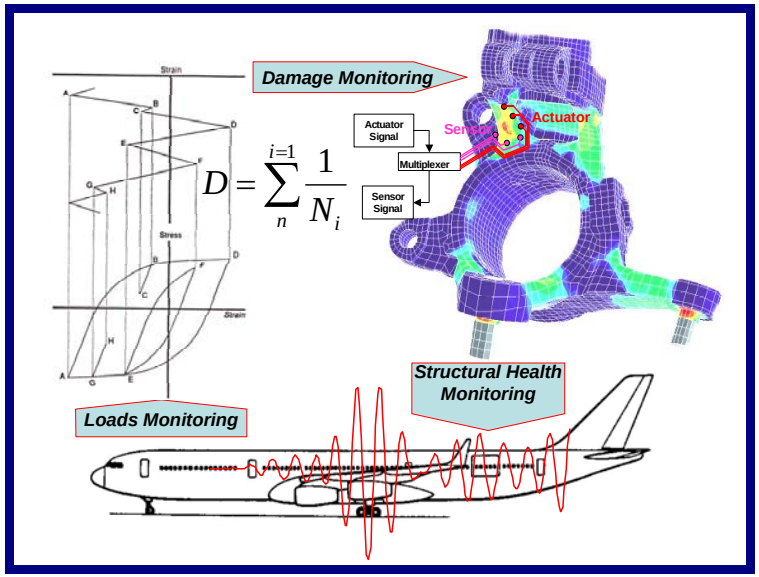
ADVANCED LECTURE SERIES ON

Structural Health Monitoring



Participating Institutions and Course dates:

7.-11. May 07	**University Politécnica de Madrid (Dept Aeronautics), Spain**
26.-30. Nov 07	**University of Siegen (Institute of Mechatronics), Germany**
21.-25. Apr 08	**University of Sheffield (Dept. of Mechanical Engineering), U. K.**
July 08	**Polish Academy of Sciences (IFFM), Gdansk, Poland**
Nov 08	**Instituto Superior Tecnico (IST), Lisbon, Portugal**
April 09	**University of Patras (Lab. for Mechanical Systems), Greece**
July 09	**RISOE National Laboratory, Denmark**

Next Edition of the Course to be held at:

University of Siegen (Institute of Mechatronics), Germany, 26.-30. Nov. 2007

Sponsored by the European Commission
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ABOUT THE INSTRUCTORS:

Instructors were selected by their technical competence, complementarities and teaching experience. All of them have done active research on SHM during more than ten years, with a large number of publications. They contribute regularly to the international conferences on related themes, they are actively involved in the organization of Workshops, and also as members of editorial committees for specialized journals and books on this subject. Highlighting some individual facts:

Christian Boller. A pioneer in the SHM field, he was a lecturer in the AGARD-CP-531 on Smart Structures in October 1992, keeping an uninterrupted activity since then. Formerly working as chief engineer for Deutsche Aerospace (now EADS), he is currently Professor at Sheffield Univ., with special interest on structural integrity.

Spilios Fassois is a leading authority on stochastic mechanical systems and statistical methods for SHM. He has over 20 years of professional experience in Europe and the USA. He has strong industrial experience and participates in European research consortia and projects.

Claus-Peter Fritzen. Expert with a professional experience of 18 years in the field, he is recognized by his work on vibration-based as well as wave propagation-based SHM principles, force identification, software for data analysis, and the development of methods for evaluation and decision-making. The methods have been applied to problems in aeronautics, mechanical and civil engineering.

Alfredo Güemes & Jose M. Menéndez. They started in 1996 an optoelectronics Laboratory, and were among the firsts in Europe to produce and embed fibre optic sensors in Composite structures. They have participated without interruption in several European research projects, addressing main issues as sensor response and its qualification. They act as Coordinator for this Project.

Malcolm McGugan & Povl Bronsted. Both are working at Risoe, in Denmark, a reference centre in Europe for research and testing of wind energy systems. They are specialists in the implementation of SHM inspection technologies in these large structures, representing one of the most advanced development in the field.

Wieslaw Ostachowicz. Professor at the Polish Academy of Sciences, Institute of Fluid Flow Machinery. He conducts research in several areas of numerical methods in mechanics, as spectral finite elements for damage detection, as well as the use of intelligent materials in dynamic control. He participates in several European research consortia and projects.

Afzal Suleman. He is currently Principal Investigator at the Instituto de Engenharia Mecanica (IDMEC-IST) in Portugal and Professor of Aerospace Engineering at the University of Victoria in Canada. He has been involved in several EU projects on structural optimization, active aeroelastic aircraft composite structures and aircraft reliability using smart materials.

Structural Health Monitoring (SHM) is an emerging technology, dealing with the development and implementation of techniques and systems where monitoring, inspection and damage detection become an integral part of structures and thus a matter of automation. It further merges with a variety of techniques related to diagnostics and prognostics .

