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Modeling of Complex Flows through Engineered Log Jam with a Semi-Automatic Method

Yong G. Lai[1], David J. Bandrowski[2], David L. Smith[3], Kuowei Wu[4], Xiaofeng Liu[5]
1. Technical Service Center, U.S. Bureau of Reclamation
Denver, CO, USA
2. Yuroktribe
Weaverville, CA, USA
3. Engineer Research and Development Center, US Army Corps of Engineers
Vicksburg, MS, USA
4. Water Resources Planning Institute, Water Resources Agency
Wu-Fong, Taichung, Taiwan
5. Department of Civil and Environmental Engineering, Penn State University, University Park
PA, USA

ABSTRACT

Engineered log jam (ELJ) is widely used in the United States for stream and watershed restoration projects. Woody structures have a permeable body that can significantly reduce local scour; it is economical as the materials are locally available, particularly in remote mountain areas; ELJ itself becomes natural habitat for aquatic life. The use of ELJs in streams, however, introduces concerns with regard to its impact on local stream morphology and safety. Design guidelines are often lacking. Laboratory or field study is difficult due to irregular nature of many in-stream ELJs. Computational modelling, therefore, becomes an attractive alternative.

In this study, a practical, semi-automatic, 3D numerical model is developed to simulate complex flow patterns produced by an ELJ placed in a laboratory flume. Real large woods are used and placed in a large flume so that velocity is measured and available to test and verify the numerical model. The ultimate goal is the ability to predict complex river flows and morphological changes (scours) induced by in-stream ELJ structures. In this presentation, we will outline our model approach towards a semi-automatic 3D mesh generation for stream flows. We will then describe the 3D numerical method adopted that allows the use of arbitrary mesh cell shapes. Preliminary modeling results are presented and results are compared with the laboratory flume data. The research demonstrates that the developed numerical model is one step closer towards a practical 3D modeling tool that may be used for ELJ design and analysis in the field by engineers.