Adaptive Structures & Material Systems

ASME & AIAA Adaptive Structures & Material Systems Newsletter Spring 2008

New Fall Conference

Chris Lynch, UCLA ■ The Adaptive Structures and Materials Systems Technical Committee (ASMS-TC) of the Aerospace Division of ASME and the AIAA Technical Committee on Adaptive Structures are pleased to collaborate and announce a new annual Fall conference:

Smart Materials, Adaptive Structures and Intelligent Systems

This conference is being spun off of the annual ASMS symposium held each year at ASME IMECE. The purpose of the conference is to continue the high impact growth of our field and lead it into the future. To achieve this, we are assembling world experts across engineering and scientific disciplines (mechanical, aerospace, electrical, materials, and civil engineering, biology, physics chemistry, etc) to actively discuss the latest breakthroughs in smart materials, cutting edge adaptive structure applications and recent advances in new device technologies and basic engineering research exploration.

Important Dates

May 3, 2008: 1000 word extended abstracts due

June 6, 2008: Authors informed of abstract acceptance

June 20, 2008: Copyright form due

Aug. 4, 2008: Final full-length paper due

Conference Sponsors

GM

Teledyne Scientific Company — A Teledyne Technologies Company

CSA Engineering

NextGen Aeronautics — Inventing Technologies for the Next 100 Years of Flight

The inaugural event will be held at the Turf Valley Resort, Ellicott City, MD on October 28-30, 2008. This beautiful, isolated retreat was chosen for an intimate, informal setting (no suits please!) that will promote active dialogue and collaboration while being very close to the BWI airport and within driving distance of Washington DC.

The conference will host three keynote speakers, Leo Christodoulou (DARPA), Daniel Inman (Virginia Tech), and Jay Kudva (NextGen Aeronautics). Each symposium will host several invited speakers who are noted experts in relevant fields. In addition, several special events are planned, including a Pioneer Banquet at which we will welcome back pioneers in the field and honor those currently blazing the path, a Karaoke reception, and other fun outings (golf, tours, etc).

This conference will host six symposia spanning the range of basic research, technological design and development, industrial and governmental integrated systems, and application demonstrations. The six symposia are:

Multifunctional Materials

Focuses on the development of materials (polymers, oxide single crystals and ceramics, metals, multiferroics, new materials systems)

Topical areas: Material formulations and evaluation, novel manufacturing technologies, material design and characterization, interface and interaction modeling

Pavel Chaplya, Zoubeida Ounaies

Diann Brei ■ Editor

Enabling Technologies and Integrated System Design

Focuses on the design processes and development of smart devices, active technologies and intelligent systems

Topical areas: Sensors and actuators, power and control electronics, smart devices and technologies, compliant mechanism design, adaptive / intelligent / integrated systems design, smart structures design processes and tools, Industrial and Government smart products and system applications, smart electronics and devices, MEMS

Mary Frecker, Nancy Johnson

Nonlinear Dynamics and Passive / Adaptive Controls

Focuses on the dynamic modeling, damping and control aspects of smart structures and their applications

Topical areas: Vibration and acoustic control, passive / semi-active / active damping, active control surfaces including shape control, structural sensors/ actuators / motion controllers, intelligent / adaptive controls, damped gyro-

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GM'S GLOBAL INITIATIVE ON AUTOMOTIVE APPLICATIONS OF SMART MATERIALS

Nancy L. Johnson (GM R&D) ■

The field of Smart Materials and Structures is evolving from high-end, one-of-a-kind products for medical, military and aerospace applications to the point of viability for mainstream, affordable, high volume products for automotive applications. For the automotive industry, there are significant potential benefits to be realized, including reduction in vehicle mass, added functionality and design flexibility, and decrease in component size and cost. General Motors has recognized the considerable potential benefits that the use of smart materials can bring to its products in terms of performance, unexpected functionalities, design features, and customer delight and satisfaction. In this regard it has established a global initiative termed "Mechamatronics" - the integration of smart materials with electronic controls and mechanical systems to provide innovative solutions to many of the complex problems facing the automotive industry. Members of GM's Global R&D Network who are involved in the Mechamatronics initiative include HRL - an affiliated Lab part owned by GM, GM's India Science Laboratory in Bangalore, a Collaborative Research Laboratory (CRL) with the University of Michigan (Profs. Diann Brei, John Shaw, Jonathan Luntz), contracts with multiple universities including University of Maryland (Prof. Norman Wereley), University of Waterloo (Prof. Robert Gorbet), IIT Chennai (Prof. Siva Kumar), and UCLA (Prof. Qibing Pei), and consulting and device development contracts with smart material developers/suppliers and the automotive supply industry. Thrust areas of the global Mechamatronics activity and CRL are smart material maturity, mechamatronic system design methodology, and smart device technology innovation. The seriousness of GM's commitment to this initiative is reflected in its over 50 issued patents in this area, with many more patent applications in place.

