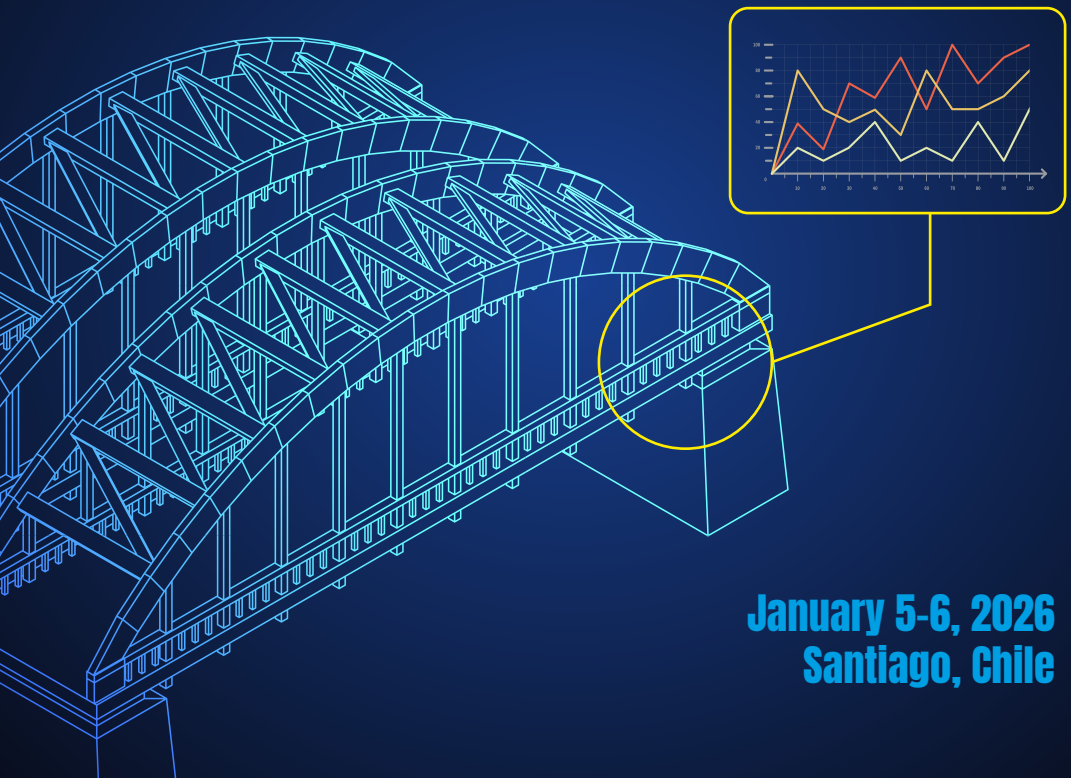
2° LATAMSHM 2026

2nd Latin-American Workshop on Structural Health Monitoring

2-Day Pre-Conference Course

Structural Health Monitoring using Statistical Pattern Recognition



January 5-6, 2026
Santiago, Chile

2° LATAMSHM 2026
Latin-American Workshop on Structural Health Monitoring
SANTIAGO

2-Day Pre-Conference Course

Structural Health Monitoring using Statistical Pattern Recognition

Course Overview

Structural Health Monitoring Using Statistical Pattern Recognition will introduce engineers to the field of damage assessment (detection, location, severity) in structures as determined from changes in their measured dynamic response. In addition to the historical motivation and development of the methods, the course will cover the theory, application, and computerized implementation of this technology with hands-on software exercises. Many real-world examples and results will be presented from the fields of aerospace, civil, and mechanical engineering. The application of statistical pattern recognition techniques will be emphasized throughout the course.

Course Topics

- Introduction to SHM and NDE methods
- Operational evaluation and damage definition
- Data acquisition, sensing technologies, and signal processing
- Feature extraction and damage-sensitive metrics
- Supervised and unsupervised learning methods
- Data normalization and environmental effects
- SHM system design and performance assessment

Participants will receive all course materials (digital and print) and access to relevant reference resources.

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SANTIAGO

2-Day Pre-Conference Course

Structural Health Monitoring using Statistical Pattern Recognition

Instructors

Dr. Charles R. Farrar
President, Los Alamos Dynamics

Internationally recognized pioneer in SHM, co-author of Structural Health Monitoring: A Machine Learning Perspective, with 400+ publications and global teaching experience.

Dr. Michael D. Todd
Distinguished Professor, UC San Diego

Leading researcher in nonlinear diagnostics, sensor systems, and UAV-enabled SHM. Recipient of major SHM and mechanics education awards.

Intended Audience

This course is aimed at graduate students, researchers, professors, and professionals in civil, mechanical, and aerospace engineering interested in advanced SHM strategies.

The instructors will assume a basic knowledge of structural mechanics, dynamics and mathematics obtained in a bachelor's aerospace, civil or mechanical engineering curriculum.

