

THERMO-MECHANICAL ANALYSIS OF A DAM LOCATED ON RMEI RIVER (MOROCCO)

Purpose(s): Verify the reinforcement capacity to maintain the dam being waterproof while it cools down after construction.

Client: INGEMA

Date: 2006

Place: Morocco

Partners: None

Project executive manager:
Céline BOURDEAU

Software(s) used: FLAC3D

Itasca Consultants S.A.S. was asked by INGEMA to use *FLAC3D* to verify that the Rmei River dam would not be subjected to excessive tractions (**concrete retraction**) while it cooled down after construction ended, as such tractions could result in the **structure no longer being waterproof**.

To reduce fracture openings on the upstream face of the dam, **horizontal reinforcement elements** were installed. The development of such vertical fractures goes with a loss of traction strength on the fracture plane; thus, rupture induces an **anisotropic behavior** that can be reproduced with *FLAC3D* software using the **ubiquitous joint model**. In this model, the virtual joints became active as soon as the traction limit in their plane was exceeded.

In this project, we simulated dam construction by superimposing several 3-m high layers. We modeled concrete set with heat emission, followed by cooling of the concrete by heat transfers toward the faces of the dam. Finally, we simulated the filling of the reservoir, considering the mechanical pressures exerted on the upstream face of the dam by water in the reservoir.

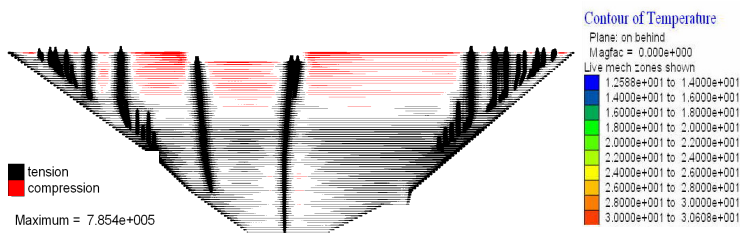


Figure 1 : Axial forces (N) along cables.

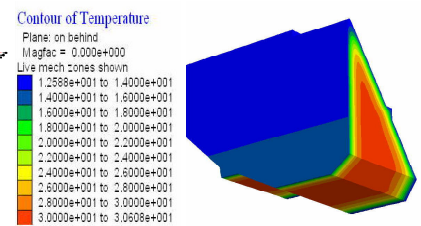


Figure 2 : Temperatures (°C) after 3 months of cooling.

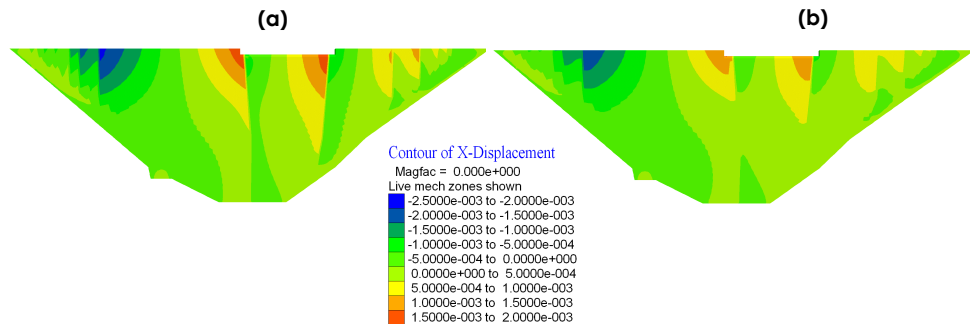


Figure 3 : Horizontal displacements (m) along the upstream face of the dam after 3 months of cooling: (a) Dam without reinforcement; (b) Reinforced dam.

KEYWORDS:

- Thermal exchanges
- Reinforcement
- Ubiquitous joint model

⇒ **RESULTS:**

During the cooling of the concrete (Figure 2), fracture development is more prominent on the upstream face of the reinforced dam (Figure 1 and Figure 3b) compared with the upstream face of the dam without reinforcement (Figure 3a). In fact, reinforcement limits the opening of fractures, spreading the effect of concrete retraction over the entire upstream face.