GM, through its global network, is closely monitoring developments in a wide range of smart materials. Those identified as of special interest, judged

Figure 2: MR fluid based MagneRide shock absorber

both in terms of maturity and high potential for meeting automotive applications requirements, are piezoelectrics, magnetorheological (MR) fluids, shape memory alloys (SMA's), shape memory polymers (SMP's), and electroactive polymers (EAP's). Indeed, GM currently has both piezioelectric devices - examples being accelerometers and fuel injectors - and MR fluid based devices - MagneRide shock absorbers (figure 2) on many of its production vehicles.

The first applications using SMA's are being targeted for 2010, followed shortly thereafter by SMP's. Some of

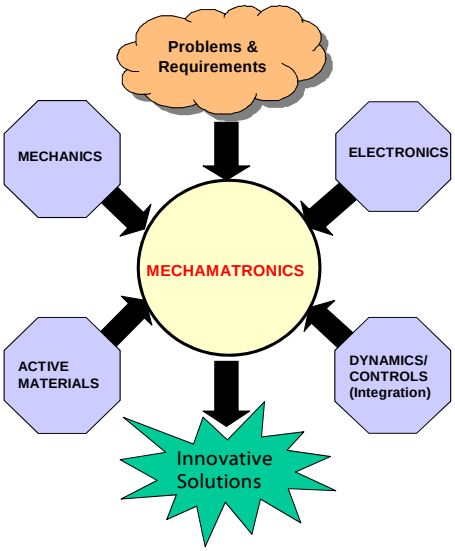

Figure 1: Mechamatronics

Figure 3: Active louvers

Figure 4 (top and right): Active air damm system

Figure 5 (bottom): Active grab handle

the applications being evaluated that utilize SMA's include airflow control devices such as active louver (figure 3) and air dam systems (figure 4).

An active grab handle (figure 5) that automatically presents itself from a folded position to make for an easier, more intuitive entry into the vehicle is an example of a customer delight feature that could be driven by an SMA actuator. GM will continue to drive the developments of various materials to satisfy the requirements for automotive applications.

More information on GM can be found at www.gm.com. ■

New Fall Conference, Continued From Page 1

scopic systems including rotor dynamics, nonlinear dynamics / vibrations, and dynamic modeling / vibration / control of micro/nano systems

Chris Rahn, Don Leo

Active Materials, Mechanics and Behavior

Focuses on characterization and mechanics based modeling of field coupled materials

Topical areas: Advanced constitutive measurements, micro- and nano-mechanics of actuator and sensor materials, phase field modeling, multi-scale and multiphysics material models, finite element implementations, reliability issues: aging, fatigue, and fracture

Marc Kamlah, Stefan Seelecke

Structural Health Monitoring / NDE:

Focuses on the application of distributed sensor networks to damage detection

Topical areas: Damage identification and mitigation, sensor networks, data fusion, data mining and management, damage diagnostic and prognostic modeling software, system integration, and applications.

Shiv Joshi, Kara Peter

Bio-Inspired Smart Materials and-Structures

Focuses on application of biological understanding to inspire novel biomimetic smart materials, devices and structures

Topical areas: Modeling of biological systems, understanding physical phenomena in biological systems, biomimetic and bio-inspired devices, machines and robotics, utilizing biological systems

Sergio Lucato, Lisa Weiland

It should be a fun and useful conference. We hope that you and your colleagues will plan to attend. Help us spread the word. The conference website is: www.asmeconferences.org/SMASIS08

For more information please contact either C.S. Lynch (cslynch@seas.ucla.edu), the General Chair or D. Brei (dibrei@umich.edu), the Technical Chair.

The organizers greatly appreciate the financial support of General Motors, Teledyne, CSA Engineering and Next-Gen Aeronautics for conference special events such as the Pioneer Banquet and student best paper awards. If you would like to financially sponsor an aspect of the conference please, contact either C.S. Lynch or D. Brei. ■

Honors and Awards

2007 Gary Anderson Early Achievement Award

Don Leo, Virginia Tech ■ Dr. Marcelo Dapino, associate professor in the Department of Mechanical Engineering at the Ohio State University, has been awarded the 2007 Gary Anderson Early Achievement Award by the ASME Adaptive Structures and Material Systems Technical Committee.

