

# The 7<sup>th</sup> International Workshop on Structural Health Monitoring – 2009



STANFORD  
UNIVERSITY

## LOCATION

Stanford University  
Stanford, CA USA

Sept. 9-11, 2009



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IWSHM, 7<sup>th</sup> International Workshop on Structural Health Monitoring  
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STANFORD, CA 94305, (650) 723-3524



Sensor and Actuator  
Development

Sensing Network/  
Autonomous System/  
Energy Harvesting

Signal Processing /  
Monitoring/  
Diagnostics

Prognostics/Health  
Management/CBM+

Modeling/  
Simulations/  
SHM-based Design

Implementation /  
Validation / Certification

Intelligent Structures/  
Hotspots

Ship structures/ SHM  
Multifunctional materials

Waves Propagation  
Models

Wind Turbines/  
Aircraft Structures

Civil, Pipelines and Energy  
Storage Infrastructures

Prognostics/ Data mining

# IWSHM – 2009 WORKSHOP AGENDA

## September 8

15:00 - 17:00	Early Registration at Crowne Plaza Hotel Cabana, Palo Alto
17:00 - 19:00	Reception

## September 9

07:00 - 08:25	Registration at Dohrman Grove, Light continental breakfast
08:25 - 08:40	Opening Remarks
08:40 - 09:10	Keynote 1: <b>Gerould Young</b> , Boeing Company, USA
09:10 - 09:40	Keynote 2: <b>Henrik Rosner</b> , Airbus, Germany
09:40 - 10:00	Coffee Break at Dohrmann Grove
10:00 - 12:00	7 Parallel Technical Sessions
12:00 - 13:10	Lunch at the Oval
13:10 - 13:40	Keynote 3: <b>Mark Stanley</b> , NIST TIP, USA
13:40 - 14:10	Keynote 4: <b>Alfredo Guemes</b> , UPM, Spain
14:10 - 14:25	Coffee Break at Dohrmann Grove
14:25 - 15:45	8 Parallel Technical Sessions
15:45 - 16:00	Coffee Break at Dohrmann Grove
16:00 - 17:15	Panel Discussion: <b>Aerospace Applications</b>
18:30 - 22:00	<p><b>SHM Networking Welcome Night:</b>            A special Networking Night for IWSHM participants, spouses, friends and students from around the world to socialize and build a tighter community. There will be hors d'oeuvres, entertainment and plenty of people to meet. We are extremely excited that <b>Airbus</b> is co-sponsoring this event to promote collaboration and networking in the SHM community.</p>

## September 10

08:40 - 09:10	Keynote 5: <b>Ignacio Perez</b> , ONR, USA
09:10 - 09:40	Keynote 6: <b>Jinping Ou</b> , DIT, China
09:40 - 10:00	Coffee Break at Dohrmann Grove
10:00 - 12:00	8 Parallel Technical Sessions
12:00 - 13:00	Lunch at the Oval
13:00 - 14:40	8 Parallel Technical Sessions
14:40 - 15:40	Coffee at Dohrmann Grove, Poster Session at Dorman Grove
15:40 - 17:10	SHM in Action
18:30 - 22:00	<p><b>Banquet and Award night:</b>            A banquet event is organized for workshop participants at Crowne Plaza Hotel Cabana at Palo Alto where a ceremony of IWSHM awards will be presented for the following awards:</p> <ol style="list-style-type: none"> <li>(1) <b>Life time achievement award by Boeing Company</b></li> <li>(2) <b>Most Practical SHM Technology for Aerospace award by Airbus</b></li> <li>(3) <b>The Person of the Year Award by the Sage publishing</b></li> <li>(4) <b>Hans J. Schmidt Award by IWSHM</b></li> </ol>

	(5) <b>The Best Paper award by Boeing Company</b> (6) <b>The Student Best Paper award by the Wiley publishing</b>
<b>September 11</b>	
08:40 - 09:10	Keynote 7: <b>Treven Baker</b> , US Army
09:10 - 09:40	Keynote 8: <b>AISC- Peter Foote</b> , BAE; <b>Grant Gordon</b> , Honeywell; <b>Mark Derriso</b> , US Air Force
09:40 - 10:00	Coffee Break at Dohrmann Grove
10:00 - 12:00	7 Parallel Technical Sessions
12:00 - 13:00	Lunch at the Oval
13:00 - 15:00	7 Parallel Technical Sessions
15:00 - 15:15	Coffee Break at Dohrmann Grove
15:15 - 16:30	Panel Discussion: <b>Opportunities in Mechanical &amp; Civil Systems</b>

