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A PARTICLE/PARTICLE INTERFACE MODEL INCLUDING SURFACE ROUGHNESS FOR STABILITY ANALYSIS OF ARCH DAM FOUNDATIONS

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In concrete dam foundations, failure mechanisms are typically defined by natural rock discontinuities, the dam/ foundation interface or strata with lower strength. Instability may occur underneath the dam, in the abutments or in adjacent slopes. In the case of arch dam foundations, special attention must be given to failure scenarios associated with sliding along weaker surfaces in the dam foundation area where the arches rest, particularly in the valley sides and in the abutments, and to those involving seepage in the valley bottom, which leads to erosion of discontinuities.

Stability analysis for scenarios of foundation failure is often based on simplified limiting equilibrium procedures. More advanced analysis, however, is carried out with discrete element based models, which allow the discontinuous nature of rock to be properly simulated, and which may include fluid flow through the discontinuities.

Concrete/rock and rock/rock interface models, usually used in stability analysis of arch dam foundations, are either based on discrete element or finite element techniques, and follow planar joint formulations (point to point, point to surface and edge to edge contacts). A new development is proposed herein in which each rock block is divided into spherical particles. The interactions between neighbouring blocks can be handled solely with particle to particle interactions. The deformability of each block can be given either by the inner particle contacts or by the discretization of the block with a finite element mesh.

The stability analysis of an idealised arch dam foundation is carried out. It is shown that the results of the proposed particle/particle interaction model are very close to those obtained with a more complex polyhedral based discrete element model. The influence of the boundary roughness, given by the adopted spherical particle size, is also assessed.