Professor Dapino is the first recipient of this award, which has been named in honor of Dr. Gary L. Anderson, a former Program Director in the Army Research Office's Engineering Sciences Directorate. The award, consisting of an ASME certificate and honorarium of $1,000, was presented at the 2007 International Symposium on Smart Structures and Materials in San Diego, California.

Professor Dapino joined the Ohio State University faculty in 2001; he received his Ph.D. from Iowa State University in 1999 and held a visiting faculty position there for two years. Professor Dapino has made significant contributions in the areas of constitutive modeling, experimental characterization, and system design of magnetically-active materials, multifunctional composites, and adaptive systems.

Professor Dapino is a principal investigator on several research programs sponsored by industry and government agencies. He is also a core investigator on a National Science Foundation Industry/University Collaborative Research Center on smart vehicle concepts, an Office of Naval Research Multidisciplinary University Research Initiative (MURI) on iron-based magnetostrictive alloys, and a Department of Energy Graduate Automotive Technical Education (GATE) center on advanced automotive propulsion systems.

Professor Dapino has authored over 85 technical publications in journals, edited volumes, and conference proceedings. He has served as Chair of the Behavior and Mechanics of Multifunctional and Composite Materials Conference of the SPIE International Symposium on Smart Structures and Materials, General Chair of the Adaptive Materials and Systems Symposium of the ASME IMECE International Congress & Exposition, and is the elected Secretary to the ASME Adaptive Structures and Material Systems Technical Committee.

Professor Dapino is the recipient of the Honda Initiation Grant Award, Ohio State University Lumley Research Award, ASME Best Paper Award in Structural Dynamics and Control, ASME Best Paper Award in Mechanics and Material Systems, SPIE Best Poster Award, SPIE Best Student Paper Award, and Iowa State University Research Excellence Award. His students have also been recognized with several awards and fellowships conferred by NSF, ASME, and SPIE.

The Gary Anderson Early Achievement Award is given to a researcher in his or her ascendancy whose work has already had an impact in his/her field within Adaptive Structures and Material Systems. The winner of the award must be within 7 years of terminal degree at the time of nomination. Nominations may be received at large from any source and should be sent to Dr. Don Leo at *donleo@vt.edu*. ■

2007 Smart Structures Product Implementation Award

Mary Frecker, Penn State and Janet Sater, IDA ■ The 2007 Smart Structures Product Implementation Award was presented to the International Center for Actuators and Transducers at the Pennsylvania State University and Micromechatronics for their Metal Tube Type Piezoelectric Ultrasonic Motors.

Currently about 80% of cell phones have a camera already installed; the newest versions have an automatic focus mechanism, which requires only 0.2 mm of lens motion. The next target for cell phone manufacturers-in 2007-will be an optical zoom mechanism in which a motor will control the large mechanical motion of the lens. The required lens motion is on the order of 2mm, which is currently not realizable with electromagnetic motors but can be achieved with metal tube type piezoelectric ultrasonic motors. These devices consist of a tiny hollow metal cylinder and two equally small rectangular plates of PZT (lead-zirconate-titanate): the interaction of the bending vibration modes in the two plates results in a hula-hoop like rotary motion.

The International Center for Actuators and Transducers at Penn State worked closely with Samsung Electronics in Korea to develop a zoom mechanism for a cell phone. The mechanism uses two micro rotary motors in conjunction with screw mechanisms to independently control zooming and lens focusing; the motors have a diameter of

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In Memoriam

Liviu Librescu (04/16/07) ■

Dr. Liviu Librescu was a Professor of Engineering Science and Mechanics at Virginia Tech and was well known to the smart structures community. He died on April 16 in the Virigina Tech shootings. He joined Virginia Tech in the 1980s after obtaining his Ph.D. from the Academy of Romanian Sciences in 1969 and working for a time in Romania and Israel. His colleagues remember him as a devoted scholar, researcher, and teacher.

Few in the smart structures community knew of the trials that Professor Librescu had experienced in his life. Born in 1930, Librescu was interned to a labor camp as a child but survived the Holocaust and was repatriated to Communist Romania after the end of World War II. He worked as a researcher in Romania from the 1950s to the early 1970s. His refusal to swear allegiance to the Communist party in Romania impeded his career, and only after personal intervention from Manachem Begin, then Prime Minister of Israel, was he allowed to leave Romania and join the faculty of Tel Aviv University and, later, the Technion, in Israel. After visiting Virginia Tech in the 1980s he accepted a position at the University, a position that he held until his death.

