

Use of DIANA in the Design and Analysis of Concrete Arch Dams in Hydroelectric Power Development Schemes

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This paper presents an engineering method developed at Stucky SA for design and structural analysis of large arch dams by means of DIANA. The objective of the method is defining an optimal shape of the dam.

The method starts by setting the design criteria necessary for the structural analysis and the evaluation of the dam design. Next, the excavations needed to provide for sound rock base and smooth footprint of the dam are defined in a CAD drawing. The optimal shape of the dam body is determined by an iterative procedure involving geometrical definition the dam, finite element static and dynamic analysis of the dam-foundation-reservoir system, and engineering evaluation of the solution. The geometry of the dam is defined for a discrete number of dam arches by a program developed in Stucky and working in AutoCAD environment. The program produces a FEMGEN archive file, which is imported into DIANA to define points, lines, surfaces, bodies and sets of geometrical entities. For the iterations following the initial one, only the point coordinates are changed and introduced into the FEM model by a batch file. Each design solution for the dam is evaluated qualitatively considering the design criteria applied to the structural analysis results, as well quantitatively on the basis of the required dam concrete volume. Finally, the optimal solution is defined as the one that meets the design criteria and involves a reasonable concrete volume.

The paper presents the practical application of the proposed procedure to the feasibility level design (FDL) of the 200 m high Khudoni arch dam planned to be built in Georgia. A total of six dam shape variants have been investigated. The optimal FDL solution proves the feasibility of the dam and will be further improved on in the final design phase.