

Ouvrages Sous Sollicitations Dynamiques et Environnementales

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UE : Ouvrages Sous Sollicitations Dynamiques et Environnementales

Module 1 : Durabilité des matériaux et des structures (15h CM, 6h15 TD)

**Module 2 : Parasismique, dynamique des structures, retrofiting sismique
(12h30 CM, 15h TP)**

**Module 3 : Interaction Sol structure –Ouvrages souterrains et Fondations
(8h45 CM , 3h45 TD, 5H TP)**

Module 4: Actions de Neige et Vent (5 x 1h15 TP)


[5A GC COD] Ouvrages sous sollicitations dynamiques et environnementales

- Cours
- Paramètres
- Participants
- Notes
- Rapports
- Plus ▾


▼ Généralités Tout replier

Cette UE se compose des modules suivants :

- 1- Durabilité des matériaux et des structures
- 2 - Parasismique et retrofitting sismique
- 3 - Interaction sol structures :
 - fondations sous solliications dynamiques
 - ouvrages souterrains
- 4 - Actions du vent et de la neige

 FORUM
Annonces

▼ Chapitre 1 : Durabilité des matériaux et structures Marqué

 FICHER
CM1 _ IntroductionOSSDE, Bases de la durabilité , durabilité versus développement durable






Plan du cours

- Chapitre 1 : Durabilité des matériaux et...
- Chapitre 2 -3 : Parasismique et dynamique des...
- Chapitre 4 : Interaction sol-structure :...
- Chapitre 5 : Action du vent et de la neige
- Chapitre Dynamique des Structures
- Section actuelle**

Médiathèque

-  Vidéos du cours

Activités

-  Devoirs
-  Forums
-  Ressources
-  Tests
-  Wooclap

Calendrier

septembre 2022

Lu	Ma	Me	Je	Ve	Sa	Di
		1	2	3	4	

Objectives de l'UE:

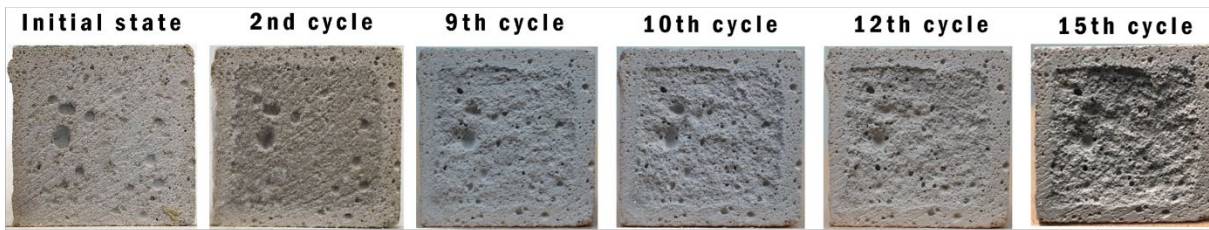
- 1- Compréhension des bases de dimensionnement ***durable*** des structures, des mécanismes de l'interaction de structures avec l'environnement : température et humidité, charges cycliques, vent et neige, charges dynamiques, séismes
- 2 - Maitriser les techniques d'évaluation de la durée de vie des structures
- 3 - Apprendre à calculer les charges dues au divers type d'actions de nature non-statique
- 4- Apprendre les techniques de l'évaluation de l'état d'une structure et son état de dégradation suite à son vieillissement, suite à un séisme, à des charges dynamiques (choc) ; apprendre bases de réparations

