- ✓ **Field actuated behavior of polymers as dielectric material**, H. Kim, J. D. Nam, J. W. Jeon, H. R. Choi, H. K. Kim, Sung Kyun Kwan Univ. (Korea); K. H. Ahn, Seoul National Univ. (Korea) . . . . . [4329-66]
- ✓ **Mechanical performance improvement of electro-active papers**, J. H. Kim, E. M. Jung, J. S. Kim, Inha Univ. (Korea); Y. B. Seo, Chungnam National Univ. (Korea) . . . . . [4329-67]
- ✓ **Electrochemical actuation of gilded polyaniline bilayers in aqueous acid solutions**, W. Lu, E. Smela, B. R. Mattes, Santa Fe Science and Technology, Inc. . . . . [4329-68]
- ✓ **Piezo-sensitivity in conducting carbon fiber/polyaniline filled PVDF composites**, S. Radhakrishnan, R. Rajexh, National Chemical Lab. (India) . . . . . [4329-69]
- ✓ **Versatile actuators with linear/bending movements in air using a series of polypyrrole and solid polymer electrolyte trilayers**, V. Olazábal, J. M. Sansiñena, Y. Bar-Cohen, Jet Propulsion Lab. . . . . [4329-71]
- ✓ **Electrostriction of composites of polyurethane (PU) with ferroelectric lead zirconate titanate (PZT) ceramic particles**, C. Y. Liu, Y. W. Wong, L. S. Tai, F. G. Shin, Hong Kong Polytechnic Univ. (Hong Kong) . . . . . [4329-72]

## Authors

You must remove your poster at the conclusion of the poster reception for that day. It is the author's responsibility to remove their posters. Posters not removed will be considered unwanted and will be discarded. SPIE assumes no responsibility for posters left up after the end of the poster reception.

# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

**Tuesday 6 March 2001**

## ✓ Posters—Tuesday

*The following posters will be displayed in the formal poster session on Tuesday evening between 6:00 and 7:30 pm. Authors will be present at this time for discussion. Poster authors will be able to set up their poster papers between 9 am and 3:00 pm Tuesday. Poster papers can be previewed after 3 pm before the formal poster session begins at 6 pm.*

✓ **Effect of dowel bar looseness on load transfer efficiency measured using FWD**, S. N. Shoukry, G. W. William, West Virginia Univ. . . . . [4330-60]

✓ **Multimode-based evaluation of cable tension force in cable-supported bridges**, G. Zheng, Y. Q. Ni, J. M. Ko, Hong Kong Polytechnic Univ. (Hong Kong) . . . . . [4330-62]

✓ **Electrorheological vibration system**, E. V. Korobko, Z. P. Shulman, Luikov A.V. Heat and Mass Transfer Institute (Belarus) . . . . . [4331-39]

✓ **Applied study of smart grating-type sensor on building structures**, W. Zhang, D. Feng, Q. Zhao, Z. Liu, X. Dong, Nankai Univ. (China) [4334-51]

✓ **Development of a semi-active vibration control system for aircraft avionics**, S. J. Dyke, S. M. Hyun, Washington Univ. . . . . [4334-52]



# Smart Structures and Materials

Conference 4326

Pacific Ballroom A Tues.–Thurs.

Conference 4327

Room: Schooner/Sloop

Conference 4328

Room: Pacific Ballroom E

Conference 4329

Room: Pacific Ballroom C

Wednesday 7 March 2001

Plenary Presentation ..... 8:00 to 8:45 am

## The Role of Smart Structures in Managing an Aging Highway Infrastructure

Speaker: Steven B. Chase, Federal Highway Administration

Coffee Break ..... 8:45 to 9:20 am

## Conference 4329

Room: Pacific Ballroom C

### Panel Discussion Wed. 11:00 to Noon

Panel Moderator: Yoseph Bar-Cohen, Jet Propulsion Lab.

Panelists: **Danilo De Rossi**, Univ. degli Studi di Pisa (Italy); **Siavouche Nemat-Nasser**, Univ. of California/San Diego; **Ron Pelrine**, SRI International; **Yoshihito Osada**, Hokkaido Univ. (Japan); **Elisabeth Smela**, Univ. of Maryland/College Park; **Satoshi Tadokoro**, Kobe Univ. (Japan); **Gordon G. Wallace**, Univ. of Wollongong (Australia); **Steven G. Wax**, DARPA; **Qiming Zhang**, The Pennsylvania State Univ.

**Topics include:** Categories of EAP—have we converged to electronic and ionic or there are other that are not included?; Challenges to the enhancement of EAP actuation force capability; Characteristic parameters and methodologies for property measurements; Areas of EAP weakness/shortcoming of the EAP technology infrastructure; What is the gap between the needed and available EAP and how to bridge it?; Potential applications of EAP as actuators and artificial muscles; Future science and engineering directions.

## Proceedings of SPIE

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### SESSION 9

Room: Pacific Ballroom A  
Wed. 9:20 am

#### Smart Composite Laminates

Chair: **Dimitris C. Lagoudas**, Texas A&M Univ.

9:20 am: **Structural coupling behaviors of anti-symmetric piezoelectric composite laminate**, R. S. Lee, H. L. Wong, Hong Kong Univ. of Science & Technology (Hong Kong) ..... [4326-36]

9:40 am: **Evaluation of segmented active constrained layer damping treatment that includes bonding layer strain energy**, P. F. Cento, G. Kawiecki, Univ. of Tennessee/Knoxville ..... [4326-37]

10:00 am: **Analytical analysis of laminated plates with oblique piezoelectric patches**, O. J. Aldraihem, King Saud Univ. (Saudi Arabia) ..... [4326-38]

10:20 am: **Interlaminar stress analysis of shell structures with piezoelectric patch including thermal loading**, X. Zhou, A. Chattopadhyay, Arizona State Univ. .... [4326-39]

10:40 am: **Finite element modeling of MFC/AFC actuators**, M. S. Azzouz, J. Bevan, J. J. Ro, C. Mei, Old Dominion Univ. ... [4326-40]

### SESSION 10

Room: Pacific Ballroom A  
Wed. 11:00 am

#### Control Applications

Chair: **Liviu Librescu**, Virginia Polytechnic Institute and State Univ.

11:00 am: **Noncontact start/stop motion control of HDD suspension using shape memory alloy actuators**, S. B. Choi, S. C. Lim, J. S. Park, Inha Univ. (Korea); Y. P. Park, Yonsei Univ. (Korea) ... [4326-41]

### SESSION 11

Room: Schooner/Sloop  
Wed. 9:20 am

#### Piezoactuators I

Chair: **Seung-Bok Choi**, Inha Univ. (Korea)

9:20 am: **Pressure control of a piezoactuator-driven valve system**, S. B. Choi, M. S. Cho, J. K. Yoo, K. G. Sung, C. C. Cheong, Inha Univ. (Korea) ..... [4327-42]

9:40 am: **Survey of piezoelectric material strain response to electron gun excitation**, P. C. Hadinata, J. A. Main, Univ. of Kentucky [4327-43]

10:00 am: **Experimental characterization of the quasi-static performance of piezoceramic telescopic actuators**, P. W. Alexander, D. E. Brei, Univ. of Michigan ..... [4327-44]

10:20 am: **Modeling and testing of a piezohydraulic actuation system**, K. Nasser, N. Vujic, D. J. Leo, H. H. Cudney, Virginia Polytechnic Institute and State Univ. [4327-45]

10:40 am: **Fabrication and testing of a piezoelectrically driven microvalve for high-pressure high-frequency applications**, D. C. Roberts, N. W. Hagood, H. Li, L. Steyn, K. Turner, Massachusetts Institute of Technology; R. Mlcak, Boston Microsystems, Inc.; S. Spearing, M. A. Schmidt, Massachusetts Institute of Technology ..... [4327-46]

### SESSION 12

Room: Schooner/Sloop  
Wed. 11:00 am

#### Piezoactuators II

Chair: **George A. Lesieutre**, The Pennsylvania State Univ.

11:00 am: **Experimental verification of flexensional transducers designed by using topology optimization method**, G. Nader, E. C. Nelli Silva, J. C. Adamowski, Univ. de Sao Paulo (Brazil) ..... [4327-47]

### SESSION 6

Room: Pacific Ballroom C  
Wed. 9:20 am

#### General EAP Materials

Chairs: **Miklos Zrinyi**, Budapest Univ. of Technology and Economics (Hungary); **Benjamin R. Mattes**, Santa Fe Science and Technology, Inc.

9:20 am: **Development of three-dimensional polymeric artificial muscles**, K. J. Kim, M. Shahinpoor, Univ. of New Mexico and Environmental Robots, Inc. .... [4329-30]

9:40 am: **Liquid crystalline elastomers as artificial muscles: role of side chain-backbone coupling**, B. R. Ratna, D. L. Thomsen III, Naval Research Lab.; P. Keller, CNRS (France); J. W. Naciri, Naval Research Lab. .... [4329-31]

10:00 am: **Electro-active nonionic poly(vinyl alcohol) gel actuator**, S. Popovic, C. Xu, Univ. of Washington; H. Tamagawa, Gifu Univ. (Japan); M. Taya, Univ. of Washington ..... [4329-32]

10:20 am: **Electric field sensitive neutral polymer gels**, M. Zrinyi, J. Feher, G. Filipcsei, Budapest Univ. of Technology and Economics (Hungary) ..... [4329-33]

10:40 am: **Photo-active polyacrylamide gel actuator**, H. Tamagawa, Gifu Univ. (Japan); C. Xu, S. Popovic, M. Taya, Univ. of Washington ..... [4329-34]

### Panel Discussion Wed. 11:00 to Noon

Panel Moderator: Yoseph Bar-Cohen, Jet Propulsion Lab.

See copy far left.

Lunch/Exhibit  
Break ..... Noon to 1:30 pm

# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

Wednesday 7 March 2001

Plenary Presentation ..... 8:00 to 8:45 am

## The Role of Smart Structures in Managing an Aging Highway Infrastructure

Speaker: Steven B. Chase, Federal Highway Administration

Coffee Break ..... 8:45 to 9:20 am

### SESSION 9

Room: Catamaran  
Wed. 9:20 am

#### Control of Cable/Bridge Vibrations

Chair: Faramarz Gordaninejad, Univ. of Nevada/Reno

9:20 am: **Modal damping and stepping-switch control of stay cables with magnetorheological fluid dampers**, W. J. Lou, Zhejiang Univ. (China); Y. Q. Ni, J. M. Ko, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4330-44]

9:40 am: **Cable oscillation and its control for cable-stayed bridge**, B. N. Sun, Z. G. Wang, Zhejiang Univ. (China) ..... [4330-45]

10:00 am: **Semi-active vibration control of stay cables using neural networks**, Y. Chen, J. M. Ko, Y. Q. Ni, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4330-46]

10:20 am: **Feasibility of active control of cable-stayed bridges: an insight into Ting Kau Bridge**, Y. Ni, B. F. Spencer, Jr., Univ. of Notre Dame; J. Ko, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4330-47]

10:40 am: **Standalone controller for a bridge semi-active damper**, L. Faravelli, F. Casciati, Univ. di Pavia (Italy) ..... [4330-48]

### SESSION 10

Room: Catamaran  
Wed. 11:00 am

#### Modeling/Characterization of SMA and Devices

Chair: Alison B. Flatau, National Science Foundation

11:00 am: **Experimental characterization of piezoelectric friction dampers**, G. Chen, Univ. of Missouri/Rolla ..... [4330-50]

### SESSION 10

Room: Pacific Ballroom F  
Wed. 9:20 am

#### Passive-Active Damping Treatments III

Chair: Kon-Well Wang, The Pennsylvania State Univ.

9:20 am: **Hybrid vibration control of laminated composite structures using magnetostrictive and hard damping materials**, V. R. Buravalla, Univ. of Sheffield (UK); B. Bhattacharya, Indian Institute of Technology (India); G. R. Tomlinson, Univ. of Sheffield (UK) ..... [4331-41]

9:40 am: **Active damping of inflatable tubes**, G. S. Agnes, Air Force Institute of Technology ..... [4331-42]

10:00 am: **Hybrid control systems for a 5-story benchmark model**, Y. M. Wu, B. Samali, Univ. of Technology/Sydney (Australia) ..... [4331-43]

10:20 am: **Variable hybrid piezoelectric damping based on control power requirement**, K. Adachi, Y. Awakura, T. Iwatsubo, Kobe Univ. (Japan) ..... [4331-44]

### SESSION 11

Room: Pacific Ballroom F  
Wed. 10:40 am

#### Passive-Active Damping Treatments IV

Chair: Wolfgang G. Lubber, Daimler-Benz Aerospace (Germany)

10:40 am: **Energy recovering PZT-panel for noise reduction; numerical analysis for fully coupled fluid-PZTstructure-electric interaction: experimental verification**, P. Mandurino, B. B. Giuseppe, ABB Ricerca SpA (Italy); R. Garbin, Univ. degli Studi di Genova (Italy) ..... [4331-45]

11:00 am: **Multimode passive piezoelectric damping tuned by using measured electrical impedance**, J. Kim, J. Y. Choi, S. B. Choi, Inha Univ. (Korea) [4331-46]

### SESSION 8

Room: Pacific Ballroom D  
Wed. 9:20 am

#### Adaptive Flow Control Applications

Chairs: Richard W. Wlezien, DARPA; Edward V. White, Boeing Co.

9:20 am: **Micro adaptive flow control (Invited Paper)**, R. W. Wlezien, DARPA ..... [4332-37]

10:00 am: **Boeing active flow control system (BAFCS)- II**, A. Jacot, F. T. Calkins, J. H. Mabe, Boeing Phantom Works ..... [4332-38]

10:20 am: **NASA micro-aero-adaptive control (Invited Paper)**, A. E. Washburn, NASA Langley Research Ctr. .... [4332-39]

#### Panel Discussion

10:40 am

#### Future Direction in Smart Structures Flow Control Applications

Moderator:

Anna-Maria R. McGowan, NASA Langley Research Ctr.

