

# Infrastar Training School on Fatigue and Reliability Analysis of Structures - Training for Assessment of Risk

Odile ABRAHAM<sup>1\*</sup>, Ernst NIEDERLEITHINGER<sup>2</sup>, Franziska SCHMIDT<sup>1</sup>,  
John Dalsgaard SØRENSEN<sup>3</sup>, Sebastian THONS<sup>4</sup>, Xavier CHAPELEAU<sup>1</sup>, Hakim FERRIA<sup>5</sup>

<sup>1</sup> Université Gustave Eiffel, France

<sup>2</sup> BAM, Germany

<sup>3</sup> Aalborg University, Denmark

<sup>4</sup> Lund University, Sweden

<sup>5</sup> INSAVALOR, France

\*Corresponding author, e-mail address: [odile.abraham@univ-eiffel.fr](mailto:odile.abraham@univ-eiffel.fr)

## Extended Abstract

### Abstract

The Infrastar training school provides lectures and hands-on training to Master and PhD students, early-stage researchers and (young) professionals on all aspects of asset management of civil infrastructures with respect to fatigue of materials. It is organized yearly since 2019 and up to 20 profiles are selected to attend the 3.5-day training.

A team of 7 teachers provides insight in multi-disciplinary and intersectoral basic concepts in three core fields, ranging from the design to the dismantling of the structures (bridges and wind turbines):

1. Monitoring and auscultation,
2. Structural and action models,
3. Reliability, risk and decision analyses.

Each year, a recognized expert is invited to deliver a keynote lecture to raise interest in a specific aspect of one of the fields covered. The presentation is recorded and published on the training school website.

**Keywords:** MSCA, ITN, DN, Doctoral School, multidisciplinary, optical fibre, ultrasonic coda waves, cracks

## 1 Origin of the Infrastar training school®

The Infrastar training school® (<https://trainingschool.infrastar.eu/>) was incubated during the European project H2020-MSCA-ITN-2015 INFRASTAR (Innovative and Networking for Fatigue and Reliability Analysis of Structures - Training for Assessment of Risk). During this project, 12 high-potential doctoral students, several researchers and several companies were involved in the advanced modelling of fatigue of concrete, in the development of non-destructive evaluation methods for early detection and monitoring damage, and probabilistic methods for risk assessment and maintenance.

The global objective of INFRASTAR was to develop knowledge on the optimal and reliable management of structures, especially bridges and wind turbine foundations. It has focused on advanced monitoring and non-destructive testing techniques for stress and strain measurements, and damage assessment due to the fatigue. Research was also conducted on structural loadings as well as on fatigue resistance models to precisely examine the behaviour of structures subjected to natural environmental effects (winds, waves, etc.) and traffic loads on bridges. Finally, INFRASTAR also developed knowledge in reliability and decision-making issues for life cycle analysis, with a focus on stochastic modelling and on the development of methods to couple the monitoring information with structural reliability models.





The techniques and engineering methods developed during the project (<https://infrastar.eu/communication-dissemination/publications/>) are available and constitute the skeleton of the Infrastar training school<sup>®</sup>. The aim is thus to contribute through training to the improvement of monitoring, and to develop strategies for preventive and corrective maintenance with early detection of damage or in showing that the condition of the structure is still acceptable even after the expected service life. The results of INFRASTAR contribute to the optimization of the design of new infrastructures by removing the excessive conservatism of current models. In addition, reliability-based methods offer potential cost and material savings and will reduce the levelized cost of energy (LCOE) in the wind sector. The results of the project contribute to the socio-economic and environmental impact by improving the sustainability of bridges and wind turbines through efficient and reliable infrastructure management. The replacement of structures can be postponed, or even avoided.

## **2 Infrastar training school<sup>®</sup> at a glance**

A major characteristic of the Infrastar training school<sup>®</sup> is the broad view it offers to trainees. The Infrastar training school<sup>®</sup> offers a global and transversal vision of the problems of fatigue of concrete, from the design stage up to the dismantling of the structure, including monitoring, maintenance and decision making. At the end of the training, participants will be able to understand:

1. How to make structures smart and its benefits (SHM),
2. How to model the structural behaviour of civil infrastructures under loads,
3. How to develop, realize and assess structural risks (information value).

The multidisciplinary frame makes the training original and unique. It offers a place where the trainees (of different backgrounds) can confront their expertise and widen their perspective to better face current and future complex challenges.

Another challenge will be in the future to maintain registration fees for the trainees as moderate as possible.

### ***2.1 Student target***

The training is aimed at Master and PhD students, early-stage researchers and professionals involved in issues of fatigue, particularly in the context of bridges and foundations of (on- and off-shore) wind turbines.

