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 does further even merge with a variety of techniques being related to diagnostics and prognostics as such.
SHM emerged from the wide 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 possibly much more. To be effective in the development of SHM systems, a multidisciplinary approach among these disciplines is therefore required. 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, have prepared an intensive (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 first session will be held in Madrid/Spain in May 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 aguemes@aero.upm.es, including your name, company, academic background and experience. Nominal fees are 1500 euros, and. will include: Full tuition material, laboratory and test equipment usage, lunch and refreshments. Partial or total discounts may apply if adequately justified (PhD students, academia, European citizens)

Timetable	**Monday**	**Tuesday**	**Wednesday**	**Thurdsday**	**Friday**
9:00 to 9:50	Siegen	Siegen	IFFM	Patras	Risoe
10:00 to 10:50	UPM	IFFM	Patras	IST	Sheffield
11:10 to 12:00	Siegen	Siegen	Patras	Patras	Risoe
12:10 to 13:00	UPM	IFFM	IST	IST	Sheffield
LUNCH					
14:00 to 14:50	UPM	IFFM	IST	Sheffield	Risoe
15:00 to 15:50	Siegen	UPM	Patras	Risoe	Sheffield
16:10 to 17:00	UPM	IFFM	IST	Sheffield	Risoe
17:00 to 19:00 LAB-DEMO work by	Siegen	UPM	IST /IFFM	Patras	Sheffield

MAIN TOPICS COVERED BY EACH INSTRUCTOR:

University of Siegen (*Prof. Claus-Peter Fritzen)*
Concepts of Structural Health Management: Local and Global Methods
Basics of Experimental Modal Analysis. Data Processing and Signal Analysis
Vibration methods. Computational Models
Model-Updating Methods, Optimisation and Damage Identification.
Examples for 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

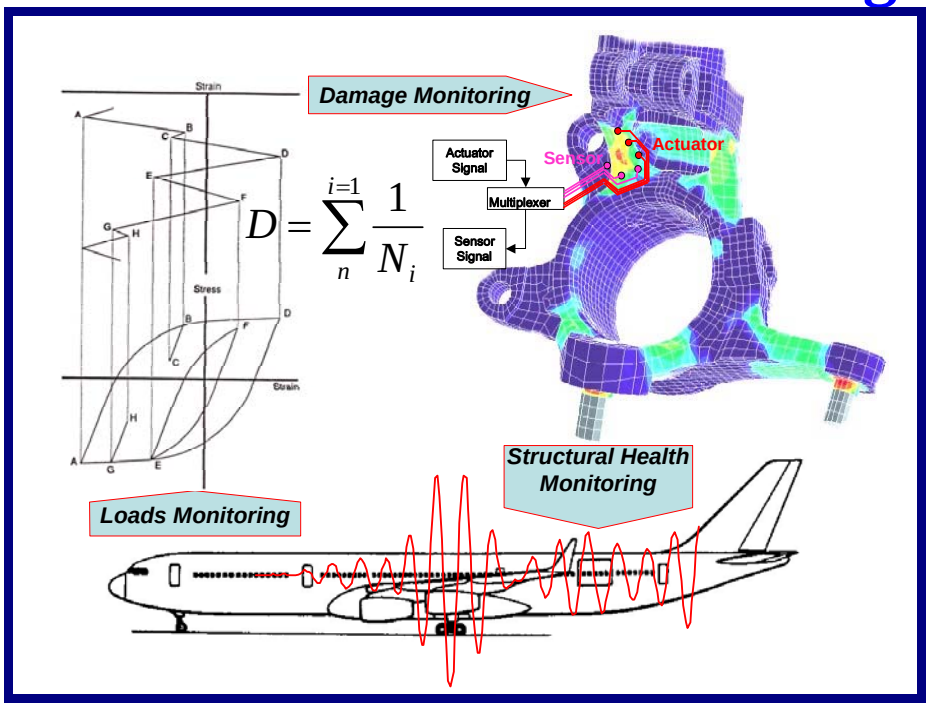
Instituto Superior Tecnico (IST) (*Prof. Afzal Suleman)*
Review of vibration-based SHM techniques, usage monitoring, damage prognosis
Active non-destructive evaluation techniques: ultrasonics, thermography, electromagnetics
Piezoelectric transducer based SHM:
Phased arrays for SHM in critical locations.
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

ADVANCED LECTURE SERIES ON

Structural HealthMonitoring



Participating Institutions:

University Politécnica de Madrid (Dept Aeronautics), Spain
University of Siegen (Institute of Mechatronics), Germany
University of Sheffield (Dept. of Mechanical Engineering), U. K.
Instituto Superior Tecnico (IST), Portugal
University of Patras (Lab. for Mechanical Systems), Greece
Polish Academy of Sciences (IFFM), Poland
RISOE National Laboratory, Denmark

First Edition to be held at:

ETSI Aeronáuticos, UPM (Madrid- Spain)

7-11 May, 2007

Sponsored by: European Commission
(Specific Support Action ASA6-CT-2006-044636)

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.

Claus Peter Fritzen. Expert with a professional experience of 18 years in the field, he is leading a team of about 20 people, recognized by their work on vibration-based as well as wave propagation-based SHM principles, software for data analysis, and the development of methods for evaluation and decision-making. The results are applied to problems in aeronautics, mechanical and civil engineering.

Spilios Fassois. He is a leading authority in Europe in the field of Stochastic Mechanical Systems and Statistical methods for SHM, after over 20 years of experience on the subject in both Europe and USA. The assessment of damage always entails a comparison, SHM is a problem in statistical pattern recognition.

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 acts 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. Polish Academy of Sciences, Institute of Fluid Flow Machinery: Associate Professor, Professor (1989), Full Professor (1992). He conduct 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.

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.