movavi OFFRE AVEC LA VERSION D'ÉVALUATION
DE MOVAVI VIDEO EDITOR

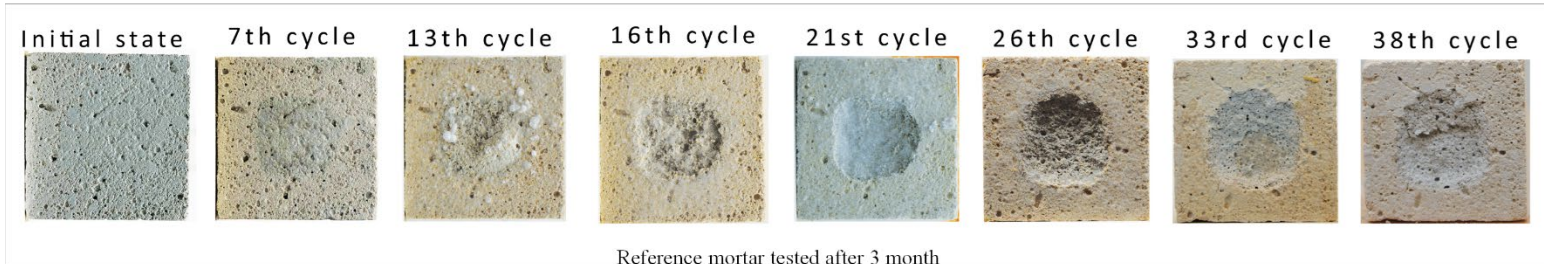


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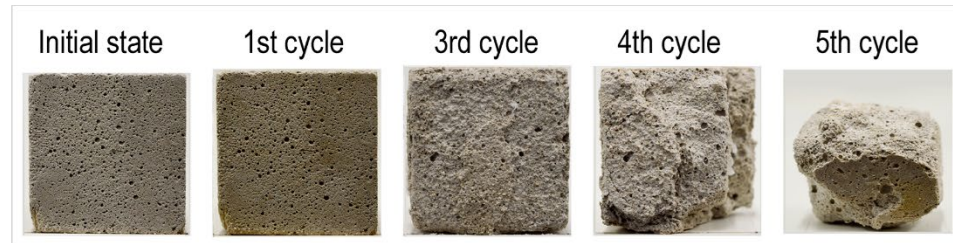
www.movavi.com



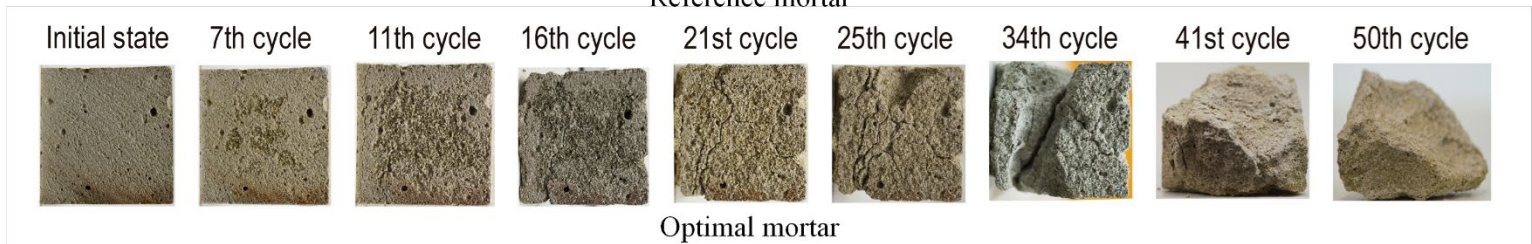
Reference mortar tested after 1 month



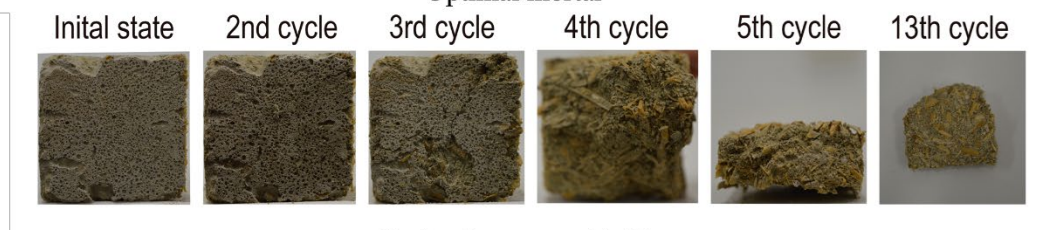
Reference mortar tested after 3 month



Reference mortar



Optimal mortar



Optimal mortar with fibers

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Module 1 : Durabilité des structures (15h CM, 6h15 TD)

Module 2 : Parasismique, dynamique des structures, retrofiting
sismique (12h30 CM, 5hTD, 10 TP)

Module 3 : Interaction Sol structure –Ouvrages souterrains et
Fondations (8h45 CM , 3h45 TD, 5H TP)

Module 4: Actions de Neige et Vent (5 x 1h15 TP)

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Module 1 : Durabilité des structures (15h CM, 6h15 TD)

