

Research axes and conclusions

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ABSTRACT: The aim of this short paper is to summarize main outcomes of the workshop, in order to guide future developments of research on Piano Key Weirs (PKW) towards most effective and integrated directions. The main research topics highlighted in this text came out from the 34 high-quality presentations given during the conference, as well as from the fruitful discussions in which the participants were actively involved. Many more truly innovative and promising ideas can be found throughout the other papers gathered in this proceedings book.

1 INTRODUCTION

As a closure of the 1st International Workshop on Labyrinth and Piano Key Weirs, an integrative lecture has been given with the aim of highlighting most promising future research directions in order to further develop focused and coordinated work towards deeper understanding of flow characteristics on PKW and more innovations in their design. This paper aims at summarizing key issues addressed in this presentation. The topics identified hereafter came out as a result of the high level of the 34 technical presentations given during the conference, as well as from the interactive discussions in which workshop participants took a very active part. Far from exhaustive, this summary needs to be complemented by the many promising paths set in the technical papers presented in this book. In addition, some of the topics listed below have already been analyzed partly by different researchers, as detailed in their respective papers.

2 RESEARCH – PHYSICAL-NUMERICAL MODELING

Regarding research projects, much work remains to be undertaken concerning the comparison between the labyrinth weir and the Piano Key weir, using both physical and a numerical modeling approaches. The same applies for parametric studies of the PKW, which remain a challenging step towards a better support for finding the optimal design in each specific application.

In addition, more fundamental experimental research is needed to enhance our present understanding of the detailed flow conditions on a PKW, especially the different flow phases depending on the upstream head as well as the spatial patterns of pressure and velocity fields.

The related problems of floating debris, sediment deposition, sediment release and ice also need to be more deeply addressed, such as the restitution conditions, the energy dissipation and the effect of the downstream water level.

Scale effects in experimental studies constitute surely one of the key challenge of the coming years, as well as the advancement of numerical modeling approaches towards truly predictive capacities. Sharing feedback on the application of both physical and numerical modeling techniques may become a crucial asset in achieving breakthroughs as regards the abovementioned research topics.

Finally, defining a single widely-recognized protocol for testing PKW as well as the use of a reference model for calibration of experimental facility, would definitely contribute to maximizing the impact of the significant amount of experimental tests carried out in laboratories worldwide.

3 PROJECTS - PHYSICAL-NUMERICAL MODELING

In terms of projects studies, the key topic for progress remains the integration of PKW on dams, based on comprehensive evaluations accounting for abutment characteristics, real-life environment conditions (bridge piers, reservoir bathymetry...) and energy dissipation downstream. Structural aspects also need to be more deeply addressed, especially regarding the use of other materials than reinforced concrete.

4 REAL STRUCTURES/PROJECTS

A number of real PKW are now in operation and several more, among which very large projects are due to be completed within the next few years. Detailed monitoring of these structures and feedback about their behavior is crucial to support validation and improvement of current experimental research as well as numerical models. This is particularly important for scale effects assessment or respond to floating debris. Such feedback from the field is thus strongly needed to guide future research.

5 HOW TO BE EFFICIENT?

A workgroup on PKWs, bringing together researcher and engineers from Hydrocoop, EDF-CIH, EDF-R&D, LCH-EPFL, ULg-HACH and University of Biskra, has been active for two years through informal one day technical meetings organized every six months. This workgroup is open to everybody interested in sharing data and knowledge about PKW. Such meetings will continue to be regularly organized in the future.

It might also be interesting to set up a common research project on the topic of PKW, at least at the scale of the European community (EU funded project), to mobilize the means necessary to undertake a large coordinated research project.

Finally, in view of the success of the first workshop, it is quite sure that you will be invited to take part in a second edition in 2013!