Professor Librescu was well known to the smart structures community. His work on shell theory and composite materials was well cited, and he worked on the development of materials models for systems that incorporated vibration damping and control. His early work on aeroelasticity was published in a book, *Elastostatics and Kinetics of Anisotropic and Heterogeneous Shell-Type Structure*. And a more recent publication was the book, *Thin-Walled Composite Beams: Theory and Application*, co-authored with Ohseop Song. He was a regular contributor to conferences on smart materials and published a number of articles on distributed vibration control in smart materials journals.

Professor Librescu's last moments are a moving tribute to his dedication to his students and his profession. On the morning of April 16 Professor Librescu was teaching a class in Norris Hall when shooting began in nearby classrooms. As is now well known, he barricaded the door so that the gunman could not enter his classroom. Several witnesses spoke of his bravery and decisiveness in these critical moments. Professor Librescu was shot and killed through the door as he tried to prevent the gunman from entering, but due to his act of heroism, many of his students had additional time to jump from the second floor window and evacuate the building.

Professor Liviu Librescu was a man of knowledge, dignity, and great courage. He will be sorely missed by his University, his family, and his fellow researchers and students. ■

Bill Armstrong (08/23/06) ■

Professor William D. (Bill) Armstrong died tragically in an airplane accident when he attempted a crash landing near the runway at the Laramie Regional Airport on August 23, 2006.

Bill Armstrong was an Associate Professor in the Department of Mechanical Engineering at the University of Wyoming. Bill obtained his Ph.D. in Mechanical Engineering and M.S. in Materials Science from the University of Washington. He then trained at two foreign research institutes, Mitsubishi Heavy Industries Nagasaki R&D Center, Japan, and Riso National Laboratory, Denmark. He was a Research Assistant Professor at the University of Washington and an Assistant Professor at State University of New York at Binghamton before joining the faculty at the University of Wyoming in 2001.

Bill is survived by his wife, Laurel, his daughter Jesse (2 years old), and his sons Isaac and Rustin (13 and 6 years old).

Bill was an active researcher in the smart materials and structures community and provided outstanding professional service and leadership in the organization of the active materials symposium at the annual SPIE Smart Materials and Structures Conference.

Please contact the organizers if you have any questions about this special symposium. ■

SPIE SMART STRUCTURES PRODUCT IMPLEMENTATION AWARD

Janet Sater, IDA ■ The original idea for this award was discussed among SPIE Smart Structures and Materials Symposium technical planning committee members more than 10 years ago. At that time, in order for the field of smart materials and structures to be better recognized and accepted in the world at large, the committee believed there was a need to recognize efforts to develop and market real products, not laboratory and other proof-of-concept demonstrations. This award recognizes those organizations that have taken this critical step.

Applications

The application package each group is required to submit to be considered for this award is fairly substantial and non-trivial. The application "form" is based on the R&D 100 Award application package. The final package can be submitted in hard copy form or electronically to the review panel team lead. The due date is typically around the middle of January in the year in which the award will be given.

Evaluations and Scoring

The five reviewers, selected by the review panel team lead, are independent technical experts having industry experience. General considerations for their evaluation include the best product based on its importance, uniqueness, and usefulness to defence or commercial industries; the most innovative — but realistic — products using smart structures and materials technologies; and a 100-point scoring scale (described below) that includes the application package, product uniqueness / significance, and product utility for consumers, industry, and/or DoD.

Application package itself (maximum of 15 points)

- Is all of the necessary information included? Most teams lose points here—packages often contain incomplete information.
- Is the information presented clearly, coherently, and succinctly?
- Are charts, tables, photographs and supporting information useful and understandable?
- Is the style readable (proper grammar, etc.)?

Uniqueness/significance of the product (maximum of 25 points)

- Is the product technologically significant? (note that uniqueness is not necessarily a virtue — it may mean that there is no demand for the product or that it's technologically insignificant)
- How does the product compare to existing technology (if any)? The reviewers are looking for qualitative AND quantitative comparisons here to see how well the nominating company understands their market competition. This is a significant information gap in many application packages.
- Are there system aspects to the product? Is it just a material, a sensor, an actuator, or a system? This criterion is not often well considered. For example, a material or device by itself is not a good candidate for the award; a material or device that has been used in a specific application where system aspects were evaluated is a much better candidate for the award.

