

9th Eastern European Young Water Professionals Conference



CONFERENCE PROCEEDINGS

Uniting Europe for Clean Water:

Cross-Border Cooperation of Old, New and Candidate Countries of EU,
for identifying problems, finding causes and solutions

24-27 May 2017 Budapest, Hungary

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Conference**



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Spillway Design Optimization for Embankment Dams Using Genetic Algorithms

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Abstract

This study investigates the capability of *genetic algorithms* to solve the problem of multicriteria optimization in design of chute spillways of embankment dams. Embankment dams generally use long chutes, requiring high investments due to extensive concrete and excavation works. Therefore, embankment dams' chutes present a suitable ground for the use of optimization methods, in order to reduce the computation time to produce a least-cost design. A significant problem in the optimization process is the large number of hydraulic conditions that must be fulfilled. To tackle this issue, a customized genetic algorithm was created, in order to include economic, hydraulic, and certain structural criteria.

Keywords

Optimization; genetic algorithm; spillway chute; embankment dam

INTRODUCTION

Chute spillway design generally takes into account a large number of interrelated criteria (hydraulic, structural, etc.). A chute-width issue always need to be considered. At the upstream end, a large width of the chute is usually favourable, to enable a considerable spillway crest length, increasing spillway capacity. Likewise, at the downstream end, a large width enables efficient energy dissipation. When the conditions permit, a prismatic chute should be designed. However, the topographical and geological conditions usually disfavour wide chute, due to the excessive excavation works. Therefore, the chute width should vary along the path of the chute, and the optimal design is needed. One should bear in mind that abrupt contraction and expansion of the chute might provoke many unfavourable phenomena, such as standing waves, roll waves and cavitation. This research investigates capability of *genetic algorithms* to solve the problem of multicriteria optimization for design of chute spillways of embankment dams.

Genetic algorithms

Genetic algorithms (GAs) are optimization methods, inspired by the process of evolution. They were first presented by John Holland in 1970s as a mean of providing optimal or near-optimal solutions to complex multicriteria problems (Mitchell, 1999). Genetic algorithms are based on evolutionary ideas of natural selection and genetics, through which the most capable individuals in a particular population would be more likely to survive and reproduce – a Darwinian principle, often referred to as the “survival of the fittest”. In a way, GAs present an intelligent exploitation of the random search strategy, in such a way that they use a population of historic data (parent data) to produce a population of new data (offspring data) closer to the global optimum or near-optimum. Production of new data is achieved through the use of genetic operators: *selection*, *crossover* and *mutation* (Blickle and Thiele, 1996; Mitchell, 1999; Lipowski and Lipowska, 2012).

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