### SESSION 7

Room: Trimaran/Brigatine  
Wed. 9:20 am

#### Fatigue and Fracture of Ferroelectrics

9:20 am: **Characterization of domain switching in piezoelectric ceramics using x-ray diffraction (Invited Paper)**, M. J. Hoffmann, A. Glazounov, Univ. Karlsruhe Technische Hochschule (Germany) ..... [4333-37]

10:00 am: **Combined effect of uniaxial stress and elevated temperature on the dielectric and piezoelectric response of PZT-5H ceramic**, P. M. Chaplya, G. P. Carman, Univ. of California/Los Angeles ..... [4333-38]

10:20 am: **Crack resistance and fracture toughness of PZT ceramics**, T. Fett, M. Kamlah, D. Munz, G. Thun, Forschungszentrum Karlsruhe (Germany) .. [4333-39]

10:40 am: **Deflection of electrically driven cracks in PZT: experiments**, S. L. dos Santos e Lucato, D. C. Lupascu, Technische Univ. Darmstadt (Germany); H. Bahr, H. Balke, Technische Univ. Dresden (Germany); J. Rödel, Technische Univ. Darmstadt (Germany) ..... [4333-40]

11:00 am: **Deflection of electrically driven cracks in PZT: fracture mechanics modeling**, H. Balke, H. Bahr, V. B. Pham, U. Bahr, Technische Univ. Dresden (Germany); S. L. dos Santos e Lucato, J. Rödel, Technische Univ. Darmstadt (Germany) .. [4333-41]

### SESSION 7

Room: Newport Ballroom North  
Wed. 9:20 am

#### Smart Devices and Systems I

Chairs: Dan J. Clingman, Boeing Phantom Works; S. M. Chang, National Taiwan Univ. (Taiwan)

9:20 am: **Mechatronics: the future of mechanical engineering; past, present, and a vision for the future (Invited Paper)**, M. K. Ramasubramanian, North Carolina State Univ. .... [4334-34]

9:50 am: **High-aspect ratio integrated force arrays (Invited Paper)**, S. M. Bobbio, Univ. of North Carolina/Charlotte; S. W. Smith, Duke Univ.; S. H. Goodwin-Johansson, MCNC; J. Zara, Duke Univ.; J. A. Hudak, M. Kerns, Univ. of North Carolina/Charlotte ..... [4334-35]

10:20 am: **MEMS pressure belt with sensor interface and communication architecture**, L. H. Eccles, M. J. Holland, L. Malchodi, N. P. Kim, Boeing Co. . . [4334-36]

10:40 am: **Development of active PBG structures for realizing novel MOEMS based on transparent metals**, S. Baglio, Univ. degli Studi di Catania (Italy); M. J. Bloemer, M. Scalora, U.S. Army Aviation and Missile Command; N. Savalli, Univ. degli Studi di Catania (Italy) ..... [4334-38]

11:00 am: **Comparative study of 2-DOF micromirrors for precision light manipulation**, J. Young, A. M. Shkel, Univ. of California/Irvine ..... [4334-39]

# Smart Structures and Materials

## Conference 4326

Pacific Ballroom A Tues.–Thurs.

## Conference 4327

Room: Schooner/Sloop

## Conference 4328

Room: Pacific Ballroom E

## Conference 4329

Room: Pacific Ballroom C

Wednesday 7 March 2001

### SESSION 10 (cont.)

Room: Pacific Ballroom A  
Wed. 11:20 am

11:20 am: **Use of linear and nonlinear vibration absorbers for buffet alleviation of twin-tailed fighter aircraft**, A. A. El-Badawy, A. O. Smith Electric Products Co.; A. H. Nayfeh, Virginia Polytechnic Institute and State Univ. [4326-42]

11:40 am: **Dynamic shape control of flexural beam vibrations: an experimental setup**, U. Pichler, I. H. Irschik, M. Krommer, Johannes Kepler Univ. Linz (Austria) [4326-43]

Noon: **Model reduction and robust control of smart structures with parameter uncertainty**, P. Liu, V. S. Rao, Univ. of Missouri/Rolla [4326-44]

Lunch/Exhibit  
Break . . . . . 12:20 to 1:30 pm

### SESSION 12 (cont.)

Room: Schooner/Sloop  
Wed. 11:20 am

11:20 am: **Single crystal disk drive miniature actuators**, M. Giovanardi, K. McKenney, D. J. Warkentin, S. Yoshikawa, Active Control eXperts, Inc. . . . . [4327-48]

11:40 am: **Development of a compact hybrid actuator**, J. Sirohi, I. Chopra, Univ. of Maryland/College Park . . . . . [4327-49]

Noon: **Electrical-mechanical coupling effects on the dynamic response of smart composite structures**, R. P. Thornburgh, A. Chattopadhyay, Arizona State Univ. . . . . [4327-50]

Lunch/Exhibit  
Break . . . . . 12:20 to 1:30 pm

### Panel Discussion

Wed. 1:30 to 3:10 pm

#### Signal Processing for Smart Structures

*Panel Moderator:* **Vittal S. Rao**, Univ. of Missouri/Rolla;  
*Panelists:* **Christian Boller**, DaimlerChrysler Aerospace (Germany); **Fu-Kuo Chang**, Stanford Univ.; **Wieslaw J. Staszewski**, Univ. of Sheffield (UK); **Edward V. White**, Boeing Co.

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

### SESSION 13

Room: Schooner/Sloop  
Wed. 1:30 pm

#### Space Applications

*Chair:* **Dale Ruebsamen**, Honeywell, Inc.

1:30 pm: **Piezoelectrically actuated miniature peristaltic pump**, Y. Bar-Cohen, Z. Chang, Jet Propulsion Lab. . . . . [4327-52]

1:50 pm: **Performance of a launch and on-orbit isolator**, J. Boyd, D. Osterberg, T. T. Hyde, T. Davis, Honeywell Space Systems [4327-53]

2:10 pm: **Novel shape memory alloy motor for space missions**, W. M. Huang, X. Y. Gao, J. J. Zhu, Nanyang Technological Univ. (Singapore) . . . . . [4327-54]

2:30 pm: **Ultrasonic/sonic drilling/coring (USDC) for planetary applications**, Y. Bar-Cohen, S. Sherrit, B. P. Dolgin, X. Bao, Z. Chang, Jet Propulsion Lab.; D. S. Pal, T. Peterson, Cybersonics, Inc. . . . . [4327-55]

Coffee Break . . . 2:50 to 3:20 pm

### SESSION 8

Room: Pacific Ballroom C  
Wed. 1:30 pm

#### Modeling EAP

*Chairs:* **Siavouche Nemat-Nasser**, Univ. of California/San Diego; **S. C. Sanday**, Naval Research Lab.

1:30 pm: **Coupled multi-field-formulation for ionic polymer gels in electric fields**, T. Wallmersperger, B. Kröplin, Univ. Stuttgart (Germany); R. W. Gölch, J. Holdenried, Eberhard-Karls-Univ. Tübingen (Germany) . . [4329-36]

1:50 pm: **Theoretical models and electrochemical behavior of polyconjugated materials for EAPAD**, T. F. Otero, Univ. del País Vasco and Univ. Politécnic e Cartagena (Spain); I. Boyano, Univ. del País Vasco (Spain) . . [4329-37]

2:10 pm: **Modeling of hydrogel swelling in buffered solutions**, R. R. Ohs, N. R. Aluru, Univ. of Illinois/Urbana-Champaign . . . [4329-38]

2:30 pm: **Modeling and optimization of electromechanical properties of EAP materials**, K. Bhattacharya, X. Yu, California Institute of Technology . . [4329-39]

2:50 pm: **Feedback control of the bending response of ionic polymer-metal composite actuators**, K. M. Newbury, D. J. Leo, Virginia Polytechnic Institute and State Univ. . . . . [4329-40]

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

# Smart Structures and Materials

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## SESSION 10 (cont.)

Room: Catamaran  
Wed. 11:20 am

11:20 am: **Self-actuating SMA-HPFRCC fuses for smart structures**, N. Krstulovic-Opara, P. Wriggers, North Carolina State Univ. .... [4330-63]

Lunch/Exhibit

Break ..... 11:40 am to 1:30 pm

## SESSION 11 (cont.)

Room: Pacific Ballroom F  
Wed. 11:20 am

11:20 am: **Piezoelectric actuation of helicopter rotor blades**, N. A. J. Lieven, Univ. of Bristol (UK) ..... [4331-47]

11:40 am: **Control of wave propagation in sandwich beams with auxetic core**, M. Ruzzene, Catholic Univ. of America; F. Scarpa, Univ. of Sheffield (UK) ..... [4331-48]

Lunch/Exhibit

Break ..... Noon to 1:30 pm

## SESSION 9

Room: Pacific Ballroom D  
Wed. 11:20 am

### Applications of MEMS

*Chairs:* Richard A. Singer, Institute for Defense Analyses; Peter C. Chen, Systems Planning and Analysis, Inc.

11:20 am: **Integrated microsystems: opportunities and challenges of the next silicon revolution**, P. J. McWhorter, Sandia National Labs. .... [4332-40]

11:40 am: **Wireless embedded microsensors**, R. Pollack, Phase IV Engineering, Inc. .... [4332-41]

Lunch/Exhibit

Break ..... Noon to 1:30 pm

## SESSION 7 (cont.)

Room: Trimaran/Brigatine  
Wed. 11:20 am

11:20 am: **Fracture properties of AlInBV semiconductor compounds as active materials for MEMS**, Y. M. Litvinov, YSC ELMA (Russia) ..... [4333-42]

11:40 am: **Closed cracks in piezoelectric media subjected to electric field**, X. Zeng, R. K. Rajapakse, Univ. of British Columbia (Canada) ... [4333-43]

Lunch/Exhibit

Break ..... Noon to 1:30 pm

## SESSION 7 (cont.)

Room: Newport Ballroom North  
Wed. 11:20 am

11:20 am: **Capacitive micro-pressure sensors with underneath readout circuit using a standard CMOS process**, S. Chang, P. Chang, J. Chiou, National Taiwan Univ. (Taiwan) ..... [4334-40]

1:40 pm: **High-power piezo-drive amplifier for large stack and PFC applications**, D. J. Clingman, M. Gamble, Boeing Phantom Works ..... [4334-41]

Lunch/Exhibit

Break ..... Noon to 1:30 pm

## SESSION 11

Room: Catamaran  
Wed. 1:30 pm

### Building Control

*Chair:* Makola M. Abdullah, Florida A&M Univ. and Florida State Univ.

1:30 pm: **Development and application of induced strain for building structures**, K. Morita, Building Research Institute (Japan); T. Fujita, Univ. of Tokyo (Japan); S. Ise, Kyoto Univ. (Japan); K. Kawagauchi, Univ. of Tokyo (Japan); H. Fujitani, Building Research Institute (Japan) ..... [4330-51]

1:50 pm: **Method for measuring the effective mass of a building using an active tuned mass damper**, I. Nishimura, T. Hamamoto, Musashi Institute of Technology (Japan) ..... [4330-52]

2:10 pm: **Active microvibration control of precision manufacturing factories with smart structure using piezoelectric actuators**, T. Fujita, M. Enomoto, Univ. of Tokyo (Japan); T. Arikabe, T. Ogawa, Sumitomo Heavy Industries, Ltd. (Japan); N. Murai, Y. Hashimoto, H. Hamaguchi, Takenaka Corp. (Japan); T. Kitahara, Hitachi Engineering and Construction Co., Ltd. (Japan) ..... [4330-53]

2:30 pm: **Seismic performance of multiply tuned mass dampers in suppressing multimode responses of building structures**, G. Chen, Univ. of Missouri/Rolla ..... [4330-54]

2:50 pm: **Using genetic algorithms to place sensor/actuators while considering actuator dynamics and control stability**, A. Richardson, M. M. Abdullah, Florida A&M Univ. and Florida State Univ. . [4330-55]

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

## SESSION 12

Room: Pacific Ballroom F  
Wed. 1:30 pm

### Viscoelastic/Constrained Layer Treatment

*Chair:* Donald J. Leo, Virginia Polytechnic Institute and State Univ.

1:30 pm: **Comparison of two passive damping treatments with an infill of viscoelastic spheres for reducing vibration levels in hollow structures**, R. J. Pamley, Defence Evaluation and Research Agency Farnborough (UK) ..... [4331-49]

1:50 pm: **Use of microcellular foam materials in constrained layer damping treatment**, P. V. H. Huam, P. G. Reinhall, I. Y. Shen, V. Kumar, Univ. of Washington ..... [4331-50]

2:10 pm: **Experimental investigation of an enhanced self-sensing active constrained layer damping treatment**, W. H. Liao, K. M. Wong, Chinese Univ. of Hong Kong ..... [4331-51]

2:30 pm: **Effect of inertia forces on the damping of a constrained layer finitely deformed in shearing**, R. C. Batra, J. Yu, Virginia Polytechnic Institute and State Univ. [4331-53]

Conference 4331 ends ■

## SESSION 10

Room: Pacific Ballroom D  
Wed. 1:30 pm

### Engine Applications

*Chairs:* Edward V. White, Boeing Co.; Jack H. Jacobs, Honeywell Space Systems

1:30 pm: **Wind tunnel demonstration of the SAMPSON smart inlet**, J. P. Dunne, D. M. Pitt, E. V. White, Boeing Co.; E. Garcia, DARPA ..... [4332-43]

1:50 pm: **Resonant bimorph driven high-torque piezoelectric rotary motor**, G. A. Lesieutre, G. H. Koopmann, E. M. Mockensturm, J. E. Frank, W. Chen, The Pennsylvania State Univ. [4332-44]

2:10 pm: **Flexible tab assisted control concept (FlexTAC)**, T. D. Nguyen, Naval Surface Warfare Ctr.; B. F. Carpenter, Lockheed Martin Astronautics; J. Hall, General Dynamics Corp. .... [4332-45]

2:30 pm: **Shape memory alloy actuation for a variable area fan nozzle**, N. M. Rey, G. Tillman, R. Miller, United Technologies Research Ctr.; T. Wynosky, Pratt and Whitney, Retired; M. Larkin, Pratt and Whitney; J. D. Flamm, L. S. Bangert, NASA Langley Research Ctr. .... [4332-46]

2:50 pm: **Smart structures and materials for future aircraft engines**, T. Lewis, Air Force Research Lab.; C. Cross, Northrop Grumman ..... [4332-47]

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

## SESSION 8

Room: Trimaran/Brigatine  
Wed. 1:30 pm

### Fracture of Ferroelectrics

1:30 pm: **Criteria for domain switching in piezoelectric materials**, C. T. Sun, A. Achuthan, Purdue Univ. .... [4333-44]

1:50 pm: **Ferroelectric switching zones around crack tips predicted by a phenomenological constitutive law**, A. Haug, R. M. McMeeking, Univ. of California/Santa Barbara ..... [4333-45]

2:10 pm: **Constitutive modeling of repolarization for the ferroelectric process zone of a crack**, H. Kessler, J. Drescher, H. Balke, Technische Univ. Dresden (Germany) [4333-46]

2:30 pm: **Damage mechanisms in ferroelectric PZT ceramics under bipolar electric cycling**, J. Nuffer, D. C. Lupascu, J. Rödel, Technische Univ. Darmstadt (Germany) ..... [4333-47]

2:50 pm: **Modeling cyclic fatigue phenomena of polycrystalline ferroelectric ceramics**, J. Rödel, W. S. Kreher, Technische Univ. Dresden (Germany) ... [4333-48]

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

## SESSION 8

Room: Newport Ballroom North  
Wed. 1:30 pm

### Smart Devices and Systems II

*Chairs:* Daniel M. Bennett, Brigham Young Univ.; Y. Eugene Pak, Samsung Advanced Institute of Technology & CRI (Korea)

1:30 pm: **MM-wave collision avoidance device inspired by insect vision principles for UAVs and nanosatellites (Invited Paper)**, D. Abbott, Univ. of Adelaide (Australia) ..... [4334-42]

1:50 pm: **Hybrid power systems for autonomous MEMS**, D. M. Bennett, J. N. Harb, P. Humble, C. Middleton, R. H. Selfridge, Brigham Young Univ. ... [4334-43]

2:10 pm: **Electromagnetic micro-x-y stage with very thick Cu coil for probe-based mass data storage device**, J. J. Choi, H. S. Park, K. Y. Kim, J. U. Jeon, Samsung Advanced Institute of Technology (Korea) ..... [4334-44]

2:30 pm: **Networked rectenna array for smart material actuators**, S. H. Choi, NASA Langley Research Ctr.; W. Golembiewski, K. D. Song, Norfolk State Univ. .... [4334-45]

2:50 pm: **New type of silicon photoelectronic negative resistance devices**, Y. Sha, The Pennsylvania State Univ. .... [4334-46]

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

# Smart Structures and Materials

## Conference 4326

Pacific Ballroom A Tues.–Thurs.