1998: Vibration Isolation and Suppression System (VISS), Honeywell Satellite Systems, Air Force Research Laboratory at Kirtland AFB, Jet Propulsion Laboratory, and Trisys Incorporated

1999: Distributed Smart Skin Seat Sensor (DS4), PhotoSense, Inc. and Boston University

2000: Fiberscan 2000, Luna Innovations

2001: Smart Magnetix Knee Prosthesis with MotionMaster MR Fluid Damper, Lord Corp. and Biedermann Motech GmbH

2002: Smart Screens™, Smart Screen Systems, Inc.

2003: Structural Health Monitoring System, Acellent Technologies, Inc.

2005: Veriflex™ Reusable Mandrel, Cornerstone Research Group, Inc.

2006: SoftRide Launch Load Alleviation System, CSA Engineering Inc.

2007: Metal Tube Type Piezoelectric Ultrasonic Motors, International Center for Actuators and Transducers (PennState) and Micromechatronics

2008: Lightning Switch®, Face International Corporation and PulseSwitch Systems, LC

Importance of product to/utility for consumers, industry, and/or DoD (maximum of 60 points split between impact and production readiness)

Impact (maximum of 40 points)

- Is the product technologically significant (as in a completely new idea/application or another way to do something that's already done better/faster/cheaper/etc.)?

- How much of industry and/or DoD benefits (breadth of application as in laboratory/R&D, manufacturing, average consumer, soldier, etc.)?
- Are statements made believable?
- Is the argument for this product effective?
- What quantitative advantages does the product offer, both in terms of competing products and system benefits? Again, this is a significant information gap in most application packages.

Production readiness (maximum of 20 points)

- Is the item actually in production or is it still really at the prototype stage? The reviewers see many packages for "products" that are still considered to be in prototype stage.
- Is there a list of specifications for the product? Few products have spec sheets.
- Is there a price (or price range) identified for the product? Price information is not often included.
- Is there a rough order of market potential provided? Market potential is not often included.

Concluding Remarks

The SPIE Industrial and Commercial Applications conference planning committee encourages appropriate submissions from all interested parties. If you have questions about the application process or are wondering whether or not your particular product might be a good candidate for the award, please contact Dr. Janet M. Sater, *jsater@ida.org* or Dr. Eric Anderson, *eric.anderson@csaengineering.com*. ■

Historical Note

Greg Reich, Air Force Research Laboratory and Greg Washington, Ohio State ■ In 1985 the field of Adaptive Structures was in the early stages of formation driven in large part by a national focus on large space structure research. The large size and light weight of the proposed structures offered a formidable challenge to conventional techniques for damping. These structures often had high modal densities and low inherent damping resulting in a move toward the development of active damping methodologies. The problem was that modern control techniques resulted in large order controllers that were difficult if not impossible to implement. That year James E. Hubbard, Jr. and student Thomas L. Bailey, published a seminal paper in the AIAA Journal of Guidance and Control entitled, "Distributed Piezoelectric Polymer Active Vibration Control of a Cantilever Beam". The paper demonstrated all mode control of a cantilever beam using a thin piezoelectric film which covered the entire structure. The technique exploited the spatially distributed nature of this film as actuator and used a continuum model of the beam which required no modal truncation. The result was a time optimal controller that was effective over the entire modal spectrum! In the first text on the subject, *Adaptive Structures Dynamics and Control*, Robert Clark of Duke University cited this work as the first adaptive structure. The paper has and continues to receive hundreds of citations and the experiment has become an icon in the field, reproduced in classrooms and corporations around the world.

Hubbard continued to promote the field by starting a company called PhotoSense Inc. which produced products using smart materials. SPIE recognized the impact of these products with the awarding of its 1999 Smart Structures Product Implementation Award given to recognize those individuals and companies who have taken the critical step of transitioning smart structures technologies into viable industrial and commercial products. As the field matured SPIE commissioned a compilation of the most notable papers in the field of large space structures. The result was SPIE Milestone Series 167 entitled `Selected Papers on Smart Structures for Spacecraft.' As stated by the editors of this book, the papers contained in the series 'were a compilation of those known and considered major steps toward the application of smart structures for space.' In addition to the inclusion of both early and recent publications of Hubbard¹s work, his papers received some 15 citations from other contributing authors in the Series.

