6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11 – 15 June 2018, Glasgow, UK

EXPERIMENTAL INVESTIGATION AND NUMERICAL MODELLING OF CONCRETE AND SHOTCRETE

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Key Words: *concrete, shotcrete, hardening, shrinkage, creep, multi-phase model.*

This contribution to the symposium in memory of Nenad Bićanić is devoted to an overview of current research projects in the fields of experimental investigation and numerical modelling of concrete and shotcrete. The interrelated projects focus on the following topics:

- *An experimental investigation of compressive and tensile creep* aiming at the evaluation of restraint effects in a RC structure strengthened by a concrete overlay. The restraint effects are mainly caused by shrinkage of the overlay concrete, which is restrained by the substrate concrete. Consequently, tensile stresses are generated in the overlay whereas compressive stresses develop in the adjacent substrate concrete. Both, the stresses in the overlay and the substrate concrete, are gradually reduced by creep strains. The experimental results serve as basis for the calibration of numerical models for the time-dependent behaviour of concrete;
- *A numerical investigation of the response of concrete specimens by a multi-phase concrete model* formulated within the framework of the theory of porous media. This advanced modelling approach allows insights into the actually non-uniform distribution of stresses and strains in such specimens and the resulting potential damage of specimens due to cracking at the surface, resulting from the temporal and spatial evolution of temperature and moisture content in the specimens and the impact of the latter. The computed response will be compared with measurement data;
- *An experimental program for determining the evolution of the material properties of shotcrete as well as shrinkage and creep of shotcrete*, starting at very young ages of the material of a few hours. The recently developed shotcrete model by Neuner et al. [1] is calibrated on the basis of the test data, and the capabilities of the model to represent observed shotcrete behaviour will be assessed both at the material point level and at structural level, the latter in the context of the numerical simulation of deep tunnel advance.

REFERENCES

[1] M. Neuner, P. Gamnitzer, G. Hofstetter, An Extended Damage Plasticity Model for Shotcrete: Formulation and Comparison with other Shotcrete Models, Materials, Vol. 10, pp. 82; 2017.