## Conference 4327

Room: Schooner/Sloop

## Conference 4328

Room: Pacific Ballroom E

## Conference 4329

Room: Pacific Ballroom C

Wednesday 7 March 2001

### SESSION 12

Room: Pacific Ballroom A  
Wed. 3:40 pm

#### Modeling Applications II

*Chair:* Reinhard Lerch, Friedrich-Alexander Univ. Erlangen-Nuermberg (Germany)

3:40 pm: **Thin plate electrostrictive finite element**, F. Pablo, ONERA (France) . . . . . [4326-45]

4:00 pm: **Nonlinear 2D model for magnetostrictive rods**, M. J. Dapino, Iowa State Univ.; R. C. Smith, North Carolina State Univ. . . . . [4326-46]

4:20 pm: **Robustness of a finite-strain superelastic model**, F. Auricchio, Univ. degli Studi di Pavia (Italy) . . . . . [4326-47]

4:40 pm: **Finite element modeling of synthetic jet actuator**, J. Ro, Old Dominion Univ.; F. Chen, NASA Langley Research Ctr. . . . . [4326-48]

### SESSION 14

Room: Schooner/Sloop  
Wed. 3:20 pm

#### Modeling and Control I

*Chair:* Kon-Well Wang, The Pennsylvania State Univ.

3:20 pm: **Approximate method for reducing the order of linear structured uncertain systems**, O. Ismail, A. R. Al-Hassan, Univ. of Aleppo (Syria) . . . . . [4327-56]

3:40 pm: **Dynamic modeling and control of slewing smart beam**, M. K. Kwak, S. Nam, Dongguk Univ. (Korea) . . . . . [4327-57]

4:00 pm: **Piezoelectric control of aeroelastic wing flutter in unsteady transonic Euler flow**, S. J. Kim, S. M. Ryu, Seoul National Univ. (Korea) . . . . . [4327-58]

4:20 pm: **Analysis of piezoelectric fiber composite beams**, T. H. Brockmann, R. Lammering, Univ. der Bundeswehr Hamburg (Germany) . . . . . [4327-59]

### SESSION 15

Room: Schooner/Sloop  
Wed. 4:40 pm

#### Modeling and Control II

*Chair:* Vit Babuska, MRJ, Inc.

4:40 pm: **Modeling and simulation of a resonant bimorph actuator drive**, E. M. Mockensturm, J. Jiang, G. H. Koopmann, G. A. Lesieutre, The Pennsylvania State Univ. . . . . [4327-60]

5:00 pm: **Numerical simulation of inflatable membrane structures**, R. Kolar, C. Whittinghill, B. N. Agrawal, Naval Postgraduate School . . . . . [4327-62]

5:20 pm: **Dynamic response of periodic shells with moving pressure loads**, G. Solaroli, Politecnico di Torino (Italy); M. Ruzzene, Catholic Univ. of America; A. M. Baz, Univ. of Maryland/College Park . . . . . [4327-63]

5:40 pm: **Modeling and simulation of human-floor system under vertical vibration**, X. Zheng, J. Brownjohn, Nanyang Technological Univ. (Singapore) . . . . . [4327-90]

### SESSION 9

Room: Pacific Ballroom C  
Wed. 3:40 pm

#### EAP Properties Characterization

*Chairs:* Yoshihito Osada, Hokkaido Univ. (Japan); Gordon G. Wallace, Univ. of Wollongong (Australia)

3:40 pm: **Development of large-surface Nafion-metal composite actuator and its electrochemical characterization**, Y. Tak, T. Noh, Inha Univ. (Korea); J. Nam, J. W. Jeon, H. M. Kim, H. R. Choi, Sung Kyun Kwan Univ. (Korea); S. S. Bae, Nanopolymer Inc. (Korea) . . . . . [4329-41]

4:00 pm: **New x-ray scattering from polymers and its quantum profile analysis applied to materials characterization**, B. Mallick, Regional Engineering College (India) . . . . . [4329-42]

4:20 pm: **Characterization of the electromechanical properties of EAP materials**, Y. Bar-Cohen, Jet Propulsion Lab.; K. Bhattacharya, California Institute of Technology; S. Lih, Jet Propulsion Lab. . . . . [4329-43]

4:40 pm: **Electrochemical stimulation and control of electroactive polymer gels**, R. W. Gulch, J. Holdenried, A. Weible, Eberhard-Karls-Univ. Tübingen (Germany); T. Wallmersperger, B. Kröplin, Univ. Stuttgart (Germany) . . . . . [4329-44]



## Caribbean Reception

Wednesday 7 March  
7:00 pm

All symposium attendees are invited to relax, socialize, and enjoy refreshments and a Caribbean buffet-style dinner in the Pacific Ballroom. Dress is casual and please wear your conference registration badge.

# Smart Structures and Materials

## Conference 4330

Room: Catamaran

## Conference 4331

Room: Pacific Ballroom F

## Conference 4332

Room: Pacific Ballroom D

## Conference 4333

Room: Trimaran/Brigatine

## Conference 4334

Room: Newport Ballroom North

Wednesday 7 March 2001

### SESSION 12

Room: Catamaran  
Wed. 3:40 pm

#### Sensors for Infrastructure Monitoring II

*Chair: Ming L. Wang,*  
Univ. of Illinois/Chicago

3:40 pm: **Health monitoring system using FBG-based sensors for a 12-story building with column dampers,** H. Iwaki, H. Yamakawa, Shimizu Corp. (Japan); A. Mita, Keio Univ. (Japan) . . . . . [4330-56]

4:00 pm: **Fiber Bragg grating accelerometer for buildings and civil infrastructures,** A. Mita, Keio Univ. (Japan); I. Yokoi, Tokyo Sokushin Co., Ltd. (Japan) . . . . . [4330-57]

4:20 pm: **Structural monitoring of composite marine piles using fiber optic sensors,** C. S. Baldwin, P. C. Chen, J. B. Niemczuk, J. S. Kiddy, Systems Planning and Analysis, Inc. . . . . [4330-58]

4:40 pm: **Acoustic emission evaluation of reinforced concrete bridge beam with graphite composite laminate,** H. W. Shen, D. E. Johnson, R. D. Finlayson, R. K. Miller, Physical Acoustics Corp. . . . . [4330-59]

Conference 4330 ends ■

### SESSION 11

Room: Pacific Ballroom D  
Wed. 3:40 pm

#### DAPRA Smart Wing Program: Phase II

*Chairs: Jayanth N. Kudva,*  
Northrop Grumman Corp.;  
**Bernie F. Carpenter,** Lockheed  
Martin Astronautics

3:40 pm: **Overview of the DARPA/AFRL/NASA smart materials and structures in smart wing program,** J. N. Kudva, Northrop Grumman Corp. . . . . [4332-48]

4:00 pm: **Smart wing wind tunnel model aeroelasticity,** J. N. Kudva, Northrop Grumman Corp. [4332-49]

4:20 pm: **Design, fabrication, and testing of scaled wind tunnel model for the smart wing phase 2 program,** C. A. Martin, Northrop Grumman Corp. . . . . [4332-50]

4:40 pm: **Development of high-rate large deflection hingeless trailing edge control surface for the smart wing wind tunnel model,** D. P. Wang, Northrop Grumman Corp. . . . . [4332-51]

### SESSION 9

Room: Trimaran/Brigatine  
Wed. 3:40 pm

#### Coupled Constitutive Behavior: SMA and Ferroelectric

3:40 pm: **Cauchy symmetric constitutive laws for polycrystalline ferroelectric ceramics,** C. M. Landis, Rice Univ. . . . . [4333-49]

4:00 pm: **Frequency-dependent model for relaxor ferroelectric materials,** R. C. Smith, North Carolina State Univ.; C. L. Hom, Lockheed Martin Advanced Technology Ctr. . . . . [4333-50]

4:20 pm: **Scattering of acousto-electric waves on a cylindrical inhomogeneity in the transversely isotropic piezoelectric medium,** V. M. Levin, Petrozavodsk State Univ. (Russia); T. Michelitsch, Univ. Stuttgart (Germany) . . . [4333-51]

4:40 pm: **Unified model of thermomechanical behavior of shape memory alloys,** Y. Matsuzaki, H. Naito, T. Ikeda, Nagoya Univ. (Japan) . . . . . [4333-52]

5:00 pm: **Thermodynamic constitutive model for stress induced phase transformation in shape memory alloys,** J. Zhu, W. Huang, K. M. Liew, Nanyang Technological Univ. (Singapore); N. Liang, LNM Institute of Mechanics (China) . . . [4333-53]

5:20 pm: **Thermomechanical behavior of shape memory alloys,** D. Helm, P. Haupt, Univ. Gesamthochschule Kassel (Germany) . . . . . [4333-55]

### SESSION 9

Room: Newport Ballroom North  
Wed. 3:40 pm

#### Smart Devices and Systems III

*Chairs: Julian W. Gardner,* Univ. of Warwick (UK); **K. A. Jose,** The Pennsylvania State Univ.

3:40 pm: **Smart tongue for monitoring the freshness of orange juice and milk,** J. W. Gardner, Univ. of Warwick (UK); V. K. Varadan, The Pennsylvania State Univ. [4334-47]

4:00 pm: **Nanoporous films on SOI membranes for high-temperature sensing devices,** J. W. Gardner, Univ. of Warwick (UK); F. Udrea, Univ. of Cambridge (UK); P. N. Bartlett, Southampton Univ. (UK) . . . . . [4334-48]

4:20 pm: **Review of microsystems by microstereo lithography and AMANDA process,** V. K. Varadan, X. N. Jiang, V. V. Varadan, The Pennsylvania State Univ. [4334-49]

4:40 pm: **Design and development of polymeric-based micropump,** J. Blattner, The Pennsylvania State Univ.; V. K. Varadan, Duke Univ.; X. N. Jiang, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. . . . . [4334-50]

Conference 4334 ends ■

# Smart Structures and Materials

Conference 4326

Pacific Ballroom A Tues.–Thurs.

Conference 4327

Room: Newport Ballroom North

Conference 4327

Room: Schooner/Sloop

Conference 4329

Room: Pacific Ballroom C

Thursday 8 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Best Student Paper Award

Plenary Presentation

### The State-of-the-Art of Intelligent Materials Research in Japan

Speaker: Dr. Norio Shinya, National Research Institute for Metals (Japan)

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 13

Room: Pacific Ballroom A  
Thurs. 9:20 am

#### Shape Memory Alloys

Chair: Ralph C. Smith, North Carolina State Univ.

