

NUMERICAL STUDY OF ARCH DAMS UNDER THE CONSTRUCTION AND OPERATION SCENARIOS

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Abstract. *With respect to arch dams, the thermal field is of fundamental importance, arising the first effects during construction. Initially, the dam body undergoes a temperature rise due to the heat of hydration, and then a temperature decrease promoted by postcooling – coils are used to reduce the concrete temperature at early ages and to obtain the desired temperature for the grouting of contraction joints. Subsequently, the external conditions (mainly the water and air temperatures) have a cyclic effect on the dam deformation. So the thermal study of arch dams is usually divided into two distinct parts: the first corresponds to the construction period; the second refers to the operation phase. Accordingly, the present paper intends to predict the thermal-mechanical behaviour of a large arch dam for each of the above-mentioned scenarios. The numerical simulations were executed using the finite element method (FEM): the initial calculation of the thermal fields and subsequent assessment of the stress fields. In the construction phase, the thermal problem was reproduced using a transient model, which includes the heat generated by cement hydration, as well as the heat transfers to the environment and to the cooling coils; for the mechanical problem, the time-dependent behaviour of concrete was characterized by the theory of viscoelasticity (with maturity effects). As regards the operation phase, the main topics include the heat transfers across the external boundaries (dam reservoir and ambient air) and the mechanical influence of contraction joints.*

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