08-Sep		Crowne Plaza Hotel Cabana							
15:00 – 17:00		Early Registration							
17:00 – 19:00		Reception							
09-Sep		Room 1 (200-002)	Room 2 (200-205)	Room 3 (200-034)	Room 4 (200-203)	Room 5 (200-030)	Room 6 (200-303)	Room 7 (200-305)	Room 8 (ART 2)
07:00 – 08:25		Registration at Dohrman Grove, Light continental breakfast							
08:25 – 08:40		Opening Remarks		Location: Memorial Auditorium					
08:40 – 09:10		Keynote 1		Location: Memorial Auditorium					
09:10 – 09:40		Keynote 2		Location: Memorial Auditorium					
09:40 – 10:00		Coffee Break at Dohrmann Grove							
10:00 – 10:20		Aerospace, Aircraft, Rotorcraft, and Launch Systems - I	Modeling and Simulation - I	Signal Processing, Monitoring, Diagnostics - I	Sensing Network, Autonomous System - I	Sensors and Actuators Development - I	Special session: Sensor based SHM for ship structures	Civil, Pipelines and Energy Storage Infrastructures- I	
10:20 – 10:40									
10:40 – 11:00									
11:00 – 11:20									
11:20 – 11:40									
11:40 – 12:00									
12:00 – 13:10		Lunch at the Oval							
13:10 – 13:40		Keynote 3		Location: Memorial Auditorium					
13:40 – 14:10		Keynote 4		Location: Memorial Auditorium					
14:10 – 14:25		Coffee Break at Dohrmann Grove							
14:25 – 14:45		Aerospace, Aircraft, Rotorcraft, and Launch Systems - II	Modeling and Simulation - II	Signal Processing, Monitoring, Diagnostics - II	Sensing Network, Autonomous System - II	Sensors and Actuators Development - II	Special session: Model based SHM for ship structures	Civil, Pipelines and Energy Storage Infrastructures- II	Special session: SHM in civil applications - I
14:45 – 15:05									
15:05 – 15:25									
15:25 – 15:45									
15:45 – 16:00		Coffee Break at Dohrmann Grove							
16:00 – 17:15		Panel Discussion		Location: Memorial Auditorium					
18:30 – 22:00		SHM Networking Welcome Night at Frost Amphitheater							
10-Sep		Room 1 (200-002)	Room 2 (200-205)	Room 3 (200-034)	Room 4 (200-203)	Room 5 (200-030)	Room 6 (200-303)	Room 7 (200-305)	Room 8 (ART 2)
08:40 – 09:10		Keynote 5		Location: Memorial Auditorium					
09:10 – 09:40		Keynote 6		Location: Memorial Auditorium					
09:40 – 10:00		Coffee Break at Dohrmann Grove							
10:00 – 10:20		Aerospace, Aircraft, Rotorcraft, and Launch Systems: III	Modeling and Simulation - III	Signal Processing, Monitoring, Diagnostics - III	Sensing Network, Autonomous System - III	Sensors and Actuators Development - III	Special session: Nonlinear ultrasonic SHM	Special session: Health Monitoring for Wind Turbines - I	Special session: SHM in Complex Aircraft Structures
10:20 – 10:40									
10:40 – 11:00									
11:00 – 11:20									
11:20 – 11:40									
11:40 – 12:00									
12:00 – 13:00		Lunch at the Oval, Demo/Poster at Dorman Grove							
13:00 – 13:20		Aerospace, Aircraft, Rotorcraft, Launch Systems: IV	Special session: Health Monitoring of Bridges for Asset management	Signal Processing, Monitoring, Diagnostics - IV	Land/Marine vehicles and structures	Sensors and Actuators Development - IV	Special session: Multifunctional Materials for SHM	Special session: Health Monitoring for Wind Turbines - II	Special session: SHM in civil applications - II
13:20 – 13:40									
13:40 – 14:00									
14:00 – 14:20									
14:20 – 14:40									
14:40 – 15:40		Coffee at Dohrmann Grove, Poster Session at Dorman Grove							
15:40 – 17:10		SHM in Action		Location: Memorial Auditorium					
18:30 – 22:00		Banquet and Award night at Crown Plaza Crowne Plaza Hotel Palo Alto							
11-Sep		Room 1 (200-002)	Room 2 (200-205)	Room 3 (200-034)	Room 4 (200-203)	Room 5 (200-030)	Room 6 (200-303)	Room 7 (ART 2)	Room 8
08:40 – 09:10		Keynote 7		Location: Memorial Auditorium					
09:10 – 09:40		Keynote 8		Location: Memorial Auditorium					
09:40 – 10:00		Coffee Break at Dohrmann Grove							
10:00 – 10:20		Implementation/Validation/Certification	Prognostics and Data mining	Signal Processing, Monitoring, Diagnostics - V	Signal Processing, Monitoring, Diagnostics - VI	Special session: Industrial Smart Material Applications - I	Special Session: Waves Propagation Models in Damage Detection - I	Special session: SHM in civil applications - III	
10:20 – 10:40									
10:40 – 11:00									
11:00 – 11:20									
11:20 – 11:40									
11:40 – 12:00									
12:00 – 13:00		Lunch at the Oval							
13:00 – 13:20		Health management/CBM+	Special session: Advanced signal processing and data mining	Signal Processing, Monitoring, Diagnostics - VII	Signal Processing, Monitoring, Diagnostics - VIII	Special session: Industrial Smart Material Applications - II	Special Session: Waves Propagation Models in Damage Detection - II	Special session: SHM in civil applications - IV	
13:20 – 13:40									
13:40 – 14:00									
14:00 – 14:20									
14:20 – 14:40									
14:40 – 15:00									
15:00 – 15:15		Coffee Break at Dohrmann Grove							
15:15 – 16:30		Panel Discussion		Location: 420-040					