9:20 am: **Model and constitutive equation describing the hysteretic behavior of single crystals in Cu-Zn-Al SMA: from single plate to a collective behavior**, V. Torra, A. Isalgue, Polytechnical Univ. of Catalonia (Spain); M. Rodriguez de Rivera, Univ. de las Palmas de Gran Canaria (Spain); F. C. Lovey, Centro Aromatico de Bariloche (Argentina) ..... [4326-49]

9:40 am: **Simplified SMA material model for shape control and vibration isolation**, D. C. Lagoudas, J. J. Mayes, M. M. Khan, Texas A&M Univ. .... [4326-69]

10:00 am: **Frequency domain reduction of linear structured uncertain systems using spectral functions**, O. Ismail, Univ. of Aleppo (Syria) ..... [4326-70]

10:20 am: **Simulation of shape memory alloys under multi-axial nonproportional loading at finite strain**, H. Andr , L. Juhasz, Univ. Karlsruhe Technische Hochschule (Germany) ..... [4326-52]

10:40 am: **Compensation for hysteresis in smart material systems**, R. C. Smith, North Carolina State Univ. .... [4326-53]

#### SESSION 14

Room: Pacific Ballroom A  
Thurs. 11:00 am

#### Smart Robotic Manipulators/ Piezoelectric Motors

Chair: Jaehwan Kim, Inha Univ. (Korea)

11:00 am: **Design and modeling of an active steerable end-effector**, W. M. Aguilar, M. I. Frecker, The Pennsylvania State Univ. [4326-54]

11:20 am: **Smart robotic manipulator systems consisting of a thin-walled beam and a spinning top rotor: vibration and stability control**, O. Song, Choong-Nam National Univ. (Korea); L. Librescu, Virginia Polytechnic Institute and State Univ.; H. Kwon, Yonsei Univ. (Korea) ..... [4326-55]

11:40 am: **Design of piezoelectric motors using topology optimization**, E. C. Nelli Silva, Univ. de S o Paulo (Brazil) .. [4326-56]

#### Sessions 16 and 17 are concurrent.

#### SESSION 16

Room: Newport Ballroom North  
Thurs. 9:20 am

#### Magnetostriction

Chair: Alison B. Flatau, National Science Foundation

9:20 am: **Characterization of a small Terfenol-D transducer in blocked-blocked configuration**, L. E. Faidley, M. J. Dapino, A. B. Flatau, Iowa State Univ. [4327-64]

9:40 am: **Collocated actuation and sensing in beams using Terfenol-D**, F. T. Calkins, Boeing Phantom Works; M. J. Dapino, Iowa State Univ.; R. C. Smith, North Carolina State Univ. .... [4327-65]

10:00 am: **Magneto-electric composite element and its application to magnetic levitation system**, J. Qiu, T. Ueno, J. Tani, Tohoku Univ. (Japan) .. [4327-66]

10:20 am: **Experimental investigation of Terfenol-D's elastic modulus**, R. A. Kellogg, Iowa State Univ.; A. B. Flatau, National Science Foundation ... [4327-87]

10:40 am: **Wide-band tunable mechanical resonator employing the Delta-E effect of Terfenol-D**, R. A. Kellogg, Iowa State Univ.; A. B. Flatau, National Science Foundation ..... [4327-88]

#### SESSION 17

Room: Schooner/Sloop  
Thurs. 9:20 am

#### Modeling and Control III

Chair: Amr M. Baz, Univ. of Maryland/College Park

9:20 am: **Novel implementation of active structural flow control**, P. Masson, P. Audrain, A. Berry, Univ. de Sherbrooke (Canada) ..... [4327-67]

9:40 am: **Wavelet analysis of wave dispersion characteristics in shells with periodic stiffeners**, Z. Gu, M. Ruzzene, Catholic Univ. of America; A. M. Baz, Univ. of Maryland/College Park . [4327-68]

10:00 am: **Hysteresis behavior and modeling of piezoceramic actuators**, X. Zhou, A. Chattopadhyay, Arizona State Univ. .... [4327-69]

10:20 am: **Flutter boundary extension in a nonlinear aeroelastic Delta-wing model using linear controller design**, R. E. Richard, Duke Univ.; J. E. Rule, Active Control eXperts, Inc.; R. L. Clark, Duke Univ. .... [4327-70]

#### SESSION 18

Room: Schooner/Sloop  
Thurs. 10:40 am

#### Modeling and Control IV

Chair: Massimo Rezzene, Catholic Univ. of America

10:40 am: **Active jitter suppression of optical structures**, M. A. McEver, R. L. Clark, Duke Univ. . [4327-71]

11:00 am: **Using active structural control for isolation**, B. Marsh, M. Giovanardi, D. J. Warkentin, Active Control eXperts, Inc. . . . [4327-72]

11:20 am: **Modeling and characterization of piezoelectric and magnetostrictive induced strain actuators**, V. Giurgiutiu, R. O. Pomirleanu, Univ. of South Carolina ..... [4327-73]

11:40 am: **Spectral finite element modeling of the propagation of axisymmetric waves in periodic stiffened shells**, G. Solaroli, Politecnico di Torino (Italy); M. Ruzzene, Catholic Univ. of America; A. M. Baz, Univ. of Maryland/College Park . [4327-74]

#### SESSION 10

Room: Pacific Ballroom C  
Thurs. 9:20 am

#### Applications to Robotics and Actuators

Chairs: Constantinos Mavroidis, Rutgers Univ.; Richard O. Claus, Virginia Polytechnic Institute and State Univ.

9:20 am: **Applications of dielectric elastomer artificial muscles** (*Invited Paper*), R. Pelrine, SRI International; G. Kofod, Ris  National Lab. (Denmark); R. D. Kornbluh, Q. Pei, J. Eckerle, R. Heydt, S. Shastri, SRI International; P. Sommer-Larsen, Ris  National Lab. (Denmark) [4329-45]

10:00 am: **Human-like android face equipped with EAP artificial muscles to endow expressivity**, G. Pignatta, F. Di Francesco, D. De Rossi, Univ. degli Studi di Pisa (Italy); D. F. Hanson, Disney Imagineering ..... [4329-46]

10:20 am: **Virtual reality robotic telesurgery simulations using MEMICA haptic system**, Y. Bar-Cohen, Jet Propulsion Lab.; C. Mavroidis, M. Bouzit, Rutgers Univ.; B. P. Dolgin, Jet Propulsion Lab.; D. L. Harm, NASA Johnson Space Ctr.; G. E. Kopchok, M.D., R. A. White, M.D., Harbor-UCLA Medical Ctr. .... [4329-47]

10:40 am: **Application requirements of EAPs for swimming robots**, P. Kerrebrock, J. Anderson, J. R. Parry, Charles Stark Draper Lab., Inc. .... [4329-70]

11:00 am: **Development of micro inchworm robot actuated by electrostrictive polymer actuator**, H. Choi, S. Ryew, S. Cho, J. Nam, J. W. Jeon, H. Kim, Sung Kyun Kwan Univ. (Korea); J. Park, Korea Advanced Institute of Technology (Korea) ..... [4329-49]

11:20 am: **Electrostrictive polymer actuators and their control systems**, J. W. Jeon, K. C. Park, S. Y. An, J. D. Nam, H. Choi, H. Kim, Sung Kyun Kwan Univ. (Korea); S. S. Bae, Nanopolymer Inc. (Korea); Y. Tak, Inha Univ. (Korea) .... [4329-50]

11:40 am: **EAP application to artificial tactile feel display of virtual reality**, M. Konyo, S. Tadokoro, T. Takamori, Kobe Univ. (Japan); K. Oguro, Osaka National Research Institute (Japan) ..... [4329-51]

Lunch Break ... Noon to 1:30 pm

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# Smart Structures and Materials

Conference 4330

Room: Catamaran

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Thursday 8 March 2001

8:00 to 8:45 am

## Smart Structures and Materials Best Student Paper Award

Plenary Presentation

### The State-of-the-Art of Intelligent Materials Research in Japan

Speaker: Dr. Norio Shinya, National Research Institute for Metals (Japan)

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 12

Room: Pacific Ballroom D  
Thurs. 9:20 am

#### Biologically Inspired Applications

Chairs: William W. Clark, Univ. of Pittsburgh; Anna-Maria R. McGowan, NASA Langley Research Ctr.

9:20 am: **Biomorphic systems and missions: surface-aerial cooperative exploration strategies** (*Invited Paper*), S. Thakoor, Jet Propulsion Lab. .... [4332-52]

10:00 am: **DNA molecular motors**, F. C. Simmel, B. Yurke, Lucent Technologies/Bell Labs. [4332-53]

10:20 am: **Smart materials in biological cell stretching systems**, W. W. Clark, Univ. of Pittsburgh ..... [4332-54]

10:40 am: **Elastin-mimetic block copolymers: biologically derived smart materials**, V. P. Conticello, E. R. Wright, R. McMillan, Emory Univ. .... [4332-55]

11:00 am: **Smart nanostructured biomaterials: the secret is in the synthesis**, D. E. Morse, Univ. of California/Santa Barbara [4332-56]

11:20 am: **Electric field-mediated processing of biomaterials: toward nanostructured biomimetic systems**, G. E. Wnek, G. L. Bowlin, K. J. Mansfield, D. G. Simpson, Virginia Commonwealth Univ. .... [4332-57]

Lunch Break . 11:40 am to 1:30 pm

#### SESSION 10

Room: Trimaran/Brigatine  
Thurs. 9:20 am

#### Actuators I

9:20 am: **Fabrication of piezoelectric ceramic fibers by extrusion of PZT powder and PZT sol mixture**, Y. Kobayashi, T. Y. Um, J. Qiu, J. Tani, Tohoku Univ. (Japan); H. Takahashi, Fuji Ceramics Corp. (Japan) ..... [4333-56]

9:40 am: **Free strain electromechanical characterization of the NASA macrofiber composite piezoceramic actuator**, W. K. Wilkie, R. G. Bryant, J. W. High, NASA Langley Research Ctr.; J. A. Ligan, NASA LARSS and Virginia Polytechnic Institute and State Univ. .... [4333-57]

10:00 am: **V-stack piezoelectric actuator**, E. V. Ardelean, R. L. Clark, Duke Univ. .... [4333-58]

10:20 am: **Performance evaluation and optimal design of lightweight piezocomposite curved actuator**, N. S. Goo, Kyungpook National Univ. (Korea); K. J. Yoon, Konkuk Univ. (Korea) ..... [4333-59]

10:40 am: **Fabrication and characterization of SMA hybrid composites**, T. L. Turner, C. L. Lach, R. J. Cano, NASA Langley Research Ctr. .... [4333-60]

11:00 am: **Large self thermal-plastic actuation in a NiTi shape memory alloy fiber aluminum metal matrix composite**, W. D. Armstrong, SUNY/Binghamton . . . . [4333-61]

11:20 am: **Manufacture, experimental, and theoretical evaluation of adaptative glass/epoxy composites with embedded shape memory alloys wires**, M. Salvia, Y. K. Choi, Ecole Centrale de Lyon (France) . . . . . [4333-62]

11:40 am: **Adaptive composites with embedded shape memory alloy wires**, J. A. Balta, V. Michaud, J. E. Manson, M. Parlinska, R. Gotthardt, Ecole Polytechnique Fédérale de Lausanne (Switzerland) . . . . . [4333-63]

Lunch Break . . . Noon to 1:30 pm



# Smart Structures and Materials

## Conference 4326

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Room: Pacific Ballroom E

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Room: Pacific Ballroom C

Thursday 8 March 2001

### SESSION 14 (cont.)

Room: Pacific Ballroom A  
Thurs. Noon

Noon: **Development and experimental validation of an improved ultrasonic traveling-wave motor model that accounts for rotor flexibility**, T. S. Glenn, M. J. Atalla, N. W. Hagood, Massachusetts Institute of Technology . . . . . [4326-57]

Lunch Break . . . . . 12:20 to 1:30 pm

### SESSION 15

Room: Pacific Ballroom A  
Thurs. 1:30 pm

#### Devices/System Applications

Chair: **Sridhar Sana**, Univ. of Missouri/Rolla

1:30 pm: **Three-dimensional assumed strain solid element for piezoelectric actuator/sensor**, H. C. Park, B. C. Cho, K. J. Yoon, Konkuk Univ. (Korea) . . . . . [4326-58]

1:50 pm: **FD-TD analysis of the concrete structure embedded with TDR sensors**, G. Chang, L. Shi, B. Chen, B. Zhou, Nanjing Engineering Institute (China) . . . . . [4326-59]

2:10 pm: **Squeeze film damping effect on micro-beam resonators**, Q. Jiang, Q. Zhang, G. Xu, Univ. of California/Riverside . . . . . [4326-60]

2:30 pm: **Spatial aperture shading applied to distributed systems for uniform damping control**, G. Washington, B. Isler, Ohio State Univ. . . . . [4326-61]

2:50 pm: **Optimal placement of active elements by use of an analytic effectiveness and a combination of optimization algorithms**, W. Wohlers, H. G. Reimerdes, J. Günnewig, Rheinisch-Westfälische Technische Hochschule Aachen (Germany) . . . . . [4326-62]

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

### SESSION 18 (cont.)

Room: Schooner/Sloop  
Thurs. Noon

Noon: **Active shape airfoil control through composite-piezoceramic actuators**, S. Amedure, Univ. degli Studi di Naples Federico II (Italy); C. Espasito, A. Concilio, CIRA-SpA (Italy) . . . . . [4327-89]

Lunch Break . . . . . 12:20 to 1:30 pm

### SESSION 19

Room: Schooner/Sloop  
Thurs. 1:30 pm

#### Sensors and Estimation I

Chair: **Victor Giurgiutiu**, Univ. of South Carolina

1:30 pm: **Temperature-compensated flat-pack fiber optic strain gage: design and evaluation**, J. S. Kiddy, P. C. Chen, J. B. Niemczuk, Systems Planning and Analysis, Inc.; S. Chen, Univ. of Maryland/College Park . . . . . [4327-75]

1:50 pm: **Buckling behavior monitoring of composite wing box model using fiber Bragg grating sensor system**, C. S. Hong, C. Y. Ryu, J. R. Lee, C. G. Kim, Korea Advanced Institute of Science and Technology (Korea) . . . . . [4327-76]

2:10 pm: **Fatigue behavior of composite patches with structurally integrated fiber optic sensors**, G. J. Tsamasphyros, G. N. Kanderakis, N. K. Furnarakis, National Technical Univ. of Athens (Greece); Z. P. Marioli-Riga, Hellenic Aerospace Industry Ltd. (Greece) . . . . . [4327-77]

### SESSION 20

Room: Schooner/Sloop  
Thurs. 2:30 pm

#### Vibration Control of Panels I

Chair: **Amr M. Baz**, Univ. of Maryland/College Park

2:30 pm: **Nonlinear control of plate vibrations**, O. N. Ashour, A. H. Nayfeh, Virginia Polytechnic Institute and State Univ. . . . . [4327-78]

2:50 pm: **Sound and vibration control tests of composite plate by using piezoceramic sensors and actuators**, K. Takahashi, K. Bansaku, T. Sanda, Kawasaki Heavy Industries, Ltd. (Japan); Y. Matsuzaki, Nagoya Univ. (Japan) . . . . . [4327-79]

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

### SESSION 11

Room: Pacific Ballroom C  
Thurs. 1:30 pm

#### Applications

Chairs: **Toribio F. Otero**, Univ. del País Vasco and Univ. Politécnica e Cartagena (Spain);

**Roy D. Kornbluh**, SRI International

1:30 pm: **Development of force-feedback controlled nanion micromanipulators**, W. J. Li, Chinese Univ. of Hong Kong; N. Xi, Michigan State Univ.; S. Ma, Ibaraki Univ. (Japan) . . . . . [4329-52]

1:50 pm: **Design, development, and testing of a multi-fingered mammalian heart compression/assist device equipped with IPMC artificial muscles**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico and Environmental Robots, Inc. . . . . [4329-53]

2:10 pm: **Solvent-driven chemical motor**, Y. Osada, J. Gong, K. Ikeda, T. Mitsumata, Hokkaido Univ. (Japan) . . . . . [4329-54]

2:30 pm: **Electromechanical actuators based on fibers and fabrics**, G. G. Wallace, J. Wu, V. Aboutanos, G. M. Spinks, D. Zhou, Univ. of Wollongong (Australia) . . . . . [4329-55]

