Perimetral Joint Effects on Stress Distribution and Seismic Behaviour of Arch Dams

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Summary

In the present study, effect of pulvino and its perimetral joint on stress distribution within dam body is investigated. Dez dam with 203m height is selected as case study and all the contraction joints of the dam body are modelled using discrete crack approach. The reservoir is assumed compressible and the foundation is modelled as a mass-less medium. The system is analyzed under static loads taking account for stage construction effects, hydrostatic loads and thermal loads taking into account the effect of sun radiation. At last, the FE model is excited using MCE earthquake records. It is found that when the perimetral joint between the saddle and the dam body is modelled, the direction of the principal stresses and their distribution patterns are changed and the safety of the system is improved. In addition, over stressed surfaces on the faces of the dam body decreased in comparison with the model without the perimetral joint.

Keywords: high arch dam; perimetral Joint; pulvino; contraction joints; stage Construction

1. Introduction

Although concrete arch dams are regarded as safe structures during earthquakes, it is essential to assess their seismic performance in various seismic levels. Mass concrete is brittle material and is susceptible to crack due to low tensile strength. For construction facilities and in order to control tensile stress due to concrete shrinkage, temperature variation and etc. arch dams are built as assemblage of monoliths separated by vertical contraction joints. Also, in some cases, perimetral joints are provided between dam body and concrete saddle which is called as pulvino. Pulvino is utilized as an artificial footing for dam body and using this structural component causes to have slender dam body due to reducing uncertainties of foundation rock just beneath body. In addition, using pulvino in thin arch dams is suitable method for constructing these kinds of dams in narrow gorge with strong foundation rock. Perimetral joint provided between pulvino and dam body is suitable in: 1) insuring symmetric stress and strain distribution within dam body; 2) decreasing probable tensile stresses in mass concrete; and 3) suitable distribution of stresses in abutments and preventing from severe stresses in these regions.

In fact, modelling contraction and perimetral joints with ability of partially opening and closing and also ability of tangential movement can affect on stress distribution and displacement pattern within dam body during seismic excitation.

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