



Graduate course

Structural Health Monitoring

February 28th – March 1st, 2023

**Dynamics Based Maintenance
Faculty of Engineering Technology
University of Twente**

General

Structural Health Monitoring is a multidisciplinary research field that has emerged over the past decades and continues to grow, thanks to the societal need to become more sustainable and resilient. It is commonly recognized that our technological society puts a significant burden on the environment and natural resources, yet at the same time society depends on the technological solutions implemented since the industrial revolution. Therefore the operational phase of a system has gained an increasing amount of interest: apart from the fact that the cost associated with maintaining a system can be significant, reliable operation – in other words, the avoidance of unexpected failure or downtime – brings about costs that are more than an amount of monetary value, such as stress on the work floor, discomfort for customers relying on services etc.

The dynamic behaviour of a structure or system provides a strong basis of information for performance assessment. Controlling a system's dynamic response can improve its performance, but the dynamics can also reveal information on the state or condition of the structure or system. On the one hand, detailed theoretical knowledge on the dynamic behaviour is of crucial importance to understand the relation between changes in the dynamic behaviour and changes in the performance of a system. On the other hand measurements, typically resulting in large amounts of data, are essential to estimate the structural integrity of a structure or system.

This course provides in the first place theoretical concepts on dynamic analysis to assess the structural integrity of a structure or system, such as modal parameter based features, but also wave propagation based features. Mode shape based methods such as the Modal Strain Energy Damage Index algorithm and non-stationary analysis wavelet based methods will be used for the first category, while guide Lamb waves will be introduced, including the way they interact with damage or degradation, for the second category.

Secondly, the course will introduce methods to use (field) data to assess a structure of system. This includes data analysis methods and machine learning algorithms. The transformation of data in information is a crucial step and is greatly improved by the inclusion of physical models in data analysis methods. This so-called physics-informed data analysis will be treated in this course.

Local organization

The course is organized by the Dynamics Based Maintenance (DBM) research group of the Faculty of Engineering Technology (ET) of the University of Twente in close collaboration with the Dynamics of Solids and Structures (DSS), and Offshore Engineering (OE) research group of the Faculty of Civil Engineering and Geoscience (CTG) of the Technical University of Delft and Maritime and Transport Technology (MTT) research group of the Faculty of Mechanical, Maritime and Materials Engineering (3ME) of the Technical University of Delft.

The local organizing committee is composed of

Dr.ir. Richard Loendersloot (UT-ET-DBM)

Lecturers

Dr. Eliz-Mari Lourens (TUD-CTG-DSS/OE)

Dr. Pooria Pahlavan (TUD-3ME-MTT)

Dr.ir. Richard Loendersloot (UT-ET-DBM)

Lecture notes

Lecture notes and course material will be distributed at the start of the course.

Program

The program consists of a series of lectures, combined with assignments that will be completed during the course. A social activity will be schedule in the evening of the first day.

Fee/Registration

The course is free for registered members of the graduate school Engineering Mechanics and for the research members of the contributing research groups. The course fee for non EM members is € 100 for students and € 400 for other participants. They will receive an invoice after accepted registration.

Participants need to register by completing the online registration form, which can be found at <https://engineeringmechanics.nl/courses> **before February 14th, 2023** to the Secretariat of the Graduate School Engineering Mechanics, Eindhoven University of Technology. Members of the Graduate School Engineering Mechanics receive priority in case of over-subscription.

Location/date

The course will take place on the campus of the University of Twente. The course language is English.

Further information about the educational programme and other activities of the Graduate School on Engineering Mechanics can be found at: <https://engineeringmechanics.nl/>