2:50 pm: **High-contrast artificial eyelid for protection of optical sensors**, S. H. Goodwin-Johansson, MCNC; M. R. Davidson, Univ. of Florida; G. J. Exarhos, Pacific Northwest National Lab.; R. W. Schwartz, Clemson Univ.; R. F. Cozzens, Naval Research Lab.; G. McGuire, MCNC; P. H. Holloway, Univ. of Florida . . . . . [4329-56]

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

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# Smart Structures and Materials

Conference 4330

Room: Catamaran

Conference 4331

Room: Pacific Ballroom F

Conference 4332

Room: Pacific Ballroom D

Conference 4333

Room: Trimaran/Brigatine

Conference 4334

Room: Newport Ballroom North

Thursday 8 March 2001

## SESSION 13

Room: Pacific Ballroom D  
Thurs. 1:30 pm

### Control and Adaptive Composites

*Chairs:* Christian Boller,  
Johannes K. Dürr,  
DaimlerChrysler Aerospace  
(Germany)

1:30 pm: **Neural control of helicopter blade-vortex interaction noise**, H. Glaessel, S. Rudolph, Univ. Stuttgart (Germany) [4332-58]

1:50 pm: **Damping in SMA-reinforced composites using SMA-intrinsic properties**, C. Boller, DaimlerChrysler Aerospace (Germany); P. Konstanzer, Univ. Stuttgart (Germany); Y. Matsuzaki, T. Ikeda, Nagoya Univ. (Japan) . . . . . [4332-60]

2:10 pm: **Multifunction piezoelectric transducers for handheld electronics devices**, R. R. Perkins, Active Control eXperts, Inc. . . . . [4332-61]

2:30 pm: **Smart wide-area imaging sensor system (SWISS)**, K. P. Kress, DaimlerChrysler Aerospace Military Aircraft (Germany); K. W. Dittrich, DaimlerChrysler Aerospace (Germany) . . . . . [4332-62]

Conference 4332 ends ■

## SESSION 11

Room: Trimaran/Brigatine  
Actuators II  
Thurs. 1:30 pm

1:30 pm: **Development of damage suppression system using embedded SMA foil in CFRP laminates**, T. Ogisu, M. Nomura, N. Ando, J. Takaki, Fuji Heavy Industries Ltd. (Japan); M. Kobayashi, T. Okabe, N. Takeda, Univ. of Tokyo (Japan) . . [4333-64]

1:50 pm: **Low-field and high-field characterization of THUNDER actuators**, Z. Ounaies, NASA Langley Research Ctr.; J. D. Bernd, Princeton Univ.; R. C. Smith, North Carolina State Univ. . . . [4333-66]

2:10 pm: **Domain configuration and switching contributions to the enhanced performance of rainbow actuators**, R. W. Schwartz, Y. Moon, Clemson Univ. . . . . [4333-67]

2:30 pm: **Thermal deformation and residual stresses analysis of lightweight piezocomposite curved actuator**, K. J. Yoon, J. H. Jung, Konkuk Univ. (Korea); N. S. Goo, Kyungpook National Univ. (Korea); H. C. Park, Konkuk Univ. (Korea) . . . . . [4333-68]

2:50 pm: **Thermomechanical fatigue of SMA actuators**, D. C. Lagoudas, Texas A&M Univ.; D. A. Miller, Los Alamos National Lab.; C. Li, Texas A&M Univ. . . . . [4333-69]

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

# Smart Structures and Materials

## Conference 4326

Pacific Ballroom A Tues.–Thurs.

## Conference 4327

Room: Schooner/Sloop

## Conference 4328

Room: Pacific Ballroom E

## Conference 4329

Room: Pacific Ballroom C

Thursday 8 March 2001

### SESSION 16

Room: Pacific Ballroom A  
Thurs. 3:40 pm

#### Modeling Applications III

*Chair:* Marcelo J. Dapino,  
Iowa State Univ.

3:40 pm: **Lambwave sensor optimization using differential evolution**, G. Manson, K. Worden, Univ. of Sheffield (UK) . . . [4326-63]

4:00 pm: **New model of the cohesion field and thin structures**, S. A. Lurie, Institute of Applied Mechanics (Russia) . . . . [4326-64]

4:20 pm: **Bending and vibrations piezoceramic cantilever plates under the influence of the electric field**, L. Mkrtychyan, M. Belubekyan, Institute of Mechanics (Armenia) . . . . . [4326-65]

4:40 pm: **Multibody simulation of mechanism with distributed actuators on lightweight components**, D. Sachau, M. Rose, DLR (Germany) . . . . . [4326-66]

5:00 pm: **Regularization based on steering parameterized Gaussian filters and Bhattacharyya distance functional**, E. P. Lopes, Federal Univ. of Rio de Janeiro and Univ. of Surrey (Brazil) . . . . . [4326-67]

Conference 4326 ends ■

### SESSION 21

Room: Schooner/Sloop  
Thurs. 3:40 pm

#### Vibration Control of Panels II

*Chair:* Stephen Jones,  
Honeywell, Inc.

3:40 pm: **Active vibration control of composite shell structure using modal sensor/actuator system**, S. J. Kim, J. Hwang, J. Mok, H. M. Koh, Seoul National Univ. (Korea) . . . . . [4327-80]

4:00 pm: **Piezoceramic actuator placement for structural acoustic and vibration control of flat and curved panels**, J. S. Bevan, C. Mei, Old Dominion Univ. . . . [4327-81]

4:20 pm: **Shape and vibration control of circular plate with piezoelectric sheet actuators**, M. K. Philen, K. W. Wang, The Pennsylvania State Univ. [4327-82]

4:40 pm: **Active vibro-acoustic control with multiple local feedback loops**, S. J. Elliott, T. C. Sors, M. J. Brennan, P. Gardonio, Univ. of Southampton (UK) . . . . . [4327-83]

### SESSION 22

Room: Schooner/Sloop  
Thurs. 5:00 pm

#### Sensors and Estimation II

*Chair:* Andrea Tonoli,  
Politecnico di Torino (Italy)

5:00 pm: **Spatially distributed sensors for detecting damage in structures**, A. S. Purekar, D. J. Pines, Univ. of Maryland/College Park . . . . . [4327-84]

5:20 pm: **Charge driven piezoelectric transducers in self-sensing configuration**, A. Tonoli, S. Carabelli, P. Civera, Politecnico di Torino (Italy) . . . . . [4327-85]

5:40 pm: **Characterization of fiber optic sensors for structural health monitoring**, G. P. Carman, D. Lee, M. Mitrovic, A. Stewart, Univ. of California/Los Angeles; W. L. Richards, NASA Dryden Flight Research Center . . . . . [4327-86]

Conference 4327 ends ■

### SESSION 12

Room: Pacific Ballroom C  
Thurs. 3:40 pm

#### Processing EAP as Actuators

*Chairs:* Yoshihito Osada,  
Hokkaido Univ. (Japan);  
**Gordon G. Wallace**, Univ. of  
Wollongong (Australia)

3:40 pm: **Molecules as actuators: toward the engines of molecular machines**, M. J. Marsella, Univ. of California/Riverside . . . [4329-57]

4:00 pm: **Fully dry solid-state artificial muscles exhibiting giant electromechanical effect**, M. Shahinpoor, K. J. Kim, Univ. of New Mexico and Environmental Robots, Inc. . . . . [4329-58]

4:20 pm: **Design and fabrication of actuators using electrostrictive graft elastomers**, J. Su, J. S. Harrison, R. Costen, NASA Langley Research Ctr. . . . . [4329-59]

4:40 pm: **Molecularly self-assembled actuators and devices**, T. Zeng, Virginia Polytechnic Institute and State Univ.; K. L. Cooper, NanoSonic, Inc.; R. O. Claus, Virginia Polytechnic Institute and State Univ.; F. J. Arregui, Univ. Publica de Navarra (Spain) . . . . . [4329-60]

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## Conference 4333

Room: Trimaran/Brigatine

## Conference 4334

Room: Newport Ballroom North

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### SESSION 11 (cont.)

#### Room: Trimaran/Brigatine Actuators II

Thurs. 3:40 pm

3:40 pm: **Influence of target temperature on the crystallization of NiTi shape memory alloys**, K. P. Mohanchandra, K. K. Ho, G. P. Carman, Univ. of California/Los Angeles . . . . . [4333-70]

4:00 pm: **Effect of aging and training on the two-way SME of a NiAl-Fe alloy**, C. Y. Xie, P. Huang, J. S. Wu, Shanghai Jiao Tong Univ. (China) . . . . . [4333-71]

4:20 pm: **Characterization of fine-grain piezoceramic stack actuators**, C. L. Davis, D. G. Morris, F. T. Calkins, Boeing Phantom Works . . . . . [4333-72]

4:40 pm: **Superelasticity of TiPdNi high-temperature shape memory alloy**, Q. Tian, J. Wu, Shanghai Jiao Tong Univ. (China) . . . . [4333-73]

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*SPIE 8th Annual International Symposium on*

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**4-8 March 2001 • Newport Beach, CA**

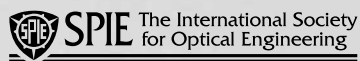
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*SPIE 6th Annual International Symposium on*

# **NDE for Health Monitoring and Diagnostics**

**4-8 March 2001 • Newport Beach, CA**

*Sponsored by*



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# NDE for Health Monitoring and Diagnostics

## Conference 4335

**Room: Yawl**  
Tuesday–Thursday 6–8 March 2001  
*Proceedings of SPIE* Vol. 4335

### Advanced NDE for Structural and Biological Health Monitoring

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

*Cochairs:* **Yoseph Bar-Cohen**, Jet Propulsion Lab.; **George A. Matzkanin**, Nondestructive Testing Information Analysis Center

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## Conference 4336

**Room: Pacific Ballroom E**  
Wednesday–Thursday 7–8 March 2001  
*Proceedings of SPIE* Vol. 4336

### NDE of Materials and Composites

*Conference Chairs:* **George Y. Baaklini**, NASA Glenn Research Ctr.; **Eric S. Boltz**, Marathon Sensors Inc.; **Steven M. Shepard**, Thermal Wave Imaging, Inc.; **Peter J. Shull**, The Pennsylvania State Univ.

*Program Committee:* **Ali Abdul-Aziz**, **Andrew L. Gyekenyesi**, NASA Glenn Research Ctr.; **David K. Hsu**, Iowa State Univ.; **Carol A. Nove**, Air Force Research Lab.; **Chiaki Miyasaka**, The Pennsylvania State Univ.; **Graham H. Thomas**, Lawrence Livermore National Lab.; **Bernhard R. Tittmann**, The Pennsylvania State Univ.

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Volume 4336

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## Conference 4337

**Room: Pacific Ballroom B**  
Tuesday–Thursday 6–8 March 2001  
*Proceedings of SPIE* Vol. 4337

### Health Monitoring and Management of Civil Infrastructure Systems

*Conference Chairs:* **Steven B. Chase**, Federal Highway Administration; **A. Emin Aktan**, Drexel Univ.

*Cochairs:* **Dryver R. Huston**, Univ. of Vermont; **Darryll J. Pines**, Univ. of Maryland/College Park

*Program Committee:* **Serafim G. Arzoumanidis**, Steinman, Boynton, Gronquist & Birdsall; **Thomas Baca**, Sandia National Labs; **Robert A. Box**, Delaware River Port Authority; **Martin P. Burke, Jr.**, Burgess & Niple, Ltd.; **Fu-Kuo Chang**, Stanford Univ.; **Ken P. Chong**, National Science Foundation; **Scott Christie**, PennDOT; **Louise K. Comfort**, Univ. of Pittsburgh; **Charles R. Farrar**, Los Alamos National Lab.; **Dan M. Frangopol**, Univ. of Colorado/Boulder; **Yozo Fujino**, Univ. of Tokyo (Japan); **Hamid Ghasemi**, **David Gibson**, Federal Highway Administration; **Vijaya K. Gopu**, National Science Foundation; **Nicholas P. Jones**, Johns Hopkins Univ.; **JanMing Ko**, Hong Kong Polytechnic Univ. (Hong Kong); **John Kulicki**, Modjeski & Masters, Inc.; **Richard Livingstone**, Federal Highway Administration; **Aftab A. Mufti**, ISIS Canada/Univ. of Manitoba (Canada); **Madhwesh Raghavendrachar**, **James Roberts**, Caltrans; **Peter Schwesinger**, Bauhaus Univ. (Germany); **Masanobu Shinozuka**, Univ. of Southern California; **Glenn A. Washer**, Federal Highway Administration; **Bojidar Yanev**, New York City DOT

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# NDE for Health Monitoring and Diagnostics

Conference 4335

Room: Yawl

Conference 4336

Room: Pacific Ballroom E

Conference 4337

Room: Pacific Ballroom B

**Tuesday 6 March 2001**

8:00 to 8:45 am • Pacific Ballroom E

**NDE Lifetime Achievement Award**

*Plenary Presentation*

**NDE Emerging Technologies, Challenges, and Trends**

*Speaker: Dr. Yoseph Bar-Cohen*

Coffee Break ..... 8:45 to 9:20 am

**SESSION 1**

**Room: Yawl**

**Tues. 9:20 am**

*Chairs: Tribikram Kundu, Univ. of Arizona; Dominique Placko, Ecole Normale Supérieure de Cachan (France)*

9:20 am: **Integrated structural health monitoring**, C. R. Farrar, H. Sohn, M. L. Fugate, Los Alamos National Lab. .... [4335-01]

9:40 am: **Conductive polymer sensor arrays: a new approach for structural health monitoring**, J. N. Schoess, Honeywell Technology Ctr. .... [4335-02]

10:00 am: **Surface-mounted periodic field eddy current sensors for structural health monitoring**, N. J. Goldfine, V. A. Zilberstein, D. E. Schlicker, A. P. Washabaugh, JENTEK Sensors, Inc. .... [4335-04]

10:20 am: **Honeywell chip FTIR for on-line oil quality monitoring**, J. G. Droessler, Honeywell Technology Ctr. .... [4335-05]

10:40 am: **FBG Sensors for structural health monitoring**, K. Chang, T. K. Lin, Y. B. Lin, National Taiwan Univ. (Taiwan) ... [4335-06]

