

Dr Emmanuel Denarié, Senior Scientist (MCS/IIC/ENAC/EPFL), Thursdays from 8 h 15 to 12 h, per Zoom visio conference

Module	Date	Content	Lect.	Exercise
1	05.11.2020	Introduction, motivation, historical perspective, HPFRCC families, strength vs deformability, components and features of UHPFRC, typical applications FRC - bases of mechanical behaviour, fibres, bond, effects of orientation, characterization of mechanical performance	1.5 2.5	
2	12.11.2020	Hydration of binders and effects of mineral additions (SCM): reactions, degree of hydration, hydration kinetics and influence factors, maturity, effects of high and low temperatures, micro and mesostructure of UHPFRC (hydrates, pore structure) <u>Exercise 1:</u> Heat of hydration – comparative analysis of test results	3	1
3	19.11.2020	Rheology at fresh state, superplasticisers <u>Exercise 2:</u> analysis and interpretation of a UHPFRC batch test	2	2
4	26.11.2020	Formulation of UHPFRC, optimisation of packing density vs rheology / strength vs deformability Mechanical properties of UHPFRC (quasi-static), ageing, orientation effects of fibres, combination with rebars, SCM Time dependent mechanical response: low strain rates (creep, shrinkage), early age, long term, fatigue, high strain rates	1 1 2	
5	03.12.2020	Transport properties of UHPFRC (moisture, liquids and gases), durability, effects of “damage-cracking” Modelling of the mechanical response of tensile strain hardening / softening composites, scale effects , inverse analysis, design with analytical models	1 3	
6	10.12.2020	<u>Exercise 3:</u> Numerical modelling of UHPFRC (mechanical) with FEM / NLFM		4
7	17.12.2020	Design of structures with UHPFRC, fire resistance, recycling, Life Cycle Analysis, examples of applications Synthesis <u>Exercise 4:</u> Group works and presentations, discussion, closure	2	2