1. Introduction : Motivations, définitions (1 CM) D.Hoxha
2. Bases de la Mécanique de la rupture (2 CM + 1TD) D.Hoxha
3. Comportement dépendant du temps (2 CM + 1TD) D.P. Do
4. Durabilité des bétons (2 CM + 1 TD) S. Remond
5. Durabilité des pierres (3 CM + 1 TD) K. Beck

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Module 1 : Durabilité des matériaux et des structures (15h CM, 6h15 TD)

**Module 2: Introduction on Data Sciences pour renovation
1h15CM 2H30 TP**

Module 3 : Parasismique, dynamique des structures, retrofiting sismique
(12h30 CM, 3h45 TD, 7h30 TP)

Module 4 : Interaction Sol structure –Ouvrages souterrains et Fondations
(8h45 CM , 3h45 TD, 5H TP)

Module 5: Actions de Neige et Vent (5 x 1h15 TP)

Durability of Materials and Structures

Objectives

- 1 - Understanding the Durability, its place in the context of sustainability renovation
- 2- Create foundation for design materials and structures fulfilling durability exigences
- 3- Be able to analyze the interaction of a given structure with environment, assess the life use of structures under complex thermal, hydric, mechanic, chemic loads
- 4 - Propose solutions for protection and renovating of existing structures according to exigences of comfort-user , low-carbon and heritage preservation criterion

UNIT 1 : Fundamentals and prerequisites of Durability of Materials and Structures

- Durability, Definitions
- Durability and sustainability, sustainable durability
- Review of prerequisite technical knowledges/skills

Readings : Lecture 1 in the website

References : See references on the readings

1- MOTIVATION

Reflexions sur deux outils differents de transmission de l'information



1- MOTIVATION

Que connaissez vous de ces deux objets



IV century – 989 - 1278-1568

1- MOTIVATION



“ Hundreds of firemen of the Paris Fire Brigade are doing everything they can to bring the terrible [#NotreDame](#) fire under control. All means are being used, except for water-bombing aircrafts which, if used, could lead to the collapse of the entire structure of the cathedral.
– Sécurité Civile Fr (@SecCivileFrance) [April 15, 2019](#)

“ So horrible to watch the massive fire at Notre Dame Cathedral in Paris. Perhaps flying water tankers could be used to put it out. Must act quickly!
– Donald J. Trump (@realDonaldTrump) [April 15, 2019](#)

1- MOTIVATION

Interaction structure- environment



The stone is internal

.... the erosion too

1- MOTIVATION

Various kinds of degradations ...



1- MOTIVATION

These very good bad ideas !!!!

