ECCS CECM E K S
European Convention for Constructional Steelwork

EUROPEAN CONVENTION FOR CONSTRUCTIONAL STEELWORK
CONVENTION EUROPEENNE DE LA CONSTRUCTION METALLIQUE
EUROPÄISCHE KONVENTION FÜR STAHLBAU

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ECCS course « Fatigue Design Of Steel And Composite Structures »

Reference book : A. Nussbaumer, L. Borges, L. Davaine, *Fatigue Design of Steel and Composite Structures: Eurocode 3: Design of Steel Structures, Part 1-9 Fatigue; Eurocode 4: Design of Composite Steel and Concrete Structures*, ECCS Eurocode Design Manuals, 2nd edition, John Wiley & Sons, 2018.

Speakers: Prof. Luis Borges, University of Coimbra, Portugal and Structurame, Geneva, Switzerland
Prof. Johan Maljaars, TU Eindhoven and TNO Delft, The Netherlands
Prof. Alain Nussbaumer, EPFL, Lausanne, Switzerland

Date	Topic	Content	Comment and possible *exercices*
DAY 1			
10 -11AM	**Introduction**	- Content, objectives - Logic of the book and of the lectures - Structures at risk, examples of cracking	Must follow ECCS manual logic, at least for some regrouping of topics. Inclusion of design examples within lectures
11AM-1PM	**Basis of fatigue design**	- Concept of S-N curves, main parameters - S-N curves: experimental determination, definitions of stress range and nb of cycles - Terminology (in relation to Eurocodes) - Variable amplitude, damage sum and equivalent damage concept	Introduce main concepts to put all participants at same min., level of understanding.
2 -4PM	**Basis of fatigue design (cont.)**	- Variable amplitude, damage sum and equivalent damage concept (cont.) - Verification methods (with stress ranges, with nb. of cycles, with damage sum)	*Exo damage sum calculation*
4 -6PM	**Codes of practice**	- Different existing codes : Eurocodes, IIW, DNV, … - Separation between action effects and resistance - Application and limitation range : materials, corrosion - Fabrication and quality assurance, EXC classes	Show where information can be found, also outside of Eurocodes, similarities between all codes. Sensitization wrt fabrication (EN 1090-2)
DAY 2			
9AM -1PM	**Actions and action effects**	- Fatigue loads, fatigue load models (general) - Road bridges load models (FLM1 to FLM5), railroad models (UIC 71, …) - Service life, new vs existing bridges - Damage equivalent factors, « span » or critical length, simultaneity (multiples charges) - Combination road and railway traffic	Go beyond strict application of Eurocodes, consider practical questions often asked
2 – 6PM	**Determination of stresses and stress ranges**	- Calculation of stresses: nominal, modified nominal, geometric - Calculation of stress ranges: in bolted, welded connections, multiaxial cases - In steel-concrete composite bridges	*Exo determination of stress in bolted detail, in welded detail*
DAY 3			
12 oct 9AM -1PM	**Fatigue strength and detail categories**	- Catalogue of construction details - Classification by identification, by analogy - Fatigue strength modifications: size effect, mean stress and residual stresses, - Hot spot stress method for fatigue design - Special details: orthotropic plates, tension elements (EN1993-1-11), reinforcing steel (EN1992-2)	*Exo detail classification*
2 - 5PM	**Safety and design methods**	- Steel quality choice: link between fatigue and brittle fracture (EN 1993-1-10) - Design methods: safe life, damage tolerant - Partial factors for fatigue determination - Evolution of reliability index during life wrt fatigue, influence of inspections, inspection interval determination	*Exo verification of a detail in a bridge*