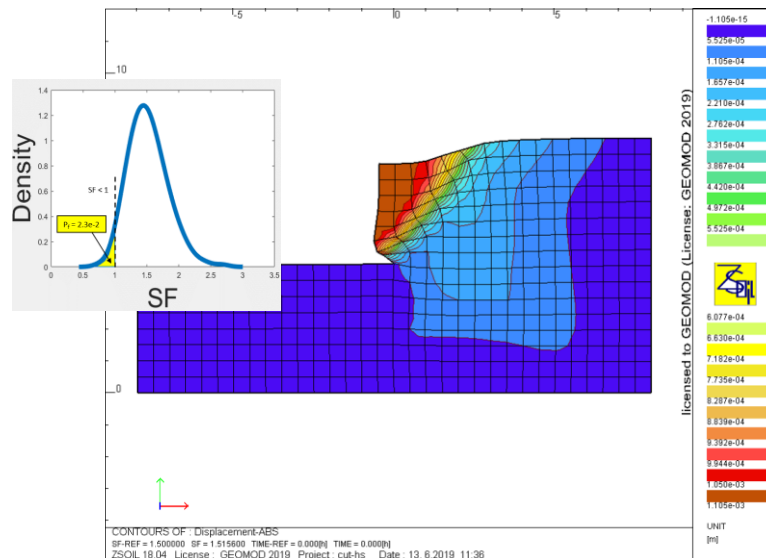




# Short course: Uncertainty Quantification, Reliability and Sensitivity Analyses applied to Geotechnics and Structures



## Motivation

On one hand, uncertainty is present everywhere in geotechnical engineering and soil-structure interaction analysis: soil parameters like cohesion, friction angle, and elastic modulus are usually not known exactly, and also vary in space. Common practice consists in testing a small number of samples at selected locations, taking the mean or characteristic value of the set, and then performing a deterministic analysis with (partial or global) "safety" factors in order to remain on the safe side. However, this technique does not give much insight into what the actual risk is.

On the other hand, probabilistic computational mechanics has made considerable progress in the past twenty years. But while probabilistic considerations are often underlying safety concepts in existing civil engineering norms, they do not enter systematically into safety evaluation or optimization procedures. Today, a stronger integration of probabilistic approaches into safety assessment procedures and geotechnical computational mechanics in general seems appropriate.

This short course will give participants an insight into probabilistic approaches in general, uncertainty quantification, reliability, sensitivity analyses and associated benefits with respect to a deterministic approach. Practical applications including typical geotechnical problems (slope stability, foundation bearing capacity, anchored wall, and tunnel in urban environment) will be discussed and solved using Matlab, combined with UQLab ([www.uqlab.com](http://www.uqlab.com)) and ZSOIL ([www.zsoil.com](http://www.zsoil.com)).

## Target audience

Civil and geotechnical engineers from the practice, researchers

## Practical information

Date and time: Thursday November 19th, 2020. 09h00-17h00  
Place: HEIA-FR, Pérolles 80, 1700 Fribourg. Auditorium B30.16 (Building B, third floor)  
Language: English, with possible French/German translations when needed  
Documentation: Each participant will get a set of notes



### Price, including coffee breaks and lunch

Regular: CHF 500 (or CHF 350 if taught online via Teams/Zoom)  
Students: CHF 250 (or CHF 175 if taught online via Teams/Zoom)

### Registration

Please fill in form at <https://limesurvey.hefr.ch/index.php/648879?lang=fr>, deadline: October 31st, 2020  
Information on payment will be sent first week of November, as it depends on the course being held in Fribourg or online via Teams/Zoom

### Speakers

#### Prof. Dr Bruno Sudret, Dr Stefano Marelli

Chair of Risk, Safety and Uncertainty Quantification  
IBK - Institute of Structural Engineering, ETH Zürich

#### Prof. Dr Stéphane Commend

iTEC - Institut des Technologies de l'Environnement Construit  
Filière de Génie Civil, HEIA Fribourg

### Tentative program

|             |   |                       |
|-------------|---|-----------------------|
| 09h00-09h15 | Welcome address   | S. Commend            |
| 09h15-10h15 | Introduction to probabilistic approaches  | B. Sudret, S. Marelli |
| 10h15-10h30 | Coffee break  |                       |
| 10h30-11h30 | Sensitivity and reliability analyses: analytical examples<br>Slope stability, foundation bearing capacity (*) | B. Sudret, S. Marelli |
| 11h30-11h45 | Coffee break  |                       |
| 11h45-12h45 | Deterministic vs probabilistic design   | B. Sudret, S. Marelli |
| 12h45-14h00 | Lunch   |                       |
| 14h00-15h15 | Probabilistic finite element applications 1<br>Slope stability, foundation bearing capacity (*)               | S. Commend            |
| 15h15-15h30 | Coffee break  |                       |
| 15h30-16h45 | Probabilistic finite element applications 2<br>Anchored wall, tunnel in urban environment (*)                 | S. Commend            |
| 16h45-17h00 | Short course conclusion   | S. Commend            |

(\*) Participants may bring their own computer with Matlab installed.  
A trial version of UQLab + ZSOIL will be available.  
Following the "hands on" tutorial is therefore possible, but not mandatory.

