

# Preface

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This proceedings is a collection of papers presented at the 9<sup>th</sup> International Workshop on Structural Health Monitoring (IWSHM) on September 10–12, 2013, detailing the most recent technology development in the field of Structural Health Monitoring (SHM) from around the world since 2011. 340 papers were selected and included in the proceedings with applications expanding from traditional aerospace structures and civil infrastructure to marine/offshore and wind power infrastructure, as well as structures in different platforms. Significant progress since the last meeting, in 2011, is clearly noticeable, particularly in the areas of quantification of SHM data through novel detection techniques, verification and validation of SHM systems using laboratory and field test data, new and innovative SHM/NDE techniques, and SHM system maturation for implementation.

It is also generally acknowledged that a clear advantage of SHM technology over traditional NDE methods is the closer interaction and automation of sensing, diagnostics and mitigation/repair that SHM enables. As SHM is a system-level technology which integrates sensors/actuator networks with structures, software to interpret sensor signals, and hardware to process and manage the signals, its maturity based on the complexity and targeted solutions can be classified into four different sequential levels: detection, identification, quantification, and decision. Detection is the lowest maturity level that the technology can achieve. Once detection is confirmed with a high degree of confidence, identification of the occurrence of the event in time and space domain is critical, which then can potentially lead to the quantification of the event. A more accurate quantification may lead to a better decision, which provides a much more efficient management solution for the structures than traditional inspection techniques, leading to a system platform for autonomous or intelligent structures.

Hence, the continuing development and maturation of SHM technology will lead to the development of autonomous or intelligent structures. Therefore, the theme of the 9<sup>th</sup> International Workshop on Structural Health Monitoring is “**Roadmap for Intelligent Structures**”. The focus of 2013 IWSHM can be categorized into the following topics:

- Sensing:
  - Smart sensors and innovative sensor network technology are presented in special sessions.

- Advanced signal processing methods for compensating environmental effects are emphasized and demonstrated.
- Sensing strategies for sensor network optimization and detection of damage precursors are offered and presented.
- Diagnostics:
  - A significant amount of efforts by the SHM community is centered on quantification techniques and procedures for damage detection.
  - More physics-based and statistics-based approaches for quantification are integrated to offer new methods for SHM.
  - More in-depth fundamental studies in various sensing principles are presented through modeling and analyses.
- System Integration:
  - Increased emphasis on system validation and verification for implementation from aerospace and civil infrastructure communities.
  - Extensive evaluation results from laboratories to field studies are presented for maturation.
  - Applications of SHM continue to expand into manufacturing, machining, and wind turbines, and many other fields.
- Automation and Control
  - Automation of data collection, processing and interpretation has been recognized from the community through numerous presentations.
  - System integration with robots or machines for inspection or control through sensing can be spotted in the several sessions.
  - A growing interest is apparent from the community to integrate sensing, diagnostics to close the loop through control for various applications.

The committee would like to extend special thanks to the special session organizers whose contributions are listed below:

Impairment Detection	G. T. Fry (Texas A&M U)
SHM Technology in Wind Turbines	W. Ostachowicz (PAS)
Optical Sensing-based SHM	N. Takeda ( U. of Tokyo)
Autonomous Sensing: Monitoring to Control	M. D. Todd (UC San Diego)
Source Localization	T. Kundu ( U. of Arizona)
POD and Reliability of SHM for Aerospace Structures	J.B. Ihn (Boeing)
SHM of Space Systems	A. Zagrai (New Mexico Tech) & L.Richards (NASA)
Next-Gen Sensing Systems for SHM	Y. Wang (GIT) & K. Loh (UC Davis)
Aerospace Structures: Standards and V&V	H. Speckmann (Airbus)
Data Interpretation and Modeling for SHM	H. Li (HIT)
Very Dense Arrays of Sensors	B. Glisic (Princeton)
Guided Waves in Structures	W. Ostachowicz (PAS)
Monitoring on Manufacturing	M.-S. Tsai (NCCU, Taiwan)
Novel SHM/NDE Tech.	S. Banerjee (U.S. Carolina)

Statistical Methods for SHM	D. Zonta (U. of Trento)
Sensing Strategy for Wave-Based SHM	Z. Su (HKPU)
V&V/Standardization for Civil Infrastructures	H. Wenzel (VCE)
SHM/NDE for Civil Infrastructures	S. Salamone (U. of Buffalo)
SHM for Harsh Environments	D. Senesky (Stanford U.)
Material State Awareness and Damage Precursors	A. Ghoshal (ARL)

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