



## **Motivation**

Non-destructive testing (NDT) is a field of science and engineering, which roughly spans between applied physics and mathematics on the one side and engineering (civil, electrical, materials science, mechanical or process) as well as biology and medicine on the other. Within the age of digital computing computer science becomes increasingly relevant too. It is related to non-intrusive characterization of materials and structures at the macro-, meso- or micro-scale respectively. NDT is considered to warrant the quality of materials and structures. This becomes important with respect to the enhanced performance of materials and structures in many fields of engineering as well as the need of life cycle enhancement and hence management.

Within the context of new development in smart materials, structures and NDT technologies, a new alliance consisting of Tohoku University, University of Lyon/France, Fraunhofer Institute for NDT, Saarland University, Nanjing University of Aeronautics and Astronautics and KTH Royal Institute of Technology has been created to accelerate collaboration and exchange among these organizations. In this framework and context the 1<sup>st</sup> Non-Destructive Testing International Winter School was held in Saarbrücken/Germany in 2015 to foster younger researchers who promote research in nondestructive testing and structural health monitoring. This was followed by the 2<sup>nd</sup> NDT Winter School held in Sendai/Japan where the focus was on nuclear decommissioning related to the Fukushima Nuclear Power Plants considering very difficult tasks in extreme environments, learning and elaborating on how NDT and structural health monitoring techniques can enhance nuclear decommissioning. These topics were very much welcomed by the participants originating from various countries around the world.

This year we introduce NDT and structural health monitoring (SHM) techniques in different structures and industries, with a focus on composite materials and aerospace engineering. Participants will get introduced into a variety of different NDT techniques applied to aeronautical structures, such as conventional ultrasound and eddy current for metals as well as emerging techniques currently just explored including eddy current, thermography, laser optics and vibrometry for composites. The currently emerging field of SHM where NDT becomes an integral part of a structure will also be touched upon from a conceptual as well as from a practical point of view. During laboratory sessions participants will get a chance to assess real aeronautical structures hands on having the opportunity to explore different techniques presented during the lectures and to have them compared in terms of different typical damages occurring in those structures.

## **Scope**

The NDT Winter School is an international event mainly driven by the following four academic institutions:

- Saarland University, Saarbrücken / Germany
- INSA Lyon / France
- Nanjing University of Aeronautics and Astronautics, Nanjing / China
- Tohoku University, Sendai / Japan

It specifically addresses students at postgraduate level targeting at a master's or doctoral degree. Academic lectures and laboratory sessions will be provided at 1:1 ratio, being related to introduction of fracture mechanics, basic theory of reliability, quality control and the related design methods, basic theory of NDT and lift prediction, an overview on NDT techniques, SHM for composite structures, NDT for aerospace engineering. The laboratory sessions are divided to two parts: demonstration of different NDT methods and instruments, and project work in terms of problem-based learning. In the project work, the students are divided in to several groups, with each group working on a specific topic using the facilities in the State Key Laboratory. The tentative topics are 1) SHM of composites, 2) ultrasonic C-scan for composites, 3) laser ultrasonic inspection of composites, and 4) Eddy current technology (ECT) for composites. The winter school will be complemented with an industrial visit. Social events and a local sightseeing tour will be also held.

## Tentative lecturers and lecture titles:

**Christian Boller** (University of Saarland): Basic theory of reliability, quality control and the related design methods (Tentative)

**Gerd Dobmann** (University of Saarland): NDT for aero-space-structure-components – basic principles and some applications based on the demands of the damage tolerance design principles

**Zhenmao Chen** (XJTU): EMAT, ECT methods for composite materials (Tentative)

**Toshiyuki Takagi** (Tetsuya Uchimoto): Numerical simulation of EMAT/ECT for composites

**Yingchun Xiao** (ASRI, AVIC): NDT for aerospace engineering (Tentative)

**Guangping Guo** (AECC Beijing Institute of Aeronautical Materials) NDT methods for aerospace materials (Tentative)

**Guiyun Tian** (University of Newcastle): NDT methods for composites (Tentative)

**Peter Qing** (Xiamen University): Application of SHM in civil aircraft (Tentative)

**Fumio Kojima** (Kobe University): Inverse problems in NDT (Tentative)

**Yong Chen** (NRC, Canada): Real-Time Monitoring of Helicopter Tail Rotor Limit Cycle Oscillation Events based on Airframe Vibration Sensor Network/Identification of Spacecraft Structural Damages in Acoustic Qualification Test Environment

**Lei Qiu and Shenfang Yuan** (NUAA): SHM Methods and Systems for composites

**Jinhao Qiu and Chao Zhang** (NUAA): Damage detection, material characterization and fatigue evaluation of composites based on laser ultrasonic method

## Date and Application:

**Date :** March 9<sup>h</sup> (Thu.) to 16<sup>th</sup> (Thu.), 2017

**Venue:** State Key Laboratory of Mechanics and Control of Mechanical Structures  
Nanjing University of Aeronautics and Astronautics

**Fee:** 3,000 RMB  
1,000 RMB (Local students)

**Deadline for application:** February 12, 2017 (see the attached application form)

**Deadline for registration:** March 1, 2017

## Supporting Organizations



