Durability of Reinforced Concrete

# Introduction

The course has a focus on the durability of reinforced concrete structures, covering common deterioration processes such as reinforcement corrosion, frost damage, ASR, etc. The course spans the range from fundamental mechanisms to aspects of engineering practice. New methods and materials for preventative measures, condition assessment and repair techniques are treated. Examples from real cases are shown.

# Objective

After this course, students will have profound understanding about:

• the different mechanisms of deterioration of concrete structures, in particular reinforcement corrosion

• the relevant parameters affecting durability of reinforced concrete

• current engineering approaches for durability design (standards) and their limitations

• refined models for enhanced durability design and service life predictions

• preventive measures to improve durability

• methods for inspection and condition assessment of existing, ageing structures

• repair methods for deteriorated concrete structures

• possible future problems for durability that may arise with modern materials and construction technologies

# Targets

Senior undergraduate and graduate students

# Course format

Lectures: online, 24 hours workload;

Exercises: 3 hand-on exercises (3 groups)

Scientific paper reading: 8 groups (3-4 papers for each group). Paper will be sent to each groups before the lecture

# Content and schedule

One lecture = 3 x 45 min, plus a 2 x 5 min break

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| **Nr.** | **Date and time (CEST)** | **Lecturer** | **Topic** |
| 1 | Aug8, Mon, 08:30-11:00 | UA | Introduction  Concrete degradation mechanisms ( corrosion)  Ex 1 hand out (engineering practices)  Reading papers discussion |
| 2 | Aug9, Tue, 08:30-11:00 | UA | Other concrete degradation mechanisms  Ex 2 hand out (engineering practices)  Reading papers discussion |
| 3 | Aug15, Wed, 08:30-11:0 | ZZ | Service life design and modeling  Ex 3 hand out (service life)  Reading papers discussion |
| 4 | Aug18, Mon, 08:30-11:00 | SM | Durability of alkali activated materials  Reading papers discussion |
| 5 | Aug 23, Thu, 08:30-11:00 | UA/PP | Condition assessment  Ex 1discussion  Reading papers discussion |
| 6 | Aug 25, Mon, 08:30-11:00 | ZZ/MP | Corrosion damage (experiment and simulations)  Reading papers discussion |
| 7 | Aug 30, Tue, 08:30-11:00 | UA/FO | Cathodic protection  Ex 2discussion  Reading papers discussion |
| 8 | Sep 02, Fri, 08:30-11:00 | UA/ZZ | Modern construction materials and technologies  Ex 3 discussion  Reading papers discussion  Closure |

**Lecturers:**

UA: Prof. Dr. Ueli Angst (ETH Zurich) MP: Dr. MohitPundir (ETH Zurich)

ZZ: Dr. Zhidong Zhang (ETH Zurich) PP: Patrick Pfändler (ETH Zurich)

SM: Dr. ShishirMundra (ETH Zurich) FO: Federico Orlando (ETH Zurich)