11:00 am: **Nondestructive imaging with mercuric iodide thick film x-ray detectors**, M. M. Schieber, Hebrew Univ. of Jerusalem (Israel) and Sandia National Labs.; H. Hermon, Real Time Radiography Readout (Israel); R. A. Street, S. E. Ready, Xerox Palo Alto Research Ctr.; A. Zuck, Hebrew Univ. of Jerusalem and Real Time Radiography Readout (Israel); A. I. Vilensky, Real Time Radiography Readout (Israel); L. Melekhov, Hebrew Univ. of Jerusalem and Real Time Radiography Readout (Israel); R. Shatunovsky, Real Time Radiography Readout (Israel); M. Lukach, Hebrew Univ. of Jerusalem and Real Time Radiography Readout (Israel); E. Meerson, Real Time Radiography Readout (Israel); Y. Saado, Hebrew Univ. of Jerusalem and Real Time Radiography Readout (Israel); E. Pinkhasy, Real Time Radiography Readout (Israel) ..... [4335-07]

11:20 am: **Theoretical study of magnetic and ultrasonic sensors: dependence of magnetic potential and acoustic pressure on the sensor geometry**, D. Placko, Ecole Normale Supérieure de Cachan (France); T. Kundu, Univ. of Arizona ..... [4335-08]

Lunch/Exhibit Break .... 11:40 am to 1:30 pm

**Opening Remarks**

**Steven B. Chase**, Federal Highway Administration; **A. Emin Aktan**, Drexel Univ.

**SESSION 1**

**Room: Pacific Ballroom B**

**Tues. 9:20 am**

**CIS Health Monitoring: Opportunities and Challenges**

*Chairs: Rae Zimmerman, New York Univ.; Detlof von Winterfeldt, Univ. of Southern California*

9:20 am: **Health monitoring and earthquake disaster mitigation**, M. Shinozuka, Univ. of Southern California ..... [4337-01]

9:40 am: **Information management for complex dynamic systems**, L. K. Comfort, Univ. of Pittsburgh ..... [4337-02]

10:00 am: **Performance measurement for infrastructure asset management decision outcomes**, D. von Winterfeldt, Univ. of Southern California; R. Zimmerman, New York Univ. .... [4337-03]

10:20 am: **Performance-based engineering and CIS health monitoring**, A. Aktan, Drexel Univ.; M. Shinozuka, Univ. of Southern California; A. Kareem, Univ. of Notre Dame; M. Q. Feng, Univ. of California/Irvine; M. L. Wang, Univ. of Illinois/Chicago ..... [4337-04]

**SESSION 2**

**Room: Pacific Ballroom B**

**Tues. 10:40 am**

**Advances in Bridge Management**

*Chair: James Roberts, CalTrans*

10:40 am: **Bridge management for the 21<sup>st</sup> Century**, J. Roberts, Caltrans ..... [4337-05]

11:00 am: **VIRTIS: integrating load ratings with a bridge management system**, A. Gugino, Caltrans ..... [4337-06]

11:20 am: **Pontis 2000: a complete asset management system**, R. Shepard, Caltrans ..... [4337-07]

11:40 am: **NDE use in bridge inspection program**, E. C. Kaslan, Caltrans ... [4337-08]

Noon: **Managing the East River bridges in New York City**, E. E. Dubin, Federal Highway Administration; B. Yanev, New York City DOT ..... [4337-09]

Lunch/Exhibit Break ..... 12:20 to 1:30 pm

# NDE for Health Monitoring and Diagnostics

## Conference 4335

Room: Yawl

## Conference 4336

Room: Pacific Ballroom E

## Conference 4337

Room: Pacific Ballroom B

**Tuesday 6 March 2001**

### SESSION 2

Room: Yawl

Tues. 1:30 pm

*Chairs:* Jaswinder S. Sandhu,  
Santec Systems, Inc.;

Kam W. Ng, Office of Naval Research

1:30 pm: **Development of a structurally compatible embedded sensor element**, S. M. Walsh, U. S. Army Research Lab.; J. C. Butler, R. Lawler, American Competitiveness Institute; J. H. Belk, Boeing Phantom Works . . . [4335-09]

1:50 pm: **Wireless subsurface microsensors for health monitoring of thermal protection systems on hypersonic vehicles**, F. S. Milos, J. B. Pallix, NASA Ames Research Ctr. . . . [4335-10]

2:10 pm: **Structural damage detection and estimation using a scanning laser vibrometer**, P. F. Pai, S. Y. Lee, Univ. of Missouri/Columbia; M. J. Schulz, North Carolina A&T State Univ. . . . . [4335-12]

2:30 pm: **Development of acoustography for aging aircraft structures**, J. S. Sandhu, H. Wang, W. J. Popek, Santec Systems, Inc.; P. J. Sincebaugh, U. S. Army Research Lab. [4335-13]

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

### SESSION 3

Room: Yawl

Tues. 3:40 pm

*Chairs:* Yoseph Bar-Cohen,  
Jet Propulsion Lab.; Ajit K. Mal, Univ. of California/Los Angeles

3:40 pm: **Some recent developments of subsurface and surface sensors for NDE of pavements**, C. Nguyen, S. T. Kim, J. S. Park, J. S. Lee, Texas A&M Univ. . . . . [4335-14]

4:00 pm: **Health monitoring of FRP bridge decks**, M. Miceli, J. C. Duke, Jr., M. R. Horne, Virginia Polytechnic Institute and State Univ. . . . . [4335-15]

4:20 pm: **Innovative frequency-dependent amplitude attenuation characteristics technique (FACT) for ultrasonic nondestructive evaluation on concrete**, J. W. Ju, L. Weng, Univ. of California/Los Angeles . . . . . [4335-16]

4:40 pm: **Combined use of GPS and FEM as a new large-scale civil structure monitoring tool**, M. Meo, Cranfield Univ. (UK) . . . . . [4335-17]

5:00 pm: **Damage identification tests of five-story steel frame with simulated damages**, K. Morita, M. Teshigawara, H. Isoda, Building Research Institute (Japan); T. Hamamoto, Musashi Institute of Technology (Japan); A. Mita, Keio Univ. (Japan) . . . . . [4335-18]

### SESSION 3

Room: Pacific Ballroom B

Tues. 1:30 pm

### FHWA Research Programs on Advanced Technologies for the Highway Transportation Infrastructure

*Chair:* Steven B. Chase,  
Federal Highway Administration

1:30 pm: **FHWA's program on asset management**, To Be Determined, Federal Highway Administration . . . . . [4337-10]

1:50 pm: **FHWA's program on intelligent transportation systems**, To Be Determined, Federal Highway Administration . . . . [4337-11]

2:10 pm: **FHWA's program on infrastructure: limitation on visual inspection**, To Be Determined, Federal Highway Administration . . . . . [4337-12]

2:30 pm: **FHWA's program on infrastructure: NDE technologies for structures**, To Be Determined, Federal Highway Administration . . . . . [4337-13]

2:50 pm: **FHWA's program on infrastructure: NDE technologies for pavements**, To Be Determined, Federal Highway Administration . . . . . [4337-14]

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

### SESSION 4

Room: Pacific Ballroom B

Tues. 3:40 pm

### Health Monitoring and Durability

*Chair:* Ken P. Chong,  
National Science Foundation

3:40 pm: **Flying blind: designing and maintaining jointed concrete pavement without monitoring pavement pressure generation**, M. P. Burke, Jr., Burgess & Niple, Ltd. . . . . [4337-15]

4:00 pm: **Monitoring durability of new concrete bridge decks**, H. M. Aktan, I. O. Yaman, Wayne State Univ.; J. F. Staton, Michigan Department of Transportation . . . . . [4337-16]

4:20 pm: **Diffuse ultrasonics for inspection of concrete**, J. A. Turner, Univ. of Nebraska/Lincoln . . . . . [4337-17]

4:40 pm: **Damage detection in beams based on redistribution of dead load**, H. W. Shenton III, X. Hu, Univ. of Delaware . . . . . [4337-18]

5:00 pm: **Real-time health monitoring of civil infrastructure systems in Colombia**, P. Thomson, J. Marulanda Casas, J. Marulanda Arbelaez, Univ. del Valle (Colombia); J. Caicedo, Washington Univ. . . . . [4337-19]

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# NDE for Health Monitoring and Diagnostics

Conference 4335

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**Tuesday 6 March 2001**

## ✓ Posters—Tuesday

*The following posters will be displayed in the formal poster session on Tuesday evening between 6:00 and 7:30 pm. Authors will be present at this time for discussion. Poster authors will be able to set up their poster papers between 9 am and 3:00 pm Tuesday. Poster papers can be previewed after 3 pm before the formal poster session begins at 6 pm.*

✓ **Affordable DPC ultrasonic transducers: design and applications**, E. G. Nesvijski, Univ. Federal de Santa Maria (Brazil) . . . . . [4335-54]

✓ **Numerical study of crack detection based on microwave-induced heating and thermography**, Q. Z. Jackson, T. H. Jackson, Purdue Univ.; A. Ungan, Indiana Univ./Purdue Univ. Indianapolis . . . . . [4335-55]

✓ **Fiber optic acoustic emission sensors for harsh environment health monitoring**, J. W. Borinski, Luna Innovations, Inc.; J. C. Duke, Jr., M. R. Horne, Virginia Polytechnic Institute and State Univ. . . . . [4335-58]

✓ **Evaluation of the detectability of the eddy current method under carbon epoxy composite patches**, Z. P. Marioli-Riga, Hellenic Aerospace Industry Ltd. (Greece); G. J. Tsamasphyros, G. N. Kanderakis, N. K. Fumarakis, National Technical Univ. of Athens (Greece) . . . . . [4336-34]

✓ **Biocompatible gradient ceramic coatings for the metal implants**, J. P. Sharkany, M. Y. Sichka, A. M. Potapchuk, Uzhgorod State Univ. (Ukraine); I. S. Lemko, J. L. Pintye, Scientific-Practical Organization (Ukraine) . . . . . [4336-35]

✓ **Innovation of x-ray frequency multiplier for radiotherapy**, B. Mallick, Regional Engineering College (India) . . . . . [4336-36]

✓ **Nondestructive control of stress-strained state for pipelines using the internal radius change data**, A. Olijnik, L. Zamikhovsky, Ivano-Frankivsk State Technical Univ. of Oil and Gas (Ukraine); V. Ivanyshyn, Dolina UMG Co. (Ukraine) . . . . . [4336-37]

✓ **Measurement design issues for infrastructure health monitoring**, K. A. Grimmelsman, R. A. Barrish, Jr., F. N. Catbas, A. E. Aktan, Drexel Univ. [4337-61]

✓ **Network integration for distributed data acquisition and control**, M. Pervizpour, J. M. Curtis, Drexel Univ.; O. Cinar, Illinois Institute of Technology; A. E. Aktan, Drexel Univ. . . . . [4337-62]

✓ **Data management for infrastructure health monitoring**, X. Qin, K. Shen, R. A. Barrish, Jr., A. E. Aktan, Drexel Univ. . . . . [4337-63]

✓ **Use of artificial intelligence for infrastructure health monitoring**, X. Qin, K. Shen, N. Catbas, A. E. Aktan, Drexel Univ. . . . . [4337-64]

✓ **Issues in fleet health monitoring of aged reinforced concrete bridges**, N. Catbas, K. Ciloglu, N. Ding, B. Duroseau, A. E. Aktan, Drexel Univ. . . . . [4337-65]

✓ **Fiber grating sensor systems for traffic monitoring**, E. Udd, J. M. Seim, W. L. Schulz, Blue Road Research; S. M. Soltész, Oregon Dept. of Transportation; H. M. Laylor, Oregon Dept. of Transportation and Blue Road Research . . . . . [4337-66]

*Oral Standby/Poster Presentation*

✓ **To Be Determined**, S. Sumitomo, Keisoku Research Consultant Co. (Japan) [4337-67]



# NDE for Health Monitoring and Diagnostics

## Conference 4335

Room: Yawl

## Conference 4336

Room: Pacific Ballroom E

## Conference 4337

Room: Pacific Ballroom B

Wednesday 7 March 2001

Plenary Presentation ..... 8:00 to 8:45 am

### The Role of Smart Structures in Managing an Aging Highway Infrastructure

Speaker: Steven B. Chase, Federal Highway Administration

Coffee Break ..... 8:45 to 9:20 am

#### SESSION 4 Room: Yawl Wed. 9:20 am

Chairs: Roy Ikegami, Boeing Phantom Works; Jianmin Qu, Georgia Institute of Technology

9:20 am: **Source characterization through acoustic emission waveform analysis**, A. K. Mal, Univ. of California/Los Angeles; S. Glaser, Univ. of California/Berkeley ..... [4335-19]

9:40 am: **Residue detection for real-time removal of paint from metallic surfaces**, Y. Bar-Cohen, X. Bao, B. P. Dolgin, N. I. Marzwell, Jet Propulsion Lab. .... [4335-20]

10:00 am: **Defect detection in thin plates using So Lamb wave scanning**, F. De Villa, E. Roldan, C. Tirado, S. Nazarian, R. A. Osegueda, Univ. of Texas/El Paso ..... [4335-21]

10:20 am: **Electro-mechanical impedance method for crack detection in aluminum plates**, V. Giurgutiu, A. Zagrai, Univ. of South Carolina ..... [4335-22]

10:40 am: **Effect of bending on ultrasonic preload measurements in bolts**, A. M. Koshti, Boeing Reusable Space Systems ... [4335-23]

11:00 am: **Continuous health monitoring of graphite epoxy motorcases (GEM)**, R. D. Finlayson, Physical Acoustics Corp.; D. T. Schaafsma, Tetra Tech Data Systems Inc.; R. K. Miller, P. E. Finkel, Physical Acoustics Corp.; B. Shepherd, U.S. Air Force/Los Angeles ..... [4335-24]

11:20 am: **Nondestructive techniques in the investigation of aircraft materials: determination of defects and patches assessment**, A. Moropoulou, N. P. Avdelidis, G. Haralampopoulos, National Technical Univ. of Athens (Greece); Z. P. Marioli-Riga, Hellenic Aerospace Industry Ltd. (Greece) .. [4335-25]

11:40 am: **Hybrid global-local identification for structural health monitoring**, C. G. Koh, C. Y. Liaw, Y. Chen, National Univ. of Singapore ..... [4335-26]

Exhibit/Lunch Break ..... Noon to 1:30 pm

#### SESSION 1 Room: Pacific Ballroom E Wed. 9:20 am

### Damage Detection in Polymer Matrix Composites

Chairs: Steven M. Shepard, Thermal Wave Imaging, Inc.; David K. Hsu, Iowa State Univ.