Applications must include a Curriculum Vitae and a cover letter in English which specifies the reasons for requesting participation in the training. Then, applications are examined by a selection committee.

### ***2.2 Training frame***

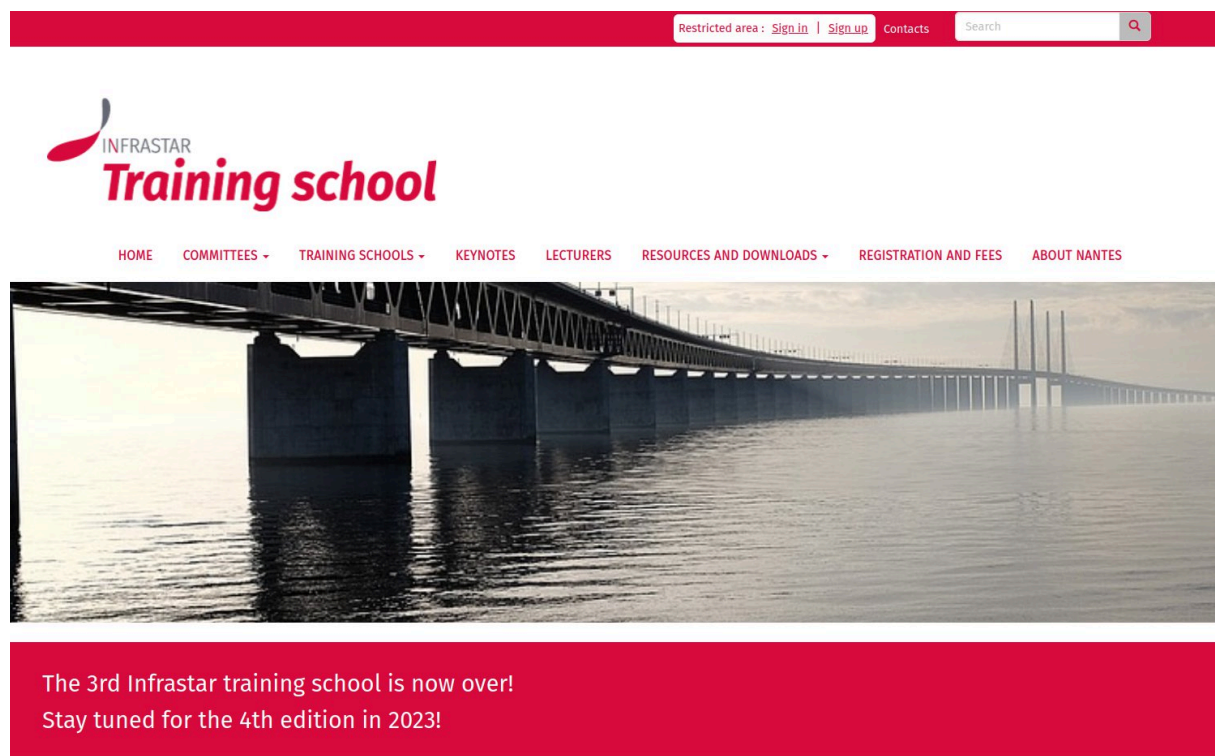
Classes, practical group activities and technical visits are given by international lecturers recognized in their field of expertise, with in particular the participation of members of the INFRASTAR consortium. An objective is to ease the trainees to network, as well as to develop the Infrastar Training School<sup>®</sup> network itself by inviting new lecturers and keynotes besides the INFRASTAR original consortium.

### ***2.3 Website***

A dedicated website is maintained and updated on a regular basis. It gathers all useful information on the training: the organising and the scientific committees, the programs of all

the former training schools, the videos of the invited keynote lecturers as well as the biographies of all the speakers, a trainee's hall of fame, and practical information, etc.

The 4th Infrastar Training School<sup>®</sup> will take place in 2023. As with previous editions, it will last 3.5 days and host 15 to 20 trainees. Interested persons can send an email to [infrastar@univ-eiffel.fr](mailto:infrastar@univ-eiffel.fr) to get notified when registration opens.



**Figure 1:** <https://trainingschool.infrastar.eu/>

### 3 Conclusion

With Infrastar Training School<sup>®</sup> we hope to contribute with a solid training intended to the needs of the future generation of researchers (doctoral and post-doctoral students, early-stage researchers industrials), based on cross-fertilization and a multi-disciplinary approach that will lead to a comprehensive treatment of the issues related to the management of engineering infrastructures civil, including bridges and foundations of wind turbines.