**SHM in Action – How SHM works in Practice**  
A Special Session at the  
International Workshop on Structural Health Monitoring 2009

Airbus is sponsoring the Most Practical SHM Technology Award  
(see description at the end)



**Objective:**

To show how a structural health monitoring (SHM) system practically works in all fields. If you are working with SHM systems and would like to show in a short presentation how they practically work, then you shall participate. This presentation can be additional to exhibits or oral presentations and is specifically targeted to underline the practical aspect of the SHM.

**Who can participate:**

- Workshop Exhibitors,
- Workshop Presenters and,
- Workshop Participants.

**Motivation:**

There is a lot of SHM technology realised in software/hardware which has and is used for a variety of applications. This technology includes a monitoring system or system like approach being related to:

- Operational loads monitoring,
- Damage monitoring,
- Sensor signal processing, and
- Virtual damage simulation.

**The session targets at:**

- Showing the audience how SHM works in practical applications,
- Better understanding the practical issues of different SHM systems,
- Getting further feedback and requirements expressed from current and potential SHM users,
- SHM users to share their experience.

**Procedure:**

The session intends to show as much of demonstration cases as possible, addressing as many of the aspects mentioned below:

- The way the monitoring system and the test is operated, i.e.:
  - Type of sensors and actuators (if required) and their way of attachment to components, linkage to the signal generation and acquisition unit, etc;
  - Signal generation and acquisition unit as a hardware and how it operates;
  - Test preparation, the way input data are entered and sensor data are received and how the result is presented;
  - Procedure for sensor signal processing.
- The 'man-machine interface' such as data input and output display, results presentation;
- Component(s) tested, area/volume to be monitored, loading procedure and the damage initially observed by conventional means of non-destructive testing;
- Characteristics of the system such as weight, size, volume, reliability, cost, etc.

Each presentation is allowed for no more than 5 minutes through **a video, internet or a hardware demonstration only**, which will be directly displayed to the audience on a large screen. It is mandatory that the SHM system is shown in action. **Static displays are not acceptable.**

The presentations will be followed by a panel discussion where the audience as well as a panel of selected SHM applicants are invited to discuss the SHM systems shown.