9:20 am: **Sensor-based damage detection in composite materials**, S. J. Kessler, S. M. Spearing, M. J. Atalla, N. W. Hagood, C. E. Cesnik, Massachusetts Institute of Technology [4336-01]

9:40 am: **Assessing inspection sensitivity as it relates to damage tolerance in composite rotor hubs**, D. P. Roach, K. Rackow, Sandia National Labs. .... [4336-02]

10:00 am: **Ultrasonic spectroscopy of flywheel composite material systems**, L. M. Harmon, Cleveland State Univ.; G. Y. Baaklini, NASA Glenn Research Ctr. .... [4336-03]

10:20 am: **Scanning ultrasonic spectroscopy for composite flywheels**, R. E. Martin, Cleveland State Univ. and NASA Glenn Research Ctr.; G. Y. Baaklini, NASA Glenn Research Ctr. .... [4336-04]

10:40 am: **Integrated NDE and FEM characterization of composite rotors**, A. Abdul-Aziz, Cleveland State Univ. and NASA Glenn Research Ctr.; G. Y. Baaklini, J. J. Trudell, NASA Glenn Research Ctr. .... [4336-05]

11:00 am: **Effect of matrix toughness on fatigue life of plain woven carbon fabric composites**, Y. Nishikawa, T. Fujii, K. Okubo, Doshisha Univ. (Japan); T. Uenoya, Technology Research Institute of Osaka Prefecture (Japan) ..... [4336-06]

11:20 am: **NDE comparison of damages in graphite/epoxy composites by electromagnetic methods**, R. Grimberg, National Institute of Research & Development for Technical Physics (Romania); D. Premel, Ecole Normale Supérieure de Cachan (France); M. Lemistre, D. L. Balageas, ONERA (France); D. Placko, Ecole Normale Supérieure de Cachan (France) . . . . [4336-07]

Lunch/Exhibit Break ..... 11:40 am to 1:30 pm

#### SESSION 5 Room: Pacific Ballroom B Wed. 9:20 am

### Innovative Health Monitoring Technologies I

Chair: Ming L. Wang, Univ. of Illinois/Chicago

9:20 am: **Development of a remote coil magnetoelastic stress sensor for steel cables**, M. L. Wang, G. M. Lloyd, O. Havorka, Univ. of Illinois/Chicago ..... [4337-20]

9:40 am: **Acoustic dispersive behavior and acoustic emission monitoring of CFRP cables for cable-stayed bridges**, F. Lanza di Scalea, P. Rizzo, Univ. of California/San Diego [4337-21]

10:00 am: **Instrumentation of bridges for long-term performance monitoring**, M. Q. Feng, D. K. Kim, Univ. of California/Irvine; L. H. Sheng, California Dept. of Transportation; Y. J. Kim, Univ. of California/Irvine; L. M. Fiji, California Dept. of Transportation ..... [4337-23]

10:20 am: **Wireless inspection of structures aided by robots**, D. R. Huston, N. V. Pelczarski, B. Esser, G. Gaida, Univ. of Vermont; S. W. Arms, C. P. Townsend, MicroStrain, Inc. . . [4337-24]

#### SESSION 6 Room: Pacific Ballroom B Wed. 10:40 am

### Innovative Health Monitoring Technologies II

Chairs: Peter Schwesinger, Bauhaus-Univ. Weimar (Germany); Yozo Fujino, Univ. of Tokyo (Japan)

10:40 am: **Development of interactive support system for visual inspection of bridges**, Y. Mizuno, M. Abe, Y. Fujino, Univ. of Tokyo (Japan); M. Abe, BMC Corp. (Japan) [4337-25]

11:00 am: **Detection of structural damage by ambient vibration measurement using laser Doppler vibrometer**, K. Kaito, M. Abe, Y. Fujino, H. Yoda, Univ. of Tokyo (Japan) . . . [4337-26]

11:20 am: **BELFA: an intelligent loading truck for rationalization of the advanced test method EXTRA**, P. Schwesinger, G. Bolle, B. Thor, Bauhaus-Univ. Weimar (Germany) . [4337-27]

11:40: **New generation of the health monitoring system SMS 2001**, R. D. Berndt, Infokom GmbH Neubrandenburg (Germany); P. Schwesinger, Bauhaus-Univ. Weimar (Germany) . [4337-28]

12:00 pm: **Bridge management strategy for a steel plate girder bridge based on minimum total cost**, K. Kaito, Univ. of Tokyo (Japan); M. Abe, BMC Corp. (Japan); Y. Fujino, Univ. of Tokyo (Japan) ..... [4337-29]

Lunch/Exhibit Break ..... 12:20 to 1:30 pm

## Caribbean Reception

Wednesday 7 March  
7:00 pm

All symposium attendees are invited to relax, socialize, and enjoy refreshments and a Caribbean buffet-style dinner in the Pacific Ballroom. Dress is casual and please wear your conference registration badge.

# NDE for Health Monitoring and Diagnostics

## Conference 4335

Room: Yawl

## Conference 4336

Room: Pacific Ballroom E

## Conference 4337

Room: Pacific Ballroom B

Wednesday 7 March 2001

### SESSION 5

Room: Yawl

Wed. 1:30 pm

*Chairs:* Alison B. Flatau, National Science Foundation; Victor Giurgiutiu, Univ. of South Carolina

1:30 pm: **Ultrasonic response to material fatigue**, Y. Jung, T. Kundu, M. R. Ehsani, Univ. of Arizona ..... [4335-28]

1:50 pm: **Optical fiber-based adhesive bondline monitoring systems for composite patch systems**, J. L. Elster, Luna Innovations, Inc.; A. Trego, Boeing Phantom Works; J. F. Dante, Univ. of Dayton Research Institute; J. Avram, U.S. Air Force Materials Directorate; M. E. Jones, Luna Innovations, Inc. .... [4335-30]

2:10 pm: **Propagation characteristics of guided waves in layered elastic orthotropic materials**, J. A. Sotiropoulos, Southern Polytechnic State Univ.; S. Nair, Illinois Institute of Technology ..... [4335-59]

### SESSION 6

Room: Yawl

Wed. 2:30 pm

*Chairs:* George A. Matzkanin, Nondestructive Testing Information Analysis Center; Shiv P. Joshi, Univ. of Texas/Arlington

2:30 pm: **Propagation of ultrasonic waves in nonlinear materials**, J. Qu, T. Meurer, L. J. Jacobs, Georgia Institute of Technology [4335-32]

2:50 pm: **Nonlinear waves in elastic layers**, C. Cetinkaya, C. Li, Clarkson Univ. ... [4335-33]

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

3:40 pm: **Nondestructive characterization of the mechanical properties of thin diaphragms**, A. K. Mal, Univ. of California/Los Angeles; D. W. Zheng, Intel Corp.; K. N. Tu, Y. Xu, Univ. of California/Los Angeles; X. Wang, K. K. Shyu, C. T. Chang, Microstress Technology .. [4335-34]

4:00 pm: **Nonlinear active wave modulation approach for microdamage detection**, H. C. Wu, K. Warmemuende, Wayne State Univ. [4335-35]

4:20 pm: **Wireless microsensors for health monitoring of structures**, V. K. Varadan, V. V. Varadan, The Pennsylvania State Univ. .... [4335-36]

### SESSION 2

Room: Pacific Ballroom E

Wed. 1:30 pm

#### Thermal NDE and Corrosion Monitoring and Evaluation

*Chairs:* Andrew L. Gyekenyesi, Ohio Aerospace Institute; Carol A. Nove, Air Force Research Lab.

1:30 pm: **NDE of America's cup yachts (Invited Paper)**, R. L. Predmesky, M. J. Zaluzec, Ford Motor Co. .... [4336-08]

2:10 pm: **Quantification and automation of pulsed thermographic NDE**, S. M. Shepard, J. R. Lhota, T. Ahmed, Thermal Wave Imaging, Inc. .... [4336-09]

2:30 pm: **Corrosion monitoring system**, R. Braunling, S. Menon, Honeywell Technology Ctr.; G. Whittaker, Whittaker Materials Engineering Associates, LLC; D. F. Wilson, Oak Ridge National Labs. .... [4336-10]

2:50 pm: **Acoustic and thermographic evaluation of polymeric corrosion protective coatings on aluminum alloy airframe structures**, J. Hoffmann, S. Sathish, N. Meyendorf, Univ. of Dayton ..... [4336-11]

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

### SESSION 3

Room: Pacific Ballroom E

Wed. 3:40 pm

#### NDE of Repairs and Applicable Techniques

*Chair:* Peter J. Shull, Chiaki Miyasaka, The Pennsylvania State Univ.

3:40 pm: **Ultrasonic characterization of shot peened metal surfaces**, A. Lavrentyev, W. Veronesi, United Technologies Research Ctr. .... [4336-39]

4:00 pm: **NDE of repairs on aircraft composite structures**, D. K. Hsu, D. J. Barnard, J. J. Peters, Iowa State Univ. .... [4336-13]

4:20 pm: **New nondestructive evaluation method of laminated composite structures by tapping sound analysis**, S. J. Kim, J. S. Hwang, Seoul National Univ. (Korea) ..... [4336-14]

4:40 pm: **Material characterization by depth-sensing impedance measurement**, Y. Xie, S. F. Ling, Nanyang Technological Univ. (Singapore) ..... [4336-15]

### SESSION 7

Room: Pacific Ballroom B

Wed. 1:30 pm

#### Intelligent Sensing for Intelligent Structures - ISIS Canada Research

*Chairs:* Aftab A. Mufti, ISIS Canada/Univ of Manitoba (Canada); Rod C. Tennyson, Univ. of Toronto (Canada)

1:30 pm: **Fiber optics sensing for civil infrastructures**, R. C. Tennyson, Univ. of Toronto (Canada); A. A. Mufti, ISIS Canada/Univ of Manitoba (Canada); K. Neale, Univ. de Sherbrooke (Canada) ..... [4337-30]

1:50 pm: **Structural health monitoring of innovative bridge decks**, A. A. Mufti, ISIS Canada/Univ of Manitoba (Canada); B. Bakht, JMBT Structures Research, Inc. (Canada); G. Tadros, SPECO, Inc. (Canada); J. P. Newhook, Univ. of Calgary (Canada) ..... [4337-31]

2:10 pm: **Strain measurement with the distributed Brillouin scattering sensor in field applications**, X. Y. Bao, Ottawa Univ. (Canada); M. D. DeMerchant, Univ. of New Brunswick (Canada) ..... [4337-32]

2:30 pm: **Monitoring of Hall's harbor marine wharf**, J. P. Newhook, Univ. of Calgary (Canada) ..... [4337-33]

2:50 pm: **Archival of data from monitoring of innovative structures**, J. Humar, Carleton Univ. (Canada) ..... [4337-34]

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

### SESSION 8

Room: Pacific Ballroom B

Wed. 3:40 pm

#### Innovative Health Monitoring Technologies III

*Chair:* Madhwesh Raghavendrachar, Caltrans

3:40 pm: **Health monitoring of the new Benicia Martinez bridge**, G. Murugesu, Caltrans ..... [4337-35]

4:00 pm: **Post-earthquake bridge damage assessment efforts**, E. C. Kaslan, Caltrans ..... [4337-36]

4:20 pm: **Seismic performance and retrofit of reinforced concrete bridge structures**, C. Pulido, M. Saiidi, D. H. Sanders, A. M. Itani, Univ. of Nevada ..... [4337-37]

4:40 pm: **Temperature monitoring of steel bridges**, F. T. K. Au, L. G. Tham, M. Tong, P. K. K. Lee, Univ. of Hong Kong; K. Y. Wong, Hong Kong SAR Government (Hong Kong) [4337-38]

# NDE for Health Monitoring and Diagnostics

Conference 4335

Room: Yawl

Conference 4336

Room: Pacific Ballroom E

Conference 4337

Room: Pacific Ballroom B

**Thursday 8 March 2001**

**8:00 to 8:45 am • Pacific Ballroom E**  
**NDE Best Paper 2000 Award**  
*Plenary Presentation*  
**Health Monitoring and Diagnostics of Civil Infrastructures**  
*Speaker: Dr. Ken P. Chong, National Science Foundation*  
 Coffee Break ..... 8:45 to 9:20 am

**SESSION 7**  
**Room: Yawl**  
**Thurs. 9:20 am**

*Chairs: Jürgen Bereiter-Hahn, J.W. Goethe Univ. (Germany); Claus S. Jørgensen, Århus Univ. Hospital/Skejby Univ. Hospital (Denmark)*

9:20 am: **Evaluation of the mechanics of atherosclerosis by acoustic microscopy**, Y. Saijo, Tohoku Univ. (Japan); C. S. Jørgensen, Århus Univ. Hospital and Skejby Univ. Hospital (Denmark); E. Falk, Århus Univ. Hospital (Denmark); S. Nitta, Tohoku Univ. (Japan) ..... [4335-37]

9:40 am: **Characterization of cytogels using acousto-microscopy-based oscillating rod rheometry**, J. Bereiter-Hahn, O. Wagner, J.W. Goethe Univ. (Germany) ..... [4335-38]

10:00 am: **Measurement of material properties of hard and soft biological tissues by means of V(z) and V(f) curves obtained with acoustic microscopy**, C. S. Jørgensen, Århus Univ. Hospital and Skejby Univ. Hospital (Denmark); T. Kundu, Univ. of Arizona ..... [4335-39]

10:20 am: **Scanning acoustic microscopy reveals distinct motility domains in living cells**, J. Bereiter-Hahn, I. Karl, S. Pohl, J.W. Goethe Univ. (Germany); P. Vesely, Institute of Molecular Genetics (Czech Republic) [4335-40]

10:40 am: **Detection of defects in the liver using ultrasonograms and 3D images**, R. V. Kumar, Univ. of Madras (India) ..... [4335-41]

11:00 am: **Nanoscale ultrasonic monitoring of biological samples**, A. Daugela, Hysitron, Inc.; M. Kohane, Durand Co.; H. Kutomi, T. J. Wyrobek, J. T. Wyrobek, Hysitron, Inc. .... [4335-42]

11:20 am: **High-performance surface acoustic wave sensors for liquid environments**, M. Weihnacht, Institute for Solid State and Materials Research (Germany); F. Herrmann, Robert Bosch Corp. .... [4335-43]

Lunch Break ..... 11:40 am to 1:30 pm

**SESSION 4**  
**Room: Pacific Ballroom E**  
**Thurs. 9:20 am**

**Development of Methods and Sensors**

*Chairs: Norbert Meyendorf, Univ. of Dayton; Graham H. Thomas, Lawrence Livermore National Lab.*

9:20 am: **High-frequency noncontact ultrasonic analysis of materials: introduction and applications (Invited Paper)**, M. C. Bhardwaj, G. F. Stead, SecondWave Systems . . . [4336-16]

