

ASSESSMENT OF STRUCTURAL CONCRETE BEHAVIOUR WITH ADVANCED NUMERICAL MODELLING

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ABSTRACT

Presently available numerical models for the analysis of concrete structures, usually based on the Finite Element Method, allow that complex problems can be realistically addressed at a macro-scale level, to help solving real civil engineering problems. Such models are quite useful for better designing structures with cutting edge architectural solutions, interpretation of structural malfunctions, or for supporting selection of the best solutions for retrofitting and strengthening interventions. In some of these complex problems nonlinear analyses are required, to address the complete structural behaviour at ultimate limit states.

This lecture will present the experience of the research group LABEST – Laboratory for the Concrete Technology and Structural Behaviour, hosted at the Faculty of Engineering of the University of Porto (Portugal), on the numerical simulation of real scale concrete structures. The presentation includes several examples where usefulness of advanced numerical analyses is to be demonstrated. Mostly performed with software DIANA, and including situations where user supplied subroutines needed to be developed and implemented, such analyses cope participations in international benchmarks, as well as the simulation of large scale concrete structures, from which it is worth remarking:

- Simulation of the performance of shear critical reinforced concrete elements;
- Assessment of the performance of reinforced concrete slabs undergoing restrained drying shrinkage deformations and loaded with service loads, to quantify the minimum reinforcement needed for cracking width control;
- Analyses of the precast concrete viaducts that provide access to a recent Portuguese bridge, on a ~10km long crossing over the Tagus river, in support of the extensive *in situ* monitoring campaign performed during construction;
- Nonlinear analysis of a prestressed concrete bridge located in the north of Portugal, presenting several pathologies;
- Thermo-mechanical analysis of the concrete embodying the Turbine Spiral Case of the Power Station of Batalha dam, located in Brazil.

Relevant conclusions are presented at the end.