Thermo-mechanical analysis of an arch dam during construction

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ABSTRACT

In arch dams the thermal field assumes an important role, appearing the first thermal effects during the construction. Due to the cement hydration and the low thermal conductivity of concrete, the dam body is subject to considerable thermal deformations, which may lead to the development of tensile stresses and further cracking of concrete at early ages.

Accordingly, the present study intends to describe a realistic simulation of the stress field of a large arch dam during the construction phase. Among the main research topics to be included, the three-dimensional representation of the castings layers, the thermal effect of the embedded cooling coils and the mechanical influence of the contraction joints will deserve particular attention. Moreover, this paper contains *in situ* monitoring of the concrete temperatures and laboratory characterization of the concrete properties.

The numerical simulations were performed using the finite element method (FEM). Thus, the thermo-mechanical modelling consists on the initial computation of the thermal field and subsequent evaluation of the corresponding stress field. The thermal problem was reproduced using a transient model, which encompasses the internal heat generated by cement hydration, the heat transfer to the environment, and the effect of the cooling pipes. The time-dependent mechanical behaviour of concrete was represented by the theory of linear viscoelasticity for aging materials. This modelling methodology is similar to those reported in [1,2,3].

Finally, it should be noted that the numerical results are discussed in detail and the main conclusions are also presented.

REFERENCES

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