9:40 am: **Acoustography: it could be a practical ultrasonic NDE tool for composites**, J. S. Sandhu, H. Wang, W. J. Popek, Santeq Systems, Inc.; P. J. Sincebaugh, Army Research Lab. . . . [4336-17]

10:00 am: **Theoretical approach to the contrast mechanism for U-AFM**, T. Adachi, Tokyo Institute of Technology (Japan); C. Miyasaka, J. Du, B. R. Tittmann, The Pennsylvania State Univ. .... [4336-18]

10:20 am: **Applicability of near-field scanning interferometry for high-resolution characterization of transducers and surface defects**, V. Kramb, J. L. Blackshire, S. Sathish, N. Meyendorf, Univ. of Dayton . . . [4336-19]

10:40 am: **Effect of thermally induced strain on optical fiber sensor embedded in cement-based composites**, L. Yuan, Harbin Engineering Univ. (China); L. M. Zhou, W. Jin, A. K. Lau, Hong Kong Polytechnic Univ. (Hong Kong) . . . . [4336-20]

11:00 am: **Design and modeling of signals by using wavelets for the pulse-echo NDT approaches**, L. Shi, B. Chen, C. Gao, B. Zhou, Nanjing Engineering Institute (China) [4336-21]

11:20 pm: **Elastic constants of "Pinus radiata D. Don" by means of ultrasound transmission techniques**, E. Baradit, C. Fuentealba, Univ. del Bío-Bío (Chile) ..... [4336-22]

Lunch Break ..... 12:25 to 1:30 pm

**SESSION 9**  
**Room: Pacific Ballroom B**  
**Thurs. 9:20 am**

**Health Monitoring Research in Hong Kong I**

*Chair: JanMing Ko, Hong Kong Polytechnic Univ. (Hong Kong)*

9:20 am: **Monitoring of wind effects and responses for cable-supported bridges in Hong Kong**, K. Y. Wong, W. Y. K. Chan, K. L. Man, Hong Kong SAR Government (Hong Kong) ..... [4337-39]

9:40 am: **Field study on moving force identification**, T. H. T. Chan, Hong Kong Polytechnic Univ. (Hong Kong); T. H. Yung, T. Y. Lin Consulting Engineers, Ltd. (Hong Kong); S. S. Law, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4337-40]

10:00 am: **GIS for bridge health monitoring in Hong Kong**, W. Z. Shi, J. M. Ko, Y. C. Pang, S. H. Siu, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4337-41]

10:20 am: **Buffeting of a long suspension bridge: analysis and field measurement**, L. D. Zhu, Y. L. Xu, Hong Kong Polytechnic Univ. (Hong Kong); F. Zhang, H. F. Xiang, Tongji Univ. (China) ..... [4337-42]

10:40 am: **Fatigue evaluation for Tsing Ma Bridge using structural health monitoring data**, T. H. T. Chan, J. M. Ko, Hong Kong Polytechnic Univ. (Hong Kong); Z. Y. Li, Southeast Univ. (China); K. Y. Wong, C. K. Lau, Hong Kong SAR Government (Hong Kong) ..... [4337-43]

**SESSION 10**  
**Room: Pacific Ballroom B**  
**Thurs. 11:00 am**


**Health Monitoring Research in Hong Kong II**

*Chair: JanMing Ko, Hong Kong Polytechnic Univ. (Hong Kong)*

11:00 am: **Application of adaptive probabilistic neural network to damage detection of Tsing Ma Suspension Bridge**, Y. Q. Ni, S. F. Jiang, J. M. Ko, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4337-44]

11:20 am: **Continuous condition assessment for bridges using wavelet-packets-based multiresolution analysis**, Z. Sun, C. C. Chang, Hong Kong Univ. of Science and Technology (Hong Kong) ..... [4337-45]

11:40 am: **Remote visualized health monitoring of cable-supported bridges**, J. M. Ko, Y. Q. Ni, Z. G. Sun, T. H. T. Chan, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4337-46]

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# NDE for Health Monitoring and Diagnostics

## Conference 4335

Room: Yawl

## Conference 4336

Room: Pacific Ballroom E

## Conference 4337

Room: Pacific Ballroom B

**Thursday 8 March 2001**

### SESSION 8

Room: Yawl

Thurs. 1:30 pm

*Chairs:* **Sridhar Krishnaswamy**, Northwestern Univ.; **Cetin Cetinkaya**, Clarkson Univ.

1:30 pm: **Laser-ultrasonic detection of hidden corrosion in aircraft structure**, D. Lévesque, M. Maroun, National Research Council Canada; M. Choquet, Tecnar Automation Ltée (Canada); J. Monchalin, National Research Council Canada . . . . . [4335-44]

1:50 pm: **Application of portable modules for fatigue crack characterization**, I. N. Komsky, Northwestern Univ. . . . . [4335-45]

2:10 pm: **Estimation of accuracy in ultrasonic preload measurements**, A. M. Koshti, Boeing Reusable Space Systems . . . . . [4335-46]

2:30 am: **Strain measurement using a Brillouin optical time domain reflectometer for development of aircraft structure health monitoring system**, T. Shimizu, T. Yari, K. Nagai, Mitsubishi Heavy Industries, Ltd. (Japan); N. Takeda, Univ. of Tokyo (Japan) . . [4335-47]

2:50 pm: **Distributed laser ultrasonic system for cure monitoring of composites**, P. A. Fomitchov, Y. K. Kim, A. K. Kromine, S. Krishnaswamy, J. D. Achenbach, I. M. Daniel, Northwestern Univ. . . . . [4335-48]

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

### SESSION 5

Room: Pacific Ballroom E

Thurs. 1:30 pm

#### Health Monitoring and Damage Detection in Superalloys and Ceramics

*Chairs:* **Ali Abdul-Aziz**, NASA Glenn Research Ctr.; **Eric S. Boltz**, Marathon Sensors Inc.

1:30 pm: **Rotor health monitoring and damage detection utilizing a disk spin simulation system**, A. L. Gyekenyesi, G. Y. Baaklini, NASA Glenn Research Ctr. . . . . [4336-23]

1:50 pm: **Nondestructive characterization of fatigue damage with thermography**, H. Rösner, Fraunhofer-Institut für Zerstörungsfreie Prüfverfahren (Germany); N. Meyendorf, S. Sathish, Univ. of Dayton . . . . . [4336-24]

2:10 pm: **Flank crack detection in locomotive wheels with NDE techniques**, M. Laczynski, R. Halter, B. R. Tittmann, The Pennsylvania State Univ. . . . . [4336-25]

2:30 pm: **Long distance leaky surface ultrasonic waves**, K. Joseph, B. R. Tittmann, The Pennsylvania State Univ. . . . . [4336-26]

2:50 pm: **Transient thermal deformation of alumina (Al<sub>2</sub>O<sub>3</sub>) substrate during laser drilling**, R. Halter, B. R. Tittmann, The Pennsylvania State Univ. . . . . [4336-27]

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

### SESSION 10 (cont.)

Room: Pacific Ballroom B

Thurs. 11:00 am

Noon: **Modal indices for identifying damage location in cable-stayed Kap Shui Mun Bridge**, Z. G. Sun, J. M. Ko, Y. Q. Ni, Hong Kong Polytechnic Univ. (Hong Kong) . . . . [4337-47]

12:20 pm: **Application of global positioning system to structural health monitoring of cable-supported bridges in Hong Kong**, K. Y. Wong, K. L. Man, C. K. Lau, Hong Kong SAR Government (Hong Kong) . . . . . [4337-48]

Lunch Break . . . . . 12:40 to 1:30 pm

### SESSION 11

Room: Pacific Ballroom B

Thurs. 1:30 pm

#### Innovative Health Monitoring Technologies IV

*Chair:* **Richard Livingstone**, Federal Highway Administration

1:30 pm: **Application of nonlinear dynamics analysis to damage detection and health monitoring of highway structures**, R. A. Livingston, S. Jin, Federal Highway Administration; D. Marzougui, George Washington Univ. . . . . [4337-49]

1:50 pm: **Lyapunov exponent maps applied to damage detection of aging nonlinear highway infrastructures**, S. Jin, R. A. Livingston, Federal Highway Administration; D. Marzougui, George Washington Univ. . . . . [4337-50]

2:10 pm: **Stochastic modeling of ambient traffic loadings in LS-DYNA nonlinear FEM analysis**, R. A. Livingston, S. Jin, Federal Highway Administration; D. Marzougui, George Washington Univ. . . . . [4337-51]

2:30 pm: **Nonlinear finite element analysis as a tool for health monitoring applications**, N. Ding, K. A. Grimmelmann, N. Catbas, A. E. Aktan, Drexel Univ. . . . . [4337-52]

2:50 pm: **Development of an LS-DYNA nonlinear finite element model for use in damage detection and health monitoring of highway bridges**, D. Marzougui, George Washington Univ.; S. Jin, R. A. Livingston, Federal Highway Administration . . . [4337-53]

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

# NDE for Health Monitoring and Diagnostics

## Conference 4335

Room: Yawl

## Conference 4336

Room: Pacific Ballroom E

## Conference 4337

Room: Pacific Ballroom B

Thursday 8 March 2001

### SESSION 9 Room: Yawl Thurs. 3:40 pm

*Chairs:* **Yuris A. Dzenis**,  
Univ. of Nebraska/Lincoln; **Kanji Ono**,  
Univ. of California/Los Angeles

3:40 pm: **Nondestructive evaluation of multilayered coatings via laser ultrasonic and AE source simulation techniques**, M. Takemoto, Aoyama Gakuin Univ. (Japan); H. Cho, Tohoku Univ. (Japan); H. Nishino, Aoyama Gakuin Univ. (Japan); K. Ono, Univ. of California/Los Angeles ..... [4335-49]

4:00 pm: **Shape correction of composite beams with SMA wires**, A. K. Maji, R. Rochin, Univ. of New Mexico ..... [4335-50]

4:20 pm: **Atomic force microscopy for high-resolution measurements of Young's modulus**, J. A. Turner, Univ. of Nebraska/Lincoln [4335-51]

4:40 pm: **Hybrid transient-parametric AE analysis of histories of damage micromechanisms in composites**, Y. A. Dzenis, J. Qian, Univ. of Nebraska/Lincoln . [4335-53]

5:00 pm: **Structural damage identification using piezoelectrics sensors**, N. Hu, H. Fukunaga, Tohoku Univ. (Japan) ..... [4335-57]

Conference 4335 ends ■

### SESSION 6 Room: Pacific Ballroom E Thurs. 3:40 pm

#### Cure Process Monitoring in Composites and Resins

*Chairs:* **Bernhard R. Tittmann**, The Pennsylvania State Univ.; **Richard E. Martin**, NASA Glenn Research Ctr.

3:40 pm: **Process monitoring of composites using multidetection techniques**, E. Chailleux, M. Salvia, N. Jaffrezic-Renault, Ecole Centrale de Lyon (France); Y. Jayet, A. Maazouz, Institut National des Sciences Appliquées de Lyon (France); G. Seytre, Univ. Claude Bernard (France); I. Kasik, Institute of Radio Engineering and Electronics (Czech Republic) .. [4336-28]

4:00 pm: **Curing behavior of polyvinyl acetate and urea formaldehyde resins by means of ultrasound monitoring**, E. Baradit, C. Fuentealba, A. Ballerini, Univ. del Bio-Bio (Chile) [4336-29]

4:20 pm: **Monitoring of fabrication strain and temperature during composite cure using fiber optic sensor**, C. S. Hong, H. K. Kang, D. H. Kang, C. G. Kim, Korea Advanced Institute of Science and Technology (Korea) ..... [4336-30]

4:40 pm: **Nondestructive evaluation of FRP composite bridge components using infrared thermography**, U. B. Halabe, West Virginia Univ.; H. AlQennah, RBA Group; H. V. S. GangaRao, P. Klinkhachorn, West Virginia Univ. [4336-38]

Conference 4336 ends ■

### SESSION 12 Room: Pacific Ballroom B Thurs. 3:40 pm

#### Innovative Applications of Health Monitoring I

*Chair:* **Dryver R. Huston**, Univ. of Vermont  
3:40 pm: **Full-scale study of the behavior of tall buildings under winds**, T. Kijewski, A. Kareem, Univ. of Notre Dame ..... [4337-54]

4:00 pm: **Application of SCADA technology to identify the affected area due to a break in water distribution systems**, J. W. Liang, Univ. of Southern California and Tianjin Univ.; M. Shinozuka, Univ. of Southern California; M. Q. Feng, Univ. of California/Irvine [4337-55]

4:20 pm: **Simultaneous monitoring of the amplitude and location of loading with embedded fiber Bragg grating sensor arrays**, Y. Wang, S. C. Tjin, X. M. Sun, P. Moyo, X. H. Zheng, J. M. Brownjohn, Nanyang Technological Univ. (Singapore) ..... [4337-56]

4:40 pm: **Analysis of long-term deformation data from the San Giorgio harbor pier in Genoa**, D. Inaudi, SMARTEC SA (Switzerland); A. E. Del Grosso, F. Lanata, Univ. degli Studi di Genova (Italy) ..... [4337-57]

5:00 pm: **Strain measurement in concrete structure using distributed fiber optic sensing based on Brillouin scattering with single-mode fiber embedded in glass rod**, C. Y. Chhoa, Univ. of New Brunswick (Canada); X. Bao, Ottawa Univ. (Canada); T. W. Bremner, M. D. DeMerchant, A. W. Brown, Univ. of New Brunswick (Canada); A. L. Kalamkarov, A. V. Georgiades, Dalhousie Univ. (Canada) ..... [4337-58]

5:20 pm: **Measurement of vibrations of tall buildings with GPS: a case study**, Y. Q. Chen, D. F. Huang, X. L. Ding, Y. L. Xu, J. M. Ko, Hong Kong Polytechnic Univ. (Hong Kong) ..... [4337-59]

5:40 pm: **Nondestructive evaluation and condition assessment of foundations**, L. D. Olson, Olson Engineering, Inc. .... [4337-60]

Standby

**Design and practice for the protection system for structure integrity monitoring of the smart civil structures**, J. S. Leng, G. R. A. Barnes, G. C. Mays, G. F. Fernando Royal Military College of Science (UK) ..... [4337-68]

Conference 4337 ends ■

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# NDE for Health Monitoring and Diagnostics

## Participants List

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Abe, Masato (4337-25)S6, (4337-26)S6  
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