The test cases being presented can be either based on self-developed or purchased SHM systems. The source of the SHM hardware is eligible to be mentioned but no further advertisement from or about the supplier of the SHM system will be accepted.

Any detailed background of the SHM system and the testing can be provided through the manuscript in the workshop proceedings. Provision of a manuscript in the proceedings is however not mandatory.

Exhibitors can provide a direct video link to their booth at the workshop such that demonstrations can be made from there and can be directly transmitted to the audience via a screen.

**SHM in Action** will be held during a plenary session. If you are interested in participating, please email [IWSHM-Exhibition@structure.stanford.edu](mailto:IWSHM-Exhibition@structure.stanford.edu) with a short description of the demo as soon as possible.

### **Most Practical SHM Technology for Aerospace Award by Airbus**

Airbus is proud to sponsor a prize for the “Most Practical SHM Technology for Aerospace” demonstrated in SHM in Action. The session will be judged by a panel of representatives from industry and government. The \$1000 prize will be awarded at the end of the session.

# IWSHM 2009 – Awards

## SHM Lifetime Achievement - Award Description

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An individual in the SHM community who has championed SHM over their career by advancing the state-of-the-art through their meritorious accomplishments in research, applications, education or sponsorship of the discipline will be selected to receive the prestigious SHM Lifetime Achievement Award by a committee of researchers, educators and practicing scientists and engineers. The award, criteria, nomination packet requirements and awards committee are outlined below.

**Eligibility:** Any individual is eligible to receive the award; however, it is anticipated that only the most distinguished members of the SHM community will possess the rich history of achievement that this prestigious award is intended to recognize.

**Evaluation Criteria:** In an effort to recognize an assortment of outstanding achievements in SHM by an individual, the evaluation criteria focus on the *impact* of the individual's contributions. Nominees who have made the most impact during their careers in the form of, for example, "citation classic" papers, a fundamental technical advance or invention that has had substantial scientific and/or commercial ramifications, a record of supporting research and developments by establishing strong research or industrial programs, educational programs and mentoring of young people within the community, etc. will be highly considered.

**Nomination Package:** The nomination package should include a) a narrative (maximum three 8.5 x 11 single-sided pages, 12 pt. font, single-spaced, one-inch margins) describing the contributions and their *impact*, which should include all figures, references, graphs, citations, etc. and b) Nominee's CV, up to three letters of support, and exhibits only as required to clearly document the rationale for the narrative statement of nomination.

Self-nominations are not permitted.

**Perspectives generally represented on Award Committee Review Panel:** Faculty members from academic institutions, industrialists with a broad view of technology, researchers with an ability to assess commercial impacts of scholarly research and knowledge of SHM and its unique mission.

**Award:** Cash prize and a plaque with inscription.

**Please send your nomination packages to Chuck Farrar ([farrar@lanl.gov](mailto:farrar@lanl.gov)) as soon as possible and no later than July 17.**

# IWSHM 2009 – Awards

## Best Paper Award

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The *SHM Best Paper Award* is presented to one or more individuals whose paper(s) are selected to have the highest quality and innovation from the Proceedings of the 2009 IWSHM. The Award, evaluation criteria, Award Committee composition, nomination and selection procedures are described below.

### **I. Eligibility**

All the papers submitted and accepted for the 7<sup>th</sup> IWSHM are eligible for this Award.

### **II. Nomination criteria**

All the authors are considered candidates for this Award. Originality and technical excellence are the two main criteria for selection

### **III. Award Committee**

The Award Committee is formed by all the Session Chairmen for this Workshop. They may propose among the articles from the sessions of their specialty, one or two papers which may be candidates for the Award, justifying their proposal.

The Award Committee Chairman is Prof. Güemes, from Madrid University, Spain. His primary responsibility is to make sure the committee functions and, based on the votes from the Award Committee members, to rank the candidates.

### **V. Selection procedure**

Originality and technical excellence are considered as the main criteria for nomination. Session chairmen will rank the papers, later a subcommittee will review these proposals and will prepare a definitive selection.

### **VI. Award presentation**

During the Workshop, a plaque accompanied by a check will be presented by the Chairman of the Award Committee.

The Chairman of the Award Committee and the Chairman of the Workshop are in charge of organizing the Award presentation ceremony.