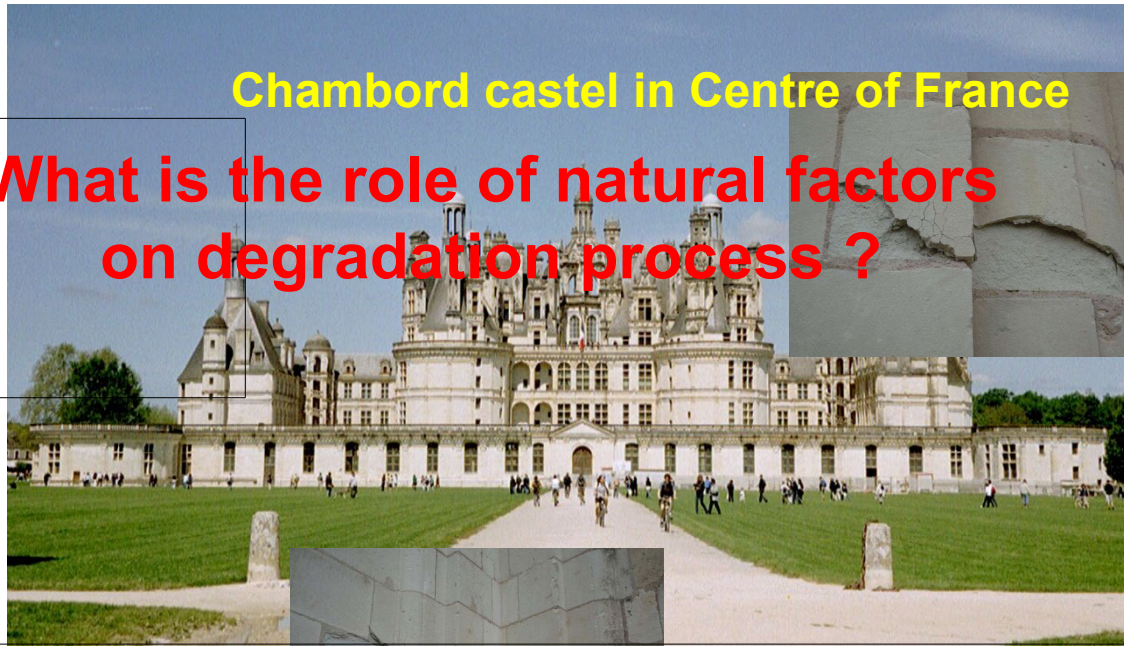


Stone-Stone compatibility (From K. Beck)

1- MOTIVATION

Chambord castel in Centre of France

What is the role of natural factors
on degradation process ?



- No known urban pollution sources from anthropological activity
- However various degradation ...

Credits : <http://www.cimn-sacre.com>



Questions introductives

Qu'est ce que c'est ULS d'une structure ?

Qu'est ce que c'est SLS d'une structure ?

Quel EC traite de la durabilité ?

What durability of structures stands for ?

What it is sustainability ?

Introductory questions :

What is Ultimate Limit State (ULS) of a structure ?

Maximal load one structure could support without failure, without becoming

What is Serviceability Limit State (SLS)

Maximal load for which one structure could keep its ability to service

What **durability of structures** stands for ?

durability concept is limited to the longevity of a given product, its ability to remain functional (without excessive maintenance), under normal conditions of use, i.e. the conditions it has been designed for

Sustainability

Indicates an approach of society developing at present such that any of these three dimensions is not compromised for the next generations.

Three aspects: economic, social and environmental

Criterion that a given economic or material flux should satisfy in order to be considered as sustainable :

- 1 - The consumption rate of renewable resources should not exceed the rate of regeneration of these same resources
- 2 - The consumption rate of non-renewable resources should not exceed the rate of developing of renewable resources that could substitute these resources
- 3- The rate of pollution issued by use of any resources should not exceed the capacity of the nature to assimilated this pollution

Sustainability

Strong versus weak sustainability

*the **weak sustainability** postulates the full substitutability of natural capital*

strong sustainability demonstrates that this substitutability should be severely seriously limited due to the existence of critical elements that natural capital provides for human existence and well-being

Sustainable durability

Modern trends on durability

- Design sustainable and durable materials and structures

Meaning ??

- 1- as long as possible life (or time between two maintenances services)
- 2 – respecting the resources renovation
- 3 - respecting the human well being, environment
- 4 – viable economically wise
- 5 – Using recycled materials : how to calculate on these conditions the “life” of a material

- Monitoring the state of structures/infrastructures, (continuous monitoring, connected devices, big data approach on decision making about the maintenance, renovation, the structure transform)

Sustainable durability

Modern trends on durability (continued)

- Assessment of durability (ULS and SLS approach) of structures, including environmental interaction on assessment

Why ?

1. - Evolution of the state of knowledge (Example : interdiction of asbestos use in constructions in some countries)

 - 2 - Evolution of the nature of structures and their use
 - o The objective of construction different
 - Think about the leaving comfort in castles
 - Functionality (and comfort) of communist time buildings
 - Waste stockage underground works
- Maintenance, protection, renovation
- Transformation, Recycling

Sustainable durability

Holistic approach

Meaning ??

Necessity for multidisciplinary research

3 domains : technic, economic/social, environmental

○ **but** also multidisplnarity inside the same domain :

Examples in Technical Domain : Multiphysics of degradation mechanisms

How the durability is impacted by :

Temperature

Humidity

Chemical interactions

Coupled **T H M C**

Fundamentals of Durability (Basic prerequisite)

Recall

End of Life : ULS or SLS

Interactive/adaptative questions

- 1 - What stress is ? Why the stress tensor is symmetric ? What is the stress-state ?
- 2- How the static /dynamic equilibrium state is written : locally ? Globally ?
- 3- What is elastic behavior ? What is elastic limit ? What is a **yield** and/or a failure surface ?
- 4 - Cite some common stress based design criterion for structures and explain their meaning ?
- 5 – Cited some strain-based design criterion and explain their meaning