SHM emerged from the field of smart structures and laterally encompasses disciplines such as structural dynamics, materials and structures, fatigue and fracture, non-destructive testing and evaluation, sensors and actuators, microelectronics, signal processing and much more. To be effective in the development of SHM systems, a multidisciplinary approach is therefore necessary. Without this global view it will be difficult for engineers to holistically manage the operation of an engineering structure through its life cycle in the future and to generate new breakthroughs in structural engineering.

The objective of this Course is to get the experts prepared for the European and other industries to be able to design and manage structural health of engineering structures in the future. A matching network of experts from European universities and research institutions, selected by their technical competence and teaching experience, has prepared an intensive (approx. 40 hours) Lectures Series, covering all theory and techniques relevant to the understanding and handling of SHM. Laboratory and demonstration activities will also be included such that participants gain hands-on experience in the main techniques addressed.

Partially supported by the European Commission, these Lecture Series will be repeated between 2007 and 2010, itinerant in different European countries. The next session will be held in Siegen/Germany in November 2007.
This advanced course addresses professionals and students in the area of engineering, applied natural science and also engineering management.

Registration and fees

Limited to 30 participants. Please send an email expressing your interest to attend to **fritzen@imr.mb.uni-siegen.de,** including your name, company, academic background and experience. Nominal fees are €1500 and will include: Full tuition material, laboratory and test equipment usage, lunch and refreshments. 50% discounts (€750) may apply if adequately justified (PhD stud., universities, research institutes). For early registration before 15th Aug., we offer an additional discount of 10% (€1350/€675).

Timetable	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
9:00 to 9:50	Sheffield1	Siegen1	Siegen4	Patras1	Risoe3
10:00 to 10:50	Madrid1	Madrid4	IFFM2	Lisbon3	Patras3
11:10 to 12:00	Sheffield2	Sheffield4	Lisbon1	Patras2	Risoe4
12:10 to 13:00	Madrid2	Siegen2	IFFM3	Risoe1	Patras4
Lunch					
Lunch/Discussions					END
15:00 to 15:50	Madrid3	Siegen3	IFFM4	Risoe2	
16:10 to 17:00	Sheffield3	IFFM1	Lisbon2	Lisbon4	
17:00 to 19:00	Madrid	Siegen	Madrid	Risoe	
LAB-DEMO work by	FOS	Vibrations	WaveProp.	AE	

MAIN TOPICS COVERED BY EACH INSTRUCTOR:

University of Siegen *(Prof. Claus-Peter Fritzen)*
Concepts of Structural Health Management: Local and global methods.
Data processing and signal analysis, experimental modal analysis.
Vibration-based methods: Computational models, model-updating methods, optimisation and damage identification, Impedance method, Time-domain methods, Force identification,
Examples of damage diagnosis in civil engineering, aerospace and wind energy plants.

University Politécnica de Madrid (UPM) *(Prof Alfredo Güemes, Dr. José M. Menéndez)*
Classification of fiber-optic sensors
The fiber Bragg grating as a strain and temperature sensor
Fiber Bragg gratings as damage sensors for composites
Embedding fiber optic sensors in composite structures
Examples of applications of fiber optic sensors in aeronautics and civil engineering

Polish Academy of Sciences (IFFM) *(Prof. Wieslaw Ostachowicz)*
Algorithms for damage localization and characterization
Methods based on the phenomenon of elastic wave propagation. Lamb waves
FFT–based Spectral Element Method. FEM versus Spectral Element Method
Wave propagation in composite plates. Interaction with damage. Experimental validation
Optimal sensor network. Estimation of optimal array of sensors placement

University of Patras *(Prof. Spilios Fassois)*
Statistical Time Series Models for Structural Dynamics
Identification of Time Series Models
Statistical Hypothesis Testing for Decision Making Under Uncertainty
Parametric and Non-Parametric Statistical Time Series Methods for SHM
SHM Applications and Outlook

Instituto Superior Tecnico (IST) *(Prof. Afzal Suleman)*
Review of NDE and vibration-based SHM techniques
Piezoelectric transducer based SHM
Phased arrays
Application to Aircraft Composite Structures

University of Sheffield *(Prof. Christian Boller)*
Why SHM in Aerospace? – An Introduction and Motivation
Loads and Overloads: Significance, Characterization, Load Monitoring. Damage tolerance
Predictive maintenance. Aircraft as an Example for Monitoring Complex Structures
State-of-the-art in damage monitoring. Gathered experience and examples
Strategies to implement SHM. System reliability issues. SHM integration in existing aircrafts

RISOE National Laboratory *(Dr. Malcolm McGugan, Dr. Povl Bronsted)*
An Industry view of potential SHM benefits
Establishing the fundamentals of remote condition monitoring for Offshore Wind Farms
Hardware validation in-situ: Techniques in use, new hardware developments, examples
Common access tools for wind turbine data (CM data)
SHM perspectives within Offshore Wind Energy