About the course

The concept of Structural Health Monitoring (SHM), the process of implementing a damage detection and characterisation strategy for engineering structures, has become established over the past two decades. Triggered by damage tolerant design, where damage has to be inspected at defined intervals by NDT techniques, modern sensing hardware may now be embedded into structural materials and combined with advanced signal processing software, allowing NDT to become integrated with the structures, avoiding costly disassembly, and opening the way to full automation of the inspection processes of in-service structures.

This Course provides an insight into the background and motivation for SHM, a description of the new miniature sensors that may be embedded into the structures, and the algorithms to handle the signals in order to extract useful information about possible damage. To be effective in the development of SHM systems, a multidisciplinary approach is required drawing expertise from disciplines such as fatigue and fracture, non-destructive testing and evaluation, sensors and actuators, signal processing and possibly much more. 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.

The objective of this course is to prepare the participants for to be able to design and manage structural health monitoring of engineering structures within industry in the future. The following topics will be covered:

Section 1
- Why SHM ? – An Introduction and Motivation
- Loads and Overloads: Significance, Characterisation, Load Monitoring, Damage tolerance
- Predictive maintenance including 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 structures

Section 2
- Classification of fibre optic sensors. The Fibre Bragg grating as a strain and temperature sensor. Fibre Bragg grating as damage sensor for composites
- Embedding fibre optic sensors in composite structures
- Data transmission for wireless SHM
- Examples of application of fibre optic sensors

Section 3
- Algorithms for damage localisation and characterisation
- Methods based on the phenomenon of elastic wave propagation. Lamb waves

Section 4
- Review of vibration-based SHM techniques, usage monitoring, damage prognosis.
- Piezoelectric transducer based SHM: Phased arrays for SHM in critical locations.
- Application to composite structures in the aerospace, transportation, marine, energy and civil engineering industries

The course is aimed at engineers, scientists and industrial managers with current interests in composite materials, either recent graduates or experienced technical personnel, who are, or who would like to be involved in the design and management of structural health monitoring.

Fees & Registration

The Master Class Course fee is S$1000 per participant, $500 after subsidy. Course material will be provided. Subsidies up to 50% are available to qualifying applicants through the Singapore Workforce Development Agency and other sources. Please contact Samantha Chan for details.

Lunch and refreshments will be provided.

To attend, please contact Samantha Chan via email chanskf@sce.a-star.edu.sg for registration.

Course Presenters

Prof Christian Boller, Prof Alfredo Güemes, and Prof Wieslaw Ostachowicz

Prof 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 became a professor at the University of Sheffield/UK before moving to Saarland University taking over a chair in NDT and quality assurance and heading Fraunhofer IZFP. His major interests are related to structural integrity assessment.

Prof Alfredo Güemes: He started in 1996 an Optoelectronics Laboratory, and was among the first in Europe to produce and embed fibre optic sensors in composite structures. He has participated without interruption in several European research projects, addressing main issues as sensor response and its qualification.

Prof 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.