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Structural Health Monitoring using Statistical Pattern Recognition

Fees & Registration

- Early (by Oct 1, 2025): €550
- Regular (from Oct 2, 2025): €650

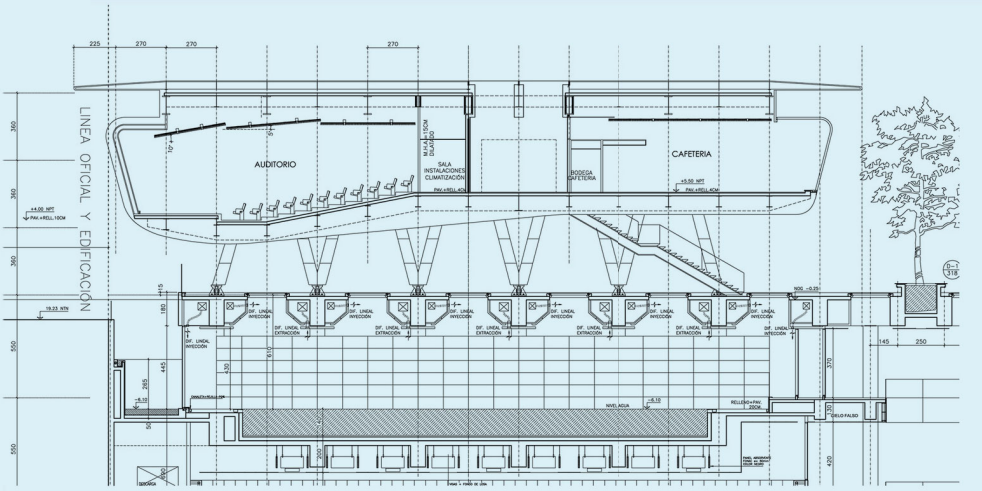
Includes all course materials and coffee breaks.
Travel, accommodation, and meals are not included.

Register Now

- https://latam-shm2026.cimne.com/registration
- latamshm2026@uchile.cl

Location

Faculty of Physical and Mathematical Sciences (FCFM)
University of Chile – Beauchef Campus
Beauchef 851, Santiago, Chile



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2-Day Pre-Conference Course

Structural Health Monitoring using Statistical Pattern Recognition

Course program | January 5, 2025

08:30 - 09:00 hrs
- **Instructor and Participant**
- **Introductions**

09:00 -10:00 hrs

1. Introduction to Structural Health Monitoring
- Motivation for SHM, (NDE vs SHM)
- Statistical pattern recognition paradigm
- Historical overview: aerospace /civil/mechanical applications

10:00 - 11:00 hrs

2. Review of NDE Methods
- Ultrasound
- Acoustic Emission
- Thermography
- Eddy Current
- Radiography
- Limitations

11:00 - 11:15 hrs - Break -

11:15 - 11:45 hrs

3. Operation Evaluation for SHM
- Economic/Life safety Justification
- Definition of damage
- Constraints
- Case studies

11:45 - 12:45 hrs

4. SHM Data Acquisition & Sensing Overview
- Sensor network components
- Sensor performance metrics
- Signal conditioning issues
- Sensor network paradigms
- Excitation

12:45 -14:00 hrs - Lunch -

14:00 -15:00 hrs

5. SHM Sensing Technologies I, II, III
- Strain
- Acceleration
- Impedance
- Emerging technologies
- Telemetry
- Embedded systems

15:00 -15:15 hrs - Break -

15:15 -16:15 hrs

6. Signal Processing for SHM
- Signal classification
- Fourier transform
- Time domain functions
- Frequency domain functions
- Time-frequency functions
- Filtering

16:15 -16:30 hrs - Break -

16:30 -17:30 hrs

7. Guided Waves in SHM
- Lamb wave theory
- Signal processing for guided waves
- Nonlinear acoustics
- Time reversal acoustics
- Integration with other SHM technologies
- Applications

2° LATAMSHM 2026
Latin-American Workshop on Structural Health Monitoring
SANTIAGO

2-Day Pre-Conference Course

Structural Health Monitoring using Statistical Pattern Recognition

Course program | January 6, 2025

08:30 - 09:30 hrs

8. Basic Statistics for SHM

- Statistical moments/distributions
- Density estimation
- Confidence limits
- Central limit theorem
- Principal component analysis

09:30 -10:30 hrs

9. Damage-Sensitive Features I

- Feature selection criteria
- Feature vs metric
- Waveform/image comparisons
- Basic statistics
- Model parameters (inverse modeling)
- Physical, time series models

10:30 -10:45 hrs - Break -

10:45 -11:45 hrs

10. Damage-Sensitive Features II

- Nonlinear response concepts
- Waveform comparisons: Nonlinear detection
- Nonlinear time series modeling
- Residual errors
- Chaotic interrogation methods
- Automated feature selection

11:45 -12:45 hrs

11. Statistical Inference and Learning Methods for SHM I

- Supervised vs. unsupervised learning
- Group Classification
- Regression modeling
- Outlier (novelty) detection
- Outlier analysis
- Hypothesis testing

12:45 -14:00 hrs - Lunch -

14:00 -15:00 hrs

12. Statistical Inference and Learning Methods for SHM II

- Outlier analysis
- Statistical process control
- Neural networks
- Support vector machines
- Regression analysis

15:00 -15:15 hrs - Break -

15:15 -16:15 hrs

13. Data Normalization for SHM

- Environmental/operational effects on SHM
- Parametric modeling of environmental effects
- Look-up table technique
- Machine learning techniques
- Experimental design

16:15 -16:30 hrs - Break -

16:30 -17:30 hrs

14. SHM System Design

- Bayes risk framework
- Classical detection theory
- Detector design
- Detection/localization examples
- Design examples
- Robustness assessment

17:30 -18:00 hrs

15. Closing Remarks

- Recap the pattern recognition paradigm
- Fundamental axioms of SHM
- Other sources of information
- Course survey

7-8-9 ENE

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2st Latin-American Workshop on Structural Health Monitoring - SANTIAGO

El Congreso Latinoamericano donde convergen la investigación de vanguardia, las tecnologías emergentes y sus aplicaciones prácticas en Monitoreo Estructural.

GEMELOS **DIGITALES**

PRONÓSTICO Y **CICLO DE VIDA**

MANTENIMIENTO **PREDICTIVO**

INNOVACIÓN

NETWORKING

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ACADEMIA - INDUSTRIA

"Infraestructura inteligente para un futuro sostenible"

https://latam-shm2026.cimne.com/

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