Dr. Hubbard continues to be an active researcher in the field as the Langley Distinguished Professor of Aerospace at the University of Maryland and the National Institute of Aerospace. ■

Honors and Awards, page 4

2.4 mm and a length of 14 mm. Although impulse type motors based on piezo materials are being developed for this application, the ultrasonic motor cameras are much more robust with respect to impact shock. Samsung tested these ultrasonic motors under realistic conditions. They were dropped 5000 times from a 2-meter height with 2-g acceleration and they passed! These motors are also applicable to vibration alarms for wristwatches and cell phones and may have some application in micro-surgery such as blood clot or kidney stone removal. ■

Education Corner

So, You Want to Get a Job in Industry

Eric Anderson, CSA Engineering ■ After more than 20 years, I recognize smart structures and materials as both established and evolving, a broad field, and one that integrates many other disciplines. When our company hires new engineers, we don't worry too much about specific labels. Instead we look for people with traits that will help us be successful in the long term. What follows is some of what I've learned about what turns young engineers into significant contributors in a place where smart structures and materials meets the industrial world.

If you're in graduate school now, or if you're working on a bachelor's degree, here are some things to think about:

1. *Learn the fundamentals.* There really isn't any substitute for this. Math, science and engineering basics are the core. Your best chance to set a solid foundation is in college. Later on, it may not always be obvious, but you will be relying on that basic knowledge to frame unusual problems or test the plausibility of new concepts.

2. *Dig deep in at least one technical area.* With a focus area, you can become a go-to person for specific questions, analyses, and designs. Other colleagues who have deep capability in another area will respect you. Project leaders and systems engineers will trust you. And when you have responsibility for a larger system, you'll be able to have at least one secure place to start a multi-discipline integration.

3. *Venture wide across disciplines.* Without sacrificing a core area, get to know something about many more, from those adjacent to your base, to those far away. Don't shy away from electronics, biology, or materials. Get some comfort level with them all. Listen to others on campus, go to seminars, and challenge yourself. This cross-discipline knowledge, or at least familiarity, can inspire new ideas and may one day become your new core discipline.

4. *Be aware of the industry and the technology state-of-the-art.* Your research is wonderful and it may be world changing, but there are lots of smart people out there. When you go to a conference, introduce yourself to industry people and ask them big questions about where things are and where they're headed. It doesn't matter if you're not in the immediate market for a job. Browse some trade magazines in the library or online to get another sense of the big picture.

5. *Learn how your research work fits.* Don't just accept the goals of your research project from a professor who tells them to you. Ask questions and understand where it fits with other research. Ask what the competing approaches are and what new things you are trying to find out. Ask why the sponsoring organization is funding you. When you present your work to people from industry they will be assured, and be better able to understand, when they get a sense that you know the context.

6. *Sweat the details.* Early in your career, you will establish a reputation for your level of attention to detail. Others will learn to trust that you've sweated the details, or always doubt that you have. If I'm working with someone who pays attention to details, I know that I don't have to spend extra time questioning and redoing that person's work.

7. *Get your hands dirty.* Get time working with physical things, materials, hardware, components, devices, and systems. Experiment, make, measure, and learn. Put Matlab aside for a while and find out why things work and why they don't.

8. *Make mistakes and recognize them quickly*. We all make mistakes, and anyone who claims not to is lying. The key is to make those mistakes quickly, to recognize them, learn from them, and then move on. Nobody likes to admit mistakes, but I see it as a measure of maturity, self-awareness, and desire to progress and grow.

I'll wrap up with some questions I ask myself when interviewing soon-to-be-graduates. They include: How big a problem can this person solve? Is this person smart enough to know what he / she doesn't know? Is he / she going to make a customer confident about choosing our product or service? Would others at our company enjoying working on a team with this person? Is he / she able to master new things quickly? And, how long will it take before he / she can do most of the tasks of the job faster than I could do them?

If you really want to know what classes to take, I can probably make some suggestions, and if you want to discuss piezoelectric actuators, we can do that, too. But I might be most helpful in describing more about what to expect from a job in industry. Send me an email at *eric@csaengineering.com*.

Eric Anderson is Vice President of CSA Engineering. ■

For more information visit the Technical Committee Websites:

ASME: http://divisions.asme.org/aerospace/committees/asms.html

and

AIAA: http://www.aiaa.org/tc/as/

STUDENT SPOTLIGHT

Ehsan Tarkesh Esfahani received his bachelor's degree from Isfahan University of Technology (Isfahan, Iran) in 2004. His Bachelor's thesis focused on developing and controlling a 21-DOF humanoid robot with dynamic stability. This robot received 2nd place in 6th International RoboCup competition in Lisbon, Portugal, and also was nominated for the best research project in the 6th Youth Khwarizmi International Festival in 2005, Iran. The control method and the dynamic trajectory generation of this system were patented in 2005 in Iran.

Ehsan joined the Dynamic and Smart Systems Laboratory in the Mechanical, Industrial and Manufacturing Engineering Department, University of Toledo, in January 2006. He started his research during his first semester and has made great strides toward advancing the state of the art in modeling and controlling shape memory alloy (SMA) actuated systems.

Another component of Ehsan's research is controlling SMA systems. This topic is closely related to the constitutive modeling of SMAs in the sense that more accurate models have enabled more effective and innovative control approaches. The research done during his Master's studies focused on modeling and controlling shape memory alloy actuators. His idea was to use this biocompatible material to provide actuation in an active ankle-foot orthosis. This idea, submitted as a proposal to the National Science Foundation, received three years of funding.

Ehsan's research has yielded a number of interesting findings that have been extremely well-received by his peers. Before defending his Master's thesis in December 2007, his research has resulted in three journal and nine conference papers. He is also a recipient of a NSF fellowship for a summer workshop on cell mechano-sensitivity at the University of Illinois at Urbana-Champaign (July 2007).

Currently he is working for the Electrical and Control Integration Lab at General Motors Research and Development Center. He is still collaborating with the Dynamic and Smart System Lab on first generation shape memory alloy assistive devices and will start his Ph.D. studies in Fall 2008. ■

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The Student Spotlight is on Neelesh Sarawate, a Ph.D. student in mechanical engineering at Ohio State University (M.S. from University of Missouri-Rolla and B.S. from University of Pune). Since joining the doctoral program at Ohio State in 2004, Neelesh has made substantial contributions to analytical and experimental aspects of ferromagnetic shape memory alloys (FSMAs). He has designed and conducted experiments for determining the quasistatic and dynamic behavior of these materials in various magnetic and mechanical loading conditions. To complement the experimental work, Neelesh led the development of powerful device models formulated as a boundary value problem incorporating coupled constitutive responses, dynamic magnetic losses, and structural device dynamics. He has used these models to design and characterize FSMA force sensors and resonators with electrical stiffness tuning. Using the same boundary value approach, Neelesh was able to construct an elegant model that accurately describes the frequency dependence of strain on magnetic field in magnetostrictive materials, a problem that until then had not been successfully addressed due to the particularly complex nature of magnetic hysteresis and dynamic magnetic losses. As a result of Neelesh's experimental and theoretical work, a number of inverse problems on smart magnetic actuators might now be more tractable. For example, using his models one could mathematically manipulate the frequency spectra to arrive at the input field profile that creates a given output strain response. Based on three years of research at Ohio State, Neelesh's work has resulted in seven journal papers (three of which are in review) and five conference proceedings (one of which is peer-reviewed). His dissertation research is being supported through a National Science Foundation grant. Neelesh has maintained a flawless academic record and was awarded an Ohio State University Graduate Fellowship and an NSF I/UCRC on Smart Vehicle Concepts Center Graduate Fellowship. He is the recipient of a runner-up award at the 2008 SPIE/ASME Smart Structures and Materials Best Student Paper and Presentation Contest. Neelesh has actively participated in campus activities as a volunteer in various seminars, conferences, recruiting events, and as a mentor to new graduate students. Neelesh is an active participant in various non-profit organizations dedicated to conducting developmental activities in India. Neelesh will graduate with a Ph.D. in mechanical engineering in August 2008 under the mentoring of Prof. Marcelo Dapino. As of April 2008, Neelesh is seeking a research position in industry. ■

International Conference on Adaptive Structures and Technologies (ICAST) and SPIE's International Symposium on SSM

Yuji Matsuzaki, Nagoya University ■ ICAST, cosponsored by ASME has now a history of seventeen years, the longest among international meetings in adaptive, intelligent or smart structures and materials field. Its conference site rotates from Europe to Asia to North America over a three-year period. The 18th conference, organized by Dr. F. Nitzsche (Carleton University), was held in October 2007 in Ottawa, Canada. The first two meetings of this conference were named First Joint USA-Japan and Second Joint Japan-USA Conferences. While time is always slipping through our fingers, a fragment of our memory is lost each year. So it is worthwhile to recall the beginning and some history of ICAST before we forget them.

During a couple of AIAA's SDM Conferences held late in 1980's, Mr. B. Wada (JPL) from the US side and Drs. K. Miura, M. Natori (ISAS), and myself from the Japanese side discussed organizing a meeting for periodically exchanging information on newly emerging technology, i.e., adaptive structures in space, civil engineering, mechanical systems, etc. In April 1990, we finally agreed that the first conference would be held by Mr. Wada in November 1990 in Maui, Hawaii, located in the middle of the Pacific Ocean between the US West Coast and the Japanese Islands. In the following year Y. Matsuzaki organized the second meeting in Nagoya, having actively invited speakers from Europe (including Dr. E. Breitbach, DLR, Germany) as well as five young researchers from Asia. One of them was Dr. S.-J. Kim, Seoul National University, who became the organizer of the 14th ICAST in Seoul. The third meeting, held again by Mr. Wada in San Diego in 1992, was then renamed The International Conference on Adaptive Structures (ICAS). In 1996 the conference title was once again modified to the International Conference on Adaptive Structures and Technologies (ICAST) to distinguish it from the International Conference on Aeronautical Science (ICAS), according to an advice given by Dr. P. Santini (University of Rome).

From 1993 to 2006, the conference was organized in turn by E. Breitbach in Cologne, Germany; J. Tani in Sendai, Japan; Craig Rogers in Key West, USA; P. Santini, in Rome, Italy; Y. Murotsu in Wakayama, Japan; N. Hagood in Boston, USA; R. Ohayon in Paris, France; Y. Matsuzaki in Nagoya, Japan; I. Chopra in College Park, USA. E. Breitbach in Potsdam, Germany; S.-J. Kim in Seoul, Korea; D. Inman in Bar Harbor, USA; R. Ohayon in Paris, France; and C.-K. Lee in Taipei, Taiwan.

The conference is traditionally three days with a single session. Adaptive / smart structure and material technologies are quite interdisciplinary. Participants in most other conferences are often separated into rather narrow research fields and attend only sessions closely related to his / her own specialty. Due to the one session policy of the ICAST, we are able to attend presentations which we would rarely listen to at other conferences. This single session focus has certainly provided us with a friendly sense of community. Historically, the participants and the locations of the conference site have well been balanced from a global perspective. We have communicated internationally and are spiritually united through the organization of the conference. ICAST 2008 and 2009 are scheduled to be held in Ascona, Switzerland and Hong Kong, China, respectively. I believe the unique features of this conference and its spirit will carry through to the future. ■

Calendar of Events

International Conference "Smart Materials, Structures and Systems", CIMTEC, *Acireale, Italy*
Dates: June 8-13, 2008
http://www.cimtec-congress.org/2008

AFOSR 2008 Structural Mechanics Annual Meeting,
Location TBD
Dates: June 16-19, 2008
Contact: AFOSR/NA, Dr. Victor Giurgiutiu (*victor.giurgiutiu@afosr.af.mil*)

AFOSR Annual Mechanics of Multifunctional Materials & Microsystems Meeting, *Arlington, VA*
Dates: August 18-21, 2008
Contact: Dr. Les Lee (*les.lee@afosr.af.mil*)
http://www.wpafb.af.mil/library/factsheets/factsheet.asp?id=9591

International Conference on Adaptive Structures and Technologies (ICAST), *Ascona, Switzerland*
Dates: October 6-9, 2008
Abstract due: April 15, 2008
http://www.icast2006.org

CANSMART International Workshop on Smart Materials and Structures, *Montreal, CA*
Dates: October 23-24, 2008
Abstract due: May 30, 2008
http://www.cansmart.com

ASME Conference on Smart Materials Adaptive Structures & Intelligent Systems (SMASIS), *Ellicot City, MD*
Dates: October 28-30, 2008
Abstract due: May 3, 2008
http://www.asmeconferences.org/smasis08/

NATO RTO AVT Morphing Vehicles Specialist Meeting, *Lisbon, Portugal*
Dates: Spring, 2009
Details: TBD

SPIE Smart Structures & Materials Symposium,
San Diego, CA
Dates: March 8–12, 2009
Abstract due: August 24, 2008
http://spie.org/smart-structures-nde.xml

AIAA/ASME/AHS Adaptive Structures Conference, *Palm Springs, CA*
Dates: May 4-7, 2009
Abstract due: August 11, 2008
http://www.aiaa.org/content.cfm?pageid=230&lumeetingid=2047&viewcon=submit

SPIE Smart Materials and Nanotechnology in Engineering, *Weihai, China*
Dates: July 8-11, 2009
Abstract due: January 15, 2009
http://www.smart-nano.org/smn2009/en/frame.htm

Call for Articles

We hope you enjoyed this issue of the AIAA Adaptive Strucutres / ASME Adaptive Structures & Material Systems TC joint newsletter. We would like to invite you to participate in making these newsletters a full success. If you would like to volunteer or contribute an article to a future newsletter, please contact the editor: Diann Brei at *dibrei@umich.edu*. ■

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Thank You!

To all those that contributed and helped in the preparation of this newsletter!

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