

THERMO-HYDRO-MECHANICAL ANALYSIS OF BIN EL OUIDANE DAM (MOROCCO)

Purpose(s): Create a diagnosis tool of dam behaviour

Client: INGEMA

Date: 2005

Location: Morocco

Partners: None

Project executive manager:
Céline BOURDEAU

Software used: *FLAC^{3D}*

In order to improve monitoring of the Bin El Ouidane dam (Figure 1a), built in 1952, Itasca Consultants SAS was asked by INGEMA to conduct a *FLAC^{3D}* analysis of the behaviour of the "dam + rock" system with respect to **seasonal temperature variations** and **water level changes in the reservoir**. Calibrating the behaviour of the dam using measurements available since its construction, we created a model able to predict the **future behaviour of the dam**.

The dam was constructed with independent cantilevers, later grouted to make the arch monolithic. For each set of parameters (water level in the reservoir and air temperature) corresponding to one particular moment in time, new **pore pressures** and **heat fluxes** between the dam and the air, on one hand, and the dam and the water, on the other, were calculated. These phenomena affect the mechanical behaviour of the dam, as shown in Figure 3, which depicts pendulum displacements from September 1998 to August 2004.

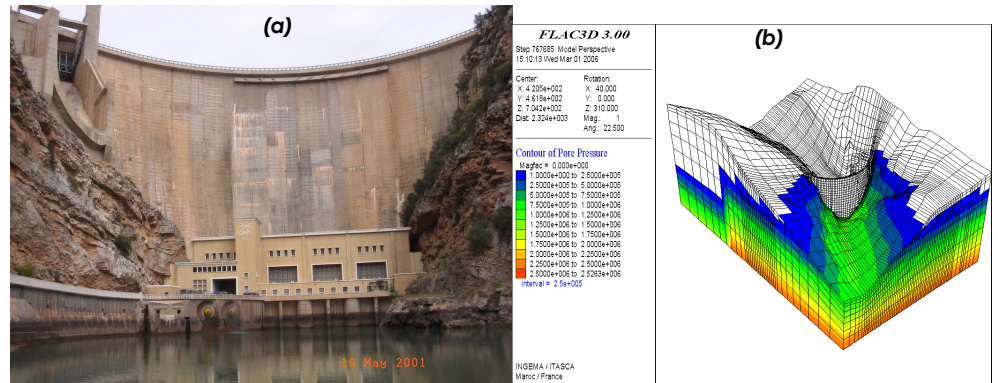


Figure 1 : (a) Photo of the **downstream side of the dam** (source : INGEMA) and (b) **rock pore pressures** at the end of the 1st reservoir filling (January 1956).

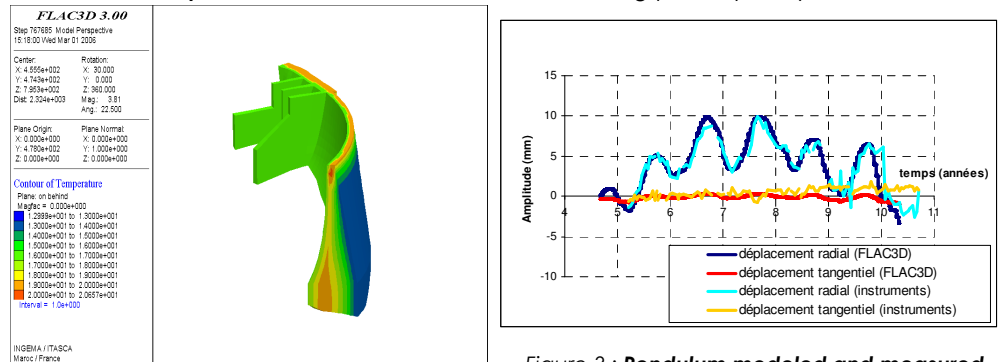


Figure 2 : **Dam temperatures** at the end of the 1st reservoir filling.

Figure 3 : **Pendulum modeled and measured displacements** are similar

KEYWORDS:

- Thermal exchanges
- Dam
- Pore pressures
- Grouting

⇒ **RESULTS:**

We created a **calibrated model** reproducing the thermo-hydro-mechanical behaviour of the dam since its construction. This model can now be used to **predict the future normal behaviour of the dam** for comparison with measurements. The **future abnormal behaviour of the dam** can be detected